

# **European science review**

**Nº 9–10 2016  
September–October**



«East West» Association for Advanced Studies and Higher Education GmbH

**Vienna  
2016**

# European Sciences review

Scientific journal

№ 9–10 2016 (September–October)

ISSN 2310-5577

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**European Science Review** is an international, German/English/Russian language, peer-reviewed journal. It is published bimonthly with circulation of 1000 copies.

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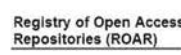
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Typeset in Berling by Ziegler Buchdruckerei, Linz, Austria.

Printed by «East West» Association for Advanced Studies and Higher Education GmbH, Vienna, Austria on acid-free paper.

## Section 1. Architecture

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-3-6>

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### Study on the energy saving strategy for residential building in Kazakhstan

**Abstract:** This paper focuses on research to determine the feasibility of the design to improve energy efficiency and to improve climate conditions in residential buildings. The methods and recommendations intended for the local building tradition. As a result, evaluate the real effectiveness of the design of energy efficient processes and provides recommendations on the development of residential buildings.

**Keywords:** energy saving, sustainable development, comfort.

#### 1. Introduction

The main objective of the paper presented in to identify the problems of the energy of residential buildings in Kazakhstan and to preserve or improve the thermal comfort. In Kazakhstan, today there is no implementation of national green standards. Nevertheless, the need for people to reduce energy consumption costs especially in winter is high. Kazakhstan has energy-efficient housing projects, but they have not yet issued. Recently, the government pays more attention to correct and integrate the principles of sustainable development [1], for new and existing buildings. Aspects include passive and active energy-efficient technologies, building orientation, natural ventilation.

In the construction industry, Kazakhstan included basic concepts of the passive house, but to obtain a certificate of international green standard rating system such as LEED, BREEAM lack experience. Includes some mandatory energy efficiency measures, leading to a different way of designing. The shape and relationship between the materials used the elements of the passive devices. The introduction of buildings by either using only the reasonable rules not based on local environmental conditions led to difficult comparable results.

Due to two main reasons is firstly, the use of advanced materials lacks sufficient design capability. Secondly, the difference from the traditional architecture and culture that to separate between modern materials and technology and the needs of users.

By monitoring the actual living conditions of thermal and energy behavior in the residential sector can be understood and highlight weaknesses study presented fits in this context. The ultimate goal is to give a simple but practical advice to planners regarding appropriate design procedures for cold climate conditions of Kazakhstan, taking into account the energy efficiency of buildings and their systems, as well as user comfort and needs in urban areas.

#### 2. Methods

For more accurate recommendations of the study consists of basic steps:

- Critical analysis and classification of residential buildings in Kazakhstan;
- The pilot building monitoring tested the internal parameters of the microclimate;
- Offering methods to improve energy efficiency and interior comfort, when evaluating the results of using a virtual model;
- Use of best practices for sustainable design of low energy and passive house construction with local techniques and materials for new construction.

The process of improving residential building is typological unit continuously. The typology classifies residential buildings using different criteria: the number of floors, type of communication of the room, type of load-bearing structures, three-dimensional structure, and other private settings. Construction practice of housing construction in Kazakhstan has a narrow typological near the low-rise buildings and high-rise buildings, in particular. This investigation was one of the concepts of development of housing construction in the USSR, undertaken for several post war decades. Mass housing construction was carried out in the north of the city with hints of a typical sectional height of houses 5, 9 (10), 12, 16 floors. With the change of social system in Kazakhstan, were private property, private investors, and developers, but for more than two decades typological series of houses did not change significantly [2].

The relevance of the design and construction of building types considered due to the need to improve the quality of the home and, at the same time reducing its cost. Without this solution to the housing problem in Kazakhstan is impossible. For proxy authentica-

tion, residential sector in Kazakhstan should be analysed based on statistical data fig.2. Kazakhstan residential area is dominated the urban population, but it is worth noting that in a small amount of 18% less than rural housing [3].

Nowadays, the researchers and engineers are used in the designing of buildings modelling program that can illustrate the energy consumption of the building. The process involves

mathematical algorithms that produce optimal search spaces. The problem designs the passive buildings in Kazakhstan, as well as cold climate. The priority is to reduce energy consumption reduction in the thermal load. The government has paid attention to the need for social housing. To this end, funds allocate from the budgets of different levels.

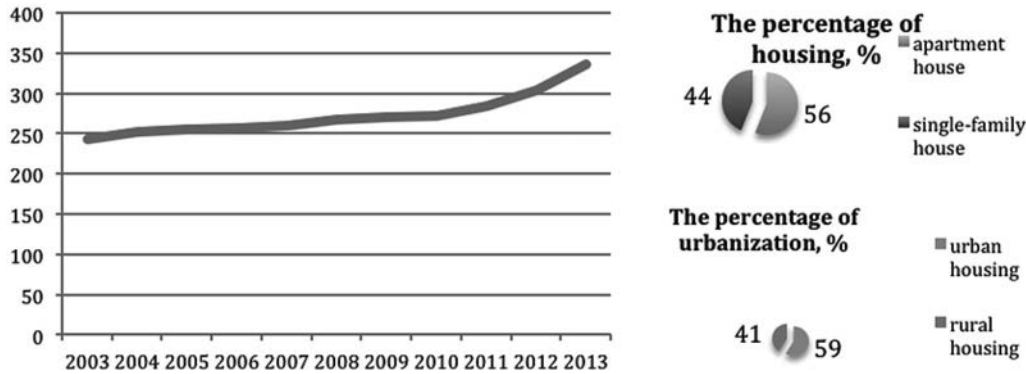


Fig 1. Housing Fund of Kazakhstan mIn m² (statistic data)

Among the issues to resolve and is shaping residential buildings, which is affected by many factors related to climatic, socio-demographic, urban and other objective and subjective [4].

**3. Results**

The architectural form of residential development in Kazakhstan at the present stage can emphasize such features — style variety, high and high-rise buildings, the complexity, the monumental, multi-functionality. Among the variety of styles in the architecture of residential buildings, can select the style, which bases on elements of the national culture. The tops of these architectural landmarks are reminiscent of the sharp spear, the traditional headgear of these places.

The typological model analysis and shown in Fig. 2, one-storey, square-shaped building with a flat roof. Some assumptions made when creating the building model:

— the house is designed for a standard residence, consisting of four members;

— the compact shape of the building flat roof allows for better compactness;

This model includes a variety of buildings; a building structure divided into cells bearing walls. Impaired visual isolation premises with monotonous repetition where two or more cells connected dwelling at ground level at the ground floor, but not in any direction, and in various. As a rule, it is a living cell, separated by load-bearing walls, but each of them focused on a nearby open space. Shared entrance to the apartment is possible but usually organized in the form of individual records from one of the outer facades. The most significant advantages of this configuration — separate the cost of construction of houses in combination with a relatively large open space around each living cell.

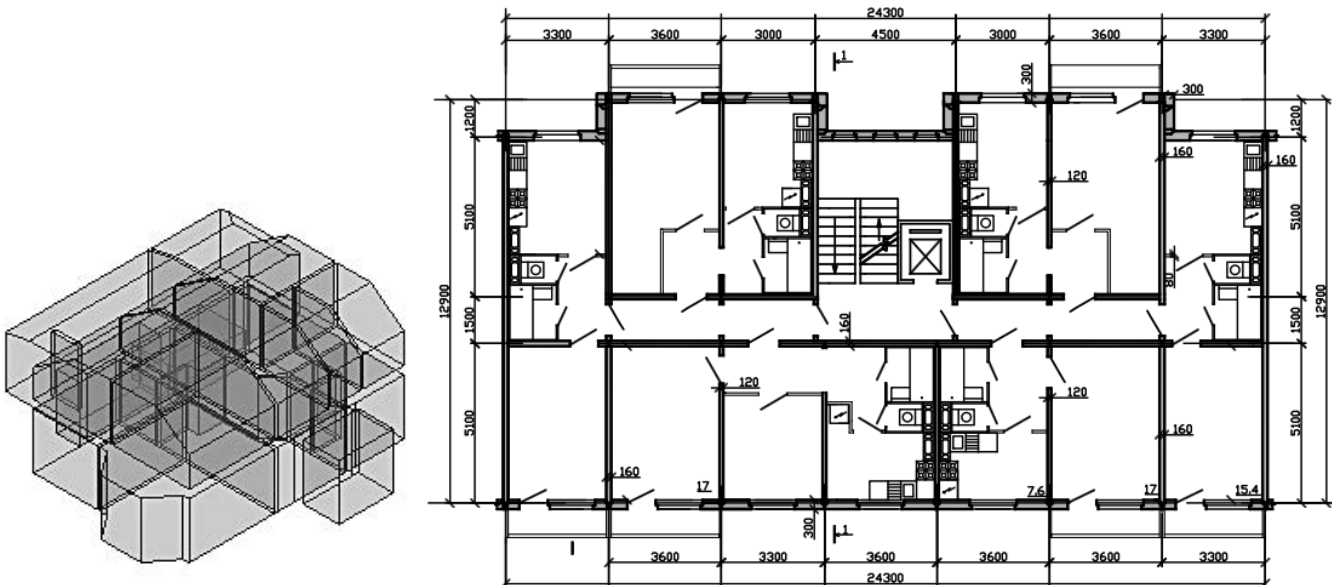


Fig. 2. Typical apartment block scheme and plan

In cold climates, it is not sufficiently compact, and it is hard to solve the problem of cleaning areas from snow. Therefore, this type of development certainly plays other kinds, and when to lock it long enough buildings to be forced to acquire the features of a perimeter or network structure development.

On the contrary, attention to energy efficient and passive green technologies is insufficient. Also, the lack of eco-friendly materials, the introduction of the construction process of green technologies, such as the system has resulted in a relatively high total cost of green buildings and to prevent its development in Ka-

zakhstan, according to fig.3 can follow recommendation. Reducing energy consumption in homes in need of modernization in the major sectors such as energy transmission, power generation, power consumption.

The designing energy-efficient apartment complex multivariate approach is taken into account, the selection of suitable thermal protection of protecting designs, engineering equipment and the ef-

iciency of the use of renewable energy sources. Another important and challenging stage of the study was the implementation of a virtual model of the building with the help of special software Autodesk Green Building Studio to determine the energy costs presented as a graph in Figure 3. The software used for imitation properties of buildings, which allow us to ascertain the behavior of the user (heating lighting).

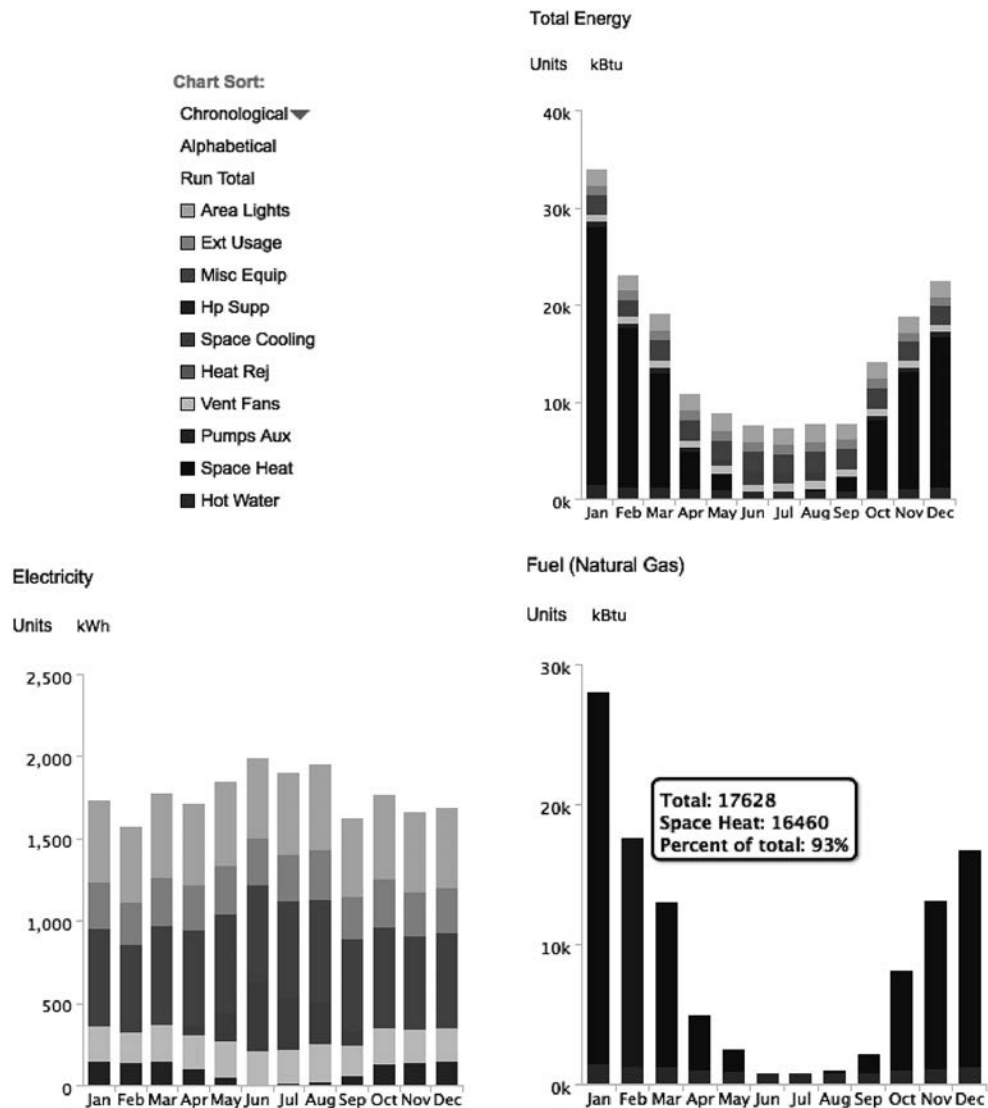


Fig 3. Energy consumption in the average a flat create by Autodesk Green building studio

Options in the virtual model allowed bringing recommendations for passive buildings to improve building energy efficiency and thermal comfort. The following options considered:

- Cover with insulating opaque element or with a simple external curtain;
- Modernization is systems engineering;
- Introduction norms energy consumption, performance of commissioning engineering systems;
- Improving the quality of technical services, through innovative technical systems for the control and automation of consumption;
- Change of outdated technical equipment and networks;
- The use of innovative technologies.

These choices can define a simple, efficient design patterns based on the comparison results, according to the methods in tab.1.

The urgency of the use of energy saving technologies is comparable to the production of energy. Modern energy-saving technolo-

gies in construction in addition to saving the financial and material resources offer opportunities for reducing environmental emissions of harmful substances formed during the heating and cooling of residential homes.

An integrated approach to the design and the study of energy indicators, as well as finding the right solutions to optimize their energy efficiency determine the solution of related problems, which cover key areas as:

1. The organization of a residential building and indoor environment;
2. Minimize the cost of energy;
3. The appropriate use of material resources.

Even ordinary apartment buildings have many opportunities to improve energy savings due to more compact layouts and the proper use of spaces for possible devices in their conservatories and greenhouses in local area. The houses of this type can use as efficiently as a closed heat-insulating sheath covering the comfort zone. This

shell provides improved thermal insulation of walls, basement, roof through the creation of a continuous thermal circuit of the building. Selection of the optimal shape of a dwelling house shows tab 1, its

location, and orientation, squares of translucent apertures, climate control facilities can reduce the negative impact of climate on the heat balance of a house.

Table 1. – Methods influence negative impact

Methods	The negative impact				
	dust protection	wind protection	Protection from frost	Protection from exposure to rainfall	Protection from solar radiation
Space-planning decisions	–	+	–	+	+
Orientation about the negative climatic factors	–	+	–	+	+
Architectural composition	–	+	–	+	+
Compact space-planning novel developing solutions	+	+	+	–	+
Using the wind and regulatory barriers	+	+	+	+	–
Greening	+	+	–	+	+
Solution walling	–	+	+	+	–
Creating a water surface	+	–	–	–	+

Energy-saving measures can classify into the following types:

- Architectural design and space planning decisions;
- Increased protection is heated translucent, opaque fences;
- Cost reduction of thermal energy and electricity for air conditioning and ventilation while maintaining the air (waste heat and cold, night ventilation, recycling, regulated electric fans, and pumps);
- Measures reduce water and heat;
- Engineering solutions using external and internal heat gain (automation of heating systems);

#### 4. Conclusion

Applied Technology for Sustainable Development in Kazakhstan.

The main technologies used, vertical gardening, outdoor permeable surface modelling of the external environment of the wind, the optimization of transportation, utilization, design and noise prediction, analysis of thermal insulation properties are mainly low-technology additional costs. Since all the technology used in this section are in the passive use. Nevertheless, the ratio of the use of certain technologies with low incremental costs remains low in Kazakhstan; for example, space planning decisions, utilization, design and noise prediction.

Regional economic development is unbalanced Kazakhstan; the government should provide support by creating incentives

to increase the adoption of green technologies. The idea of integration must strengthen, which includes two steps: (1) use passive technology with priority, and take full advantage of passive technologies; (2) Apply optimized (very efficient) technology intelligently active.

In most northern regions with a low level of economic development, the project developer should first focus on the development and application of low-income incremental price (passive) technology and then intelligently apply active technology claimed to boost the development of green buildings.

In the most of the developed southern regions and parts of the industrialized northern regions, the developer must not only focus on the development of technologies with little additional costs but also to develop active technologies to gain experience. The implementation of active technologies and invent optimization measures to reduce the cost of technology increases the activity of the same or a higher level and performance of environmental resources.

An effective way to disseminate the experience and technology to optimize the active measures of the economically developed regions in economically developing regions, as well as to improve the efficiency of the incremental costs of cleaner technologies and green building certification promotes in Kazakhstan.

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## Section 2. Biology

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-7-8>

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### Rosa aphids (Homoptera, Aphidinea), spreading and their peculiarities of the use the feeding plant

**Abstract:** In article is considered a specious discrepancy, life cycle, choice of inhabitation on feeding plant, peculiarities of subdivision and forming sequences of the ecological branches in guild Rosa aphids.

**Keywords:** Rosana aphids, ecosystems, life cycle, monoecious cycle, obligate, dioecious cycle, migration, entomotsenoz, fodder plants, ecological niche, ecological specialization, phytophage, strong competitor, a weak opponent, the gradient of the plant, morphological differentiation of species, guild, density, abundance, habitat.

Rosana aphids in Central Asia such us, bring together a wide-spread and sparse spread forms of species and genus rank which plays an important role in the functioning of mountain ecological. Some species commonly was founded in lowland areas where serious harm of cultivated roses.

**Types of diversity and distribution.** Nowadays, the number of species of aphids, which well-known to the roses and wild roses in Central Asia, it reached to 10, 8 genera belonging to Lachnidae-Aphididae families.

In particular, aphids *Maculolachnus submacula* (Walk.) and *M.jachonthovi* Kan & Juchn., are belong to Lachnidae family. The other 8 belongs to Aphididae family: *Aphiduromyzus rosae* Umar & Ibr., *Amphorophora catharinae* Nevs., *Chaetosiphon chaetosiphon* Nevs., *Myzaphis rosarum* (Kalt.), *M.turanica* Nevs., *Myzus distinctus* Nevs., *Metopolophium dirhodum* (Walk.), *Macrosiphum rosae* L.

*Maculolachnus submacula* sporadically distributed throughout the Palearctic in Central Asia which known from the mountain area (Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan). Types of *M.jachonthovi* was marked in the gorge Uch — Bulak Djambul region of Kazakhstan [4]. *Aphiduromyzus rosae* known only in the Tien Shan (Issyk-Kul — the gorge Akterek) [6].

In Central Asia *Myzaphis turanica* and *M.rosarum* are wide-spread in both valleys and mountain area. *Myzus distinctus* was marked in Tashkent [7] and in Southern Kazakhstan [5]. *Chaetosiphon chaetosiphon* widespread in Central Asia, Azerbaijan, and Western Europe [6]. Areal *Macrosiphum rosae* covers Central Asia, which introduced in all countries. *Metopolophium dirhodum* and *Amphorophora catharinae* occurs mainly in the valley in the foothill zone and the bottom of the strip middle belt of mountains.

**Life cycle.** According to the life cycle of aphids classifications [8; 9] Rosana aphids from Central Asia, have a normal cycle mon-ecious *Amphorophora catharinae*, *Myzaphis rosarum*, *M.turanica*, *Maculolachnus submacula*, *M.jachonthovi*, *Chaetosiphon chaetosiphon*, *Myzus distinctus* and obligated dioecious cycle have *Aphiduromyzus rosae*, *Metopolophium dirhodum*, *Macrosiphum rosae*.

Meanwhile, under favorable conditions, supply part of the colony of aphids *Macrosiphum rosae* and *Metopolophium dirhodum* remain on roses and rose hips in the course of the season. Consequently, these species belong to the group and optionally — Migratory aphids.

**Selection of habitats and ecological niches division.** Each species of aphids has its place in entomotsenoz and host plants. If the range of the species as the geographic rank determines its distribution in space, the environment — mean its distribution and ecological niche.

Selective aphids attitude to environmental factors, and gives rise to discrimination to the habitat, which, ecological specialization. Habitat or station aphids — a set of conditions meet environmental requirements within the range of the species: part of the host plant or a certain type of environment where it occurs.

Often taxonomically close species, settling near to a biological group, occupy different ecological niches. At the same time, they specialize not only on plants of the same species, but also to perform certain parts of the plant — leaves, stems, roots, etc. One forage plants can simultaneously inhabit several species of aphids.

On the base of the biological characteristics of aphid occurs division of ecological niches in the direction of specialization of the various parts of the host plant. This reduces the competitive tension among them and confirms the position that the smaller supplied with plants, the smaller the scale of irregularities which it can specialize [3].

Observations show that *Rosa Fedtschenkoana* during the season a live 6 species of aphids. So, *Amphorophora catharinae* settling lives in large colonies on the tips of thin branches and shoots. *Macrosiphum rosae* lives on stems, leaves and axils of the shoots. *Chaetosiphon chaetosiphon* and *Metopolophium dirhodum* live in small colonies on the tops of young branches and on the underside of leaves.

We marked that two species of aphids can occupy the same position in a particular part of the plant, with one of them acts as a strong competitor, the second, as the weaker opponent, usually propagated before the first.

So, *Metopolophium dirhodum* and *Chaitosiphon chaitosiphon* develop together, spring in the at the bottom of the leaves and shoot tips. Then the parameters of ecological niches of the species cover each other. According to our observations of the development and reproduction *Metopolophium dirhodum* occur somewhat earlier and in their colonies to develop mass nymphs and winged migrants and they are fully migrate to secondary host plants.

This *Metopolophium dirhodum* prevents roses and wild roses from excessive migration of two types of aphids on one of the host plant.

It conforms one more on remarks confirms the findings M. H. Ahmedov [2], which, if two species, one of which acts as a strong competitor, and the second as a weak opponent occupy the same niche in a particular part of the host plant, one of them is migratory, which using a forage plant in the short term development.

Aphids *Myzaphis turanica* diffused colonies, often singly suck on the top and underside of the leaves on the tops of the shoots and buds middle tier of the plant. *Maculolachnus submacula* mainly lives in the root of the wild rose. The division of ecological niches aphids roses and wild roses are determined by the following parameters.

The first position of aphids — the location of their plants along the altitudinal gradient or the separation of niches in space. So, *Maculolachnus submacula* lives at a height of 0–5 sm from the soil surface. *Myzaphis turanica* at a height of 80–100 sm, *Metopolophium dirhodum* and aphids *Chaitosiphon chaitosiphon* found at a height of 100–120 sm fodder plant. At the very top of rosehip lives *Amphorophora catharinae* and below *Macrosiphum rosae*.

The second group of ecological niches which dependencies habitat is characterized by aphids. *Amphorophora catharinae* populates the top thin branches and shoots, *Macrosiphum rosae* is in the bottom of the upper tier. In the middle tier of leaves *Chaitosiphon chaitosiphon* and live *Metopolophium dirhodum* and root parts of the plant *Maculolachnus submacula*.

Thus, several species of aphids, living on the same food plants, share resources and form a gradient sequence niches. The third parameter is the ecological niches of aphids morphological differentiation of species.

Separation niches Rosa aphids as members of one guild [11], corresponds to a certain level of morphological differences. It appears common to all these types of property — adjacent along the

gradient of host plants of aphids consistently different body sizes.

For example, *Maculolachnus submacula*, discriminate a larger body, longer than *Macrosiphum rosae* 0.19 mm. Length body *Amphorophora catharinae* 0.50 mm shorter are *Macrosiphum rosae*. *Metopolophium dirhodum* morphological parameters significantly different from *Chaitosiphon chaitosiphon* (252x1.42 against 1.74x0.92 mm).

Analogical data were obtained when comparing the width of the body. According to the rule Hutchinson [10], a number of animal species in the neighboring sequence of potential competitors differ in the length of about 1.3 times. Approximately the same ratio observed in guilds Rosana aphids. Thus, the ratio of body length Rosa aphids ranges from 1.11 to 1.44 (mean — 1.28 times), width — 1,21–1,41 (average — 1.31 times).

Depending on the size of the habitat of aphids, it is the density of their population. As a rule, the latter is in inverse proportion to body size. Thus, the largest *Maculolachnus submacula* in the root of the plant is found in small colonies, whereas aphids *Amphorophora catharinae* and *Macrosiphum rosae* form dense colonies on top of the host plant.

In entomological group and host plants differentiated ecological niches increasingly goes in the direction of each other complement, not compete directly in the direction of the user the space ecological system which host plants and the possible types of interactions [1; 2].

**Disutility of aphids on roses and rose hips.** From aphids roses plantations cause considerable damage aphids *Macrosiphum rosae* and *Amphorophora catharinae*. Since april young shoots of roses covered by large colonies of aphids.

Won the mass of their reproduction in april — may the shoots of host plants wilt and the leaves fall off. Wingless virgin forming in october in fairly large colonies occur in December, some years in January.

More favorable environmental conditions, the absence of other species of aphids on host plants, leads to an intense breeding *Maculolachnus submacula*.

At the same time, large colonies of aphids live on the stem and the top of the shoots and in the root of the wild rose. In consequence it is the observed mass falling of the leaves of the plant. The harmfulness of other species of aphids on roses and rose hips are observed, which belong to their way of life.

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## The capacity of absorption, the composition and the ratio of exchangeable cations of light sierozems of Karshi steppe

**Abstract:** The materials provided in the present work characterizes the main elements of fertility and humus content on which depends the composition. The ratio of absorbed bases irrigated light sierozems are characterized as well.

**Key words:** fertility, cations, absorbed, amount, humus, nutrient element, gross, mobil.

**Introduction.** The study of composition and properties of absorbed bases of soil is one of the main tasks of the theoretical soil science, from the depth of its solution flowing out an understanding of the appropriateness of the geographic distribution and reclamation of alkaline soil and the other soils, the development of the processes of soil in general. The founder of the doctrine of the absorption capacity of soils Tyurin I. V. [1, 33–34] mentioned: “All the properties of the soil, which will ultimately determine the value of the produced crop, depend to some extent on the size, nature and composition of the soil absorption complex. In close depending on the soil, there is the structure of soil, physical properties of soil and water, air, micro-biological, nutritional and sanitary regime of the soil”.

The doctrine of an absorption of the composition and proportions of exchangeable cations stands on a solid foundation of scientific works of scientists, such as, V.A. Kovda [2, 380–385], D. S. Orlov, L. K. Sadovnikova, N. I. Sukhanova [3, 115–151], W. R. Kelley [4, 86–91] and others. Among the scientific papers, covering the composition and the ratio of absorbed cations in soils of the Central Asia, the works of P. N. Besedina [5, 84–92] express the greatest interest. These above mentioned and other authors have noted a low cation exchange capacity in soils of Central Asia.

It should be noted that today, it is very difficult to find the work materials related to the present sphere, the works in which one could find materials that enable to trace in time space. There is a lack of information giving an idea about the composition and properties of absorbed bases in Karshi steppe sierozems.

As for an actuality of the topic, basically the capacity exchange of irrigated soils of the region and an impact of certain factors on the composition and properties of exchange bases light sierozems of Karshi steppe determined relevance of the topic.

**Research methods.** During the research period from 2008 to 2015 in the survey area of the zone of influence of Mubarak gas processing plant of Kashkadarya region of the Republic of Uzbekistan, by depending on the condition of light sierozems, in survey area were laid 18 full-profile soil profiles. The selection, preparation, agrochemical analysis of soil samples carried out in accordance with adopted methods [6, 5–148].

**Results of the research.** It is known that sierozem is leaching from the soil profile, soil-forming rocks of water-soluble salts, gypsum sometimes carbonates. The leaching energy is reducing from dark to light sierozem. The results of the analysis of aqueous extracts of a number of sections of the object of study indicate that, the light sierozems contain in the upper horizons and the overall profile insignificant amount of water-soluble salts, and they belong to the group of non-saline soils. Carbonate horizon soils irrigating the light sierozems practically does not differ from the soil-forming rocks.

The soil-forming rock contains carbonates within the 6–9%, in carbonate-illuvial horizons it contains 7–10%. In composition of the carbonates in the studied soils, the magnesium carbonate is significantly less in comparison with the calcium carbonate.

The cations exchange capacity (CEC) is considered as a common indicator of the soil cation exchange properties. In English-language literature, this indicator means CEC (the cations Exchange capacity), [7, 206–237].

By own contain, the sum of exchangeable cations, or the sum of exchangeable bases can be considered as the close notion to the CEC. The results of analysis of the composition and amount of absorbed bases irrigated light sierozems are indicated in the following table.

Table 1. – The composition of absorbed bases irrigated light sierozems (n=8)

Depth, cm	Meq. 100 g. of soil					As a percentage of the amount			
	Ca <sup>++</sup>	Mg <sup>++</sup>	K <sup>+</sup>	Na <sup>+</sup>	Amount	Ca <sup>++</sup>	Mg <sup>++</sup>	K <sup>+</sup>	Na <sup>+</sup>
S. Maymanak, profile 3									
0–30	6,51	2,11	0,81	0,51	9,94	65,5	21,2	8,1	5,1
31–50	6,33	2,01	0,76	0,41	9,51	66,6	21,1	8,0	4,3
51–70	6,41	1,70	0,83	0,43	9,32	68,7	18,1	8,8	4,6
Karshi, profile 4									
0–30	7,03	2,01	0,71	0,43	10,18	69,1	19,7	7,0	4,2
31–50	6,73	1,90	0,66	0,33	9,62	69,9	19,7	6,9	3,4
51–70	6,50	1,85	0,77	0,41	9,43	68,9	19,6	8,1	4,3

It should be noted, that the whole exchange capacity value of the sierozems of Karshi steppe is close to the same soils in other regions of Uzbekistan.

The soil absorbing complex of sierozems of Karshi steppe is full of mostly alkaline earth cations, from which flow out that sierozem formation is not accompanied by the accumulation and the formation of sig-

nificant amounts of calcium and magnesium carbonates. The relatively high content of carbonates in these soils is the result of physical and chemical processes occurring in the soil-forming rocks of loess type.

The irrigated light sierozems differ from other soils of this series by containing low humus and other organic substances, as well as the gross and mobile forms of nutrients plants (Table 2).

Table 2. – Agrochemical properties of irrigated light sierozems (n=8)

Depth, cm.	Humus,%	Gross,%			Mobile, mg/kg	
		Nitrogen	Phosphorus	Potassium	Phosphorus	Potassium
S. Maymanak, profile 3						
0–30	1,38	0,088	0,120	1,720	19,46	300
31–50	0,91	0,082	0,090	1,846	15,80	340
51–70	0,80	0,038	0,103	1,880	16,30	290
Karshi, profile 4						
0–30	1,20	0,120	0,141	1,884	12,70	280
31–50	0,96	0,079	0,136	1,902	19,80	310
51–70	0,63	0,045	0,125	1,916	17,73	295

Furthermore, it should be noted, that sierozem forming does not accompanying by the accumulation of large amounts of humus, nitrogen, phosphorus, potassium, where a relatively high content of potassium is associated with its contents in soil-forming rocks [8, 170–176]. During the scientific research of the mineralogical composition of irrigated light sierozems, found the significant amount of colloidal minerals such as montmorillonite, illite, vermiculite, kaolinit and etc., it is quite possible, that potassium vigorously enters into the crystal lattice of these minerals.

The above mentioned materials relating to water-soluble salts, carbonates and humus content and also nutrients contribute to low absorption capacity of these soil cations.

Irrigated light sierozems are characterized by a low amount of absorbed cations, due to the lack of humus and minerals with high capacity exchange.

This situation can be observed according to Kovda [2, 384–385], which leads to the absorption capacity of the various components: 3–9 humic acid, 2.6 soil humus, 1–1.7 montmorillonite, 0.3–0.5 illite, 0.1–0.2 meq/g kaolinite. Consequently, exceptionally high absorbency humus and humic acids, as well as the montmorillonite group minerals substantially determines the absorption capacity of the soil. The soils in which organic matter is small, by the way the light sierozems are also included to them, an absorption capacity is not high.

The irrigated light sierozems of Karshi steppe are characterized by low absorption capacity, which contain very little humus and soil colloids. These soils are formed in sierozem zone and have an absorption capacity of not higher 9,37–10,18 meq/100 g of soil (Table 1).

One should note the high saturation of the absorbing complex of the studied soil alkaline bases, where the amount of absorbed calcium and magnesium constitute the 86,7–89,6% of the amount

of absorbed bases, the remaining 10,4–13,3% are potassium and sodium. The amount of absorbed magnesium in soils varies in 28,1–21,2% of the amount, which is almost 3 times or more less than the absorption of calcium.

Obviously, from the alkali metals potassium prevails, which varies between 6,9–8,1% of the amount. The amount of absorbed sodium varies in the range of 3,4–5,1%, which leads to the conclusion, that the soil is not alkaline. In the soil horizons as it approaches the surface, one can observe slow increase content of absorbed calcium and magnesium. This pattern of absorbed calcium and magnesium in sierozem forming linked together with other biological factors offsets of these elements. As for the almost equal distribution of absorbed calcium and magnesium in irrigated light sierozems of the studied area, this process is associated with the fact that in the past, these soils were passed the process of salinity and desalting, in which cation exchange takes place on a different principle.

Thereby, the results mentioned above show that, during agriculture irrigating process, the cation exchange capacity and its quality is in dynamic equilibrium, the growth of the cation exchange capacity is observing with an increase in cultivated soils. The high carbonate content and saturation of the absorbing complex of alkaline earth elements irrigating the light sierozems, give slightly alkaline reaction, where the pH of the aqueous extract in the upper horizons of the arable and sub-arable varies in the range of 7.2–7.8.

The capacitance value of exchange and the number of exchangeable bases such little humus irrigated light sierozems are not only more, depending on the humus content and texture, but also on the mineralogical composition and the amount of the clay fraction. In using of these lands into agriculture the maximum attention should be directed to the development of chemical reclamation of soils in order to preserve and increase the absorption of calcium and the reduction of absorbed magnesium, sodium in the soil absorbing complex.

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## In Vitro rearing of trichogramma (Hymenoptera: Trichogrammatidae)

**Abstract:** This article reports the recent results of our experiments using artificial media devoid of insects additives for rearing *T.pintoe*, *T.evanescens* in vitro.

**Key words:** Artificial media, parasitoid growth factors, in vitro, hemolymph, egg yolk, inorganic salt mixture, cow milk, *trichogrammatidae*, predator, research tool, mass production.

### Introduction

At the process of entirely rearing *trichogramma* parasite in the laboratory condition cultivates *Sitotrogoce reallela* Olive egg a lot of corn productions such as grain, maize, barley and worker force are spent. In the result of it, rearing price is increased. More than 150 thousand ton barley is emitted in exist biolaboratory our Republic in a year [1; 2; 3].

Emitting this barley, other diets cultivation happens in the account of decreasing producing of plants or enterprises. This testifies that above mentioned process is damaging for diets industry [1; 2].

By rearing *trichogramma* commonly using artificial diets mediums and automatizing them gives an opportunity to solve above problem.

In China 1975–1978 years for 3 year' investigations rearing *trichogramma* in the diets medium, which belongs to artificial medium researches showed its good results [1; 3].

According to the first medium, first general ingredients: (Hemolymph from pupae *Antheraea pernyi* 43.1%, egg yolk 34.48%, inorganic salt mixture 13.79%, and pig serum 8.62% or hemolymph from pupal *Philosamia cynthia* ricini 31.75%, cow milk 31.75%, egg yolk 23.81% and, inorganic salt mixture 12.70% [2; 3].

By the method of rearing Entomophags in vitro many scientists investigated and achieved positive results

According to Gao and others' (1982) researches *trichogramma* generation which is reared in vitro when is used against *H.armigera* in the field of cotton-plant was achieved biologic effectiveness by 93% [1; 2].

The artificial rearing of *trichogrammatidae* started a long time ago, with the main goal to try obtaining a mean to multiply and produce parasitoids to be released in biological control strategies. But it is also a powerful tool to conduct studies on biology, physiology and behavior of entomophags, especially endoparasitoid species (Grenier, S., Plantevin, G. 1990.). *Trichogramma* spp 5 are widely used for biological control of pest insects. Currently, these egg parasitoids can be produced only from natural or factitious hosts or from insect hemolymph- based diets [2; 3].

Wu *et al.* (1982), Liu and Wu (1982), and Qin and Wu (1988) described artificial diets devoid of insect components for the *in vitro* rearing of *Trichogramma dendrolimi* Matsumura [2; 3].

Considerable work has been done on the development of artificial diets for *Trichogramma* spp. Many of these efforts have involved diets containing hemolymph (Guan *et al.*, 1978; Hoffman *et al.*, 1975; Hubei Research Group, 1979; Liu *et al.*, 1979, 1982; Wu *et al.*, 1982; Strand and Vinson, 1985; Xiet *et al.*, 1986, 1997a; Qin and Wu, 1988; Grenier *et al.*, 1995). Development of artificial diets for *Trichogramma* would foster the implementation of automated mass rearing systems. Some progress has been made along this line, primarily in China (U.S. Department of Agriculture, 1982; Li *et al.*, 1988, 1995a, b)

where *in vitro* reared *Trichogramma chilonis* Ishii have been released for control of sugarcane stem borers (Liu *et al.*, 1995b) and *Trichogramma dendrolimi* Matsumura has been reared for control of *Heliothis armigera* L. in cotton and *Dendrolimus punctatus* L. in pine trees [1; 3].

### Materials and methods

Source of *Trichogramma* and In Vitro Rearing *Trichogramma* stock: *T. evenecens*, *T.pintoe* were collected from Tashkent province, Buka district, and reared in the laboratory on *Heliothis armigera* and *Agretus segetum* shif.

**Ingredients for in vitro medium:** Pupae hemolymph (*G.melonnellan* or *H.armigera*), cow milk or 10% powdered milk solution, chicken embryo extract and Neisenheimer's mixture salt.

#### Preparation of the ingredients

1. **Insect hemolymph collection:** Alive pupae were immersed in water bath at 60 °C for 6 or 7 min to avoid blackening of the hemolymph. After surface sterilization with alcohol and need sterile condition.

2. **Chicken embryo extract collection:** The Chicken embryo extract, only it should be the egg yolk and need sterile condition.

3. **Milk:** Fresh cow milk or 10% powdered milk solution also need sterile condition.

4. **Inorganic mixture salt:** Use Neisenheimer's mixture salt (NaCl 7.5 g, KCl 0.1 g, CaCl<sub>2</sub> 0.2 G, NaHCO<sub>3</sub> 0.2 g, H<sub>2</sub>O 100 ml).

#### Artificial "egg-cards"

There are 2 types of artificial "egg-cards" [2; 3].

1) Tri-ring "egg-cards" 2 pieces of plastic film are used. The semispherical concaves are made on the upper plastic film. Artificial medium is poured into concaves fully (but without overflow) with a micro-syringe or micro-pipette. The bottom plastic film has no concaves. The upper and bottom plastic films are separated and stretched tightly by three plastic ring with different inner diameters, in our Cass they are: 5:5 cm, 5.4 cm, 5.2 cm respectively;

2) Bag-form "egg-cards": One half of a piece of film is filled of concaves with medium and is covered by another half of film. Three sides of film are sealed. Convex side of capsules are exposed and between the concave side and bottom half of the same piece of film there should be space for aeration. The size of plastic film depends upon the number of semispherical concaves made on film [2; 3].

**Culture of *G.melonnella* or *H.armigera*** fresh cocoons of *G.melonnellan* or *H.armigera* from Tashkent province.

#### Components of artificial diets for *Trichogramma pintoi*

**The first medium:** Hemolymph (A) *G.melonnellan* (A<sub>1</sub>) 45,5%, Neisenheimer's (A<sub>2</sub>) 15,5%, Chicken egg yolk (A<sub>3</sub>) 25,5%, milk (A<sub>4</sub>) 13,5%.

**The second medium:** Hemolymph (B) *Heliothis armigera* Hb (B<sub>1</sub>) 34,5%, Neisenheimer's (B<sub>2</sub>) 12,5%, Chicken egg yolk (B<sub>3</sub>) 30,5%, milk (B<sub>4</sub>) 22,5%.

**The three medium:** Hemolymph (C) *Agretus segetum shif* (C<sub>1</sub>) 42,5%, Neisenheimer's (C<sub>2</sub>) 13,5%, Chicken egg yolk (C<sub>3</sub>) 23,5%, milk (C<sub>4</sub>) 20,5%.

**The four medium:** Hemolymph (D) *G.melonnellan* (D<sub>1</sub>) 45,5%, Neisenheimer's (D<sub>2</sub>) 12,5%, Chicken egg yolk (D<sub>3</sub>) 30,5%, milk (D<sub>4</sub>) 11,5%.

**The five medium:** Hemolymph (E) *G.melonnellan* (E<sub>1</sub>) 45,5%, Neisenheimer's (E<sub>2</sub>) 13,5%, Chicken egg yolk (E<sub>3</sub>) 20,5%, milk (E<sub>4</sub>) 20,5%.

### The results of the research

It was showed in the Table 1 that the pupae hemolymph of either *G.melonnellan* or *H.armigera* Hb could be used as the main component of the artificial diet for the development of *T. pinto* and *T. evenecens*. There was no significant difference in their parasitism, survival, percentage of pupation, adult emergence and reproductively when the pupae hemolymph of *G.melonnellan* was used instead of that of *H.armigera* Hb.

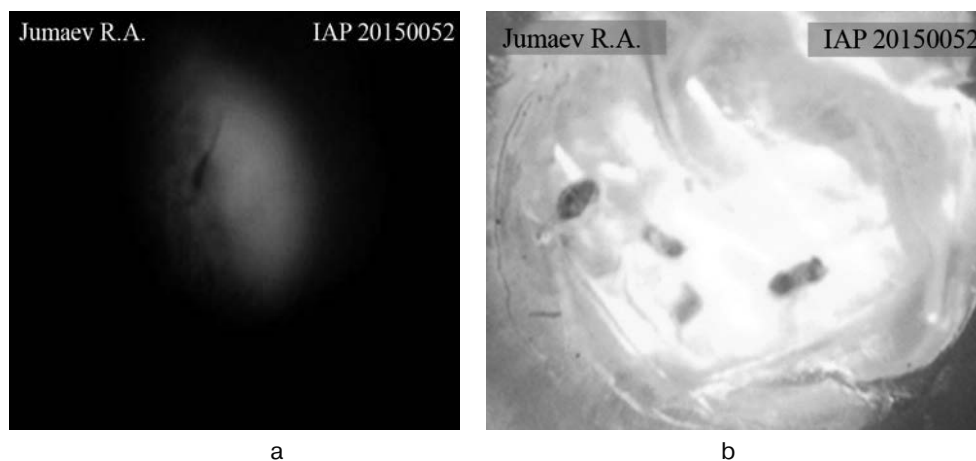
Developmental stages of *T. evenecens* by in vitro.



Picture 1. a – Bag-form artificial “egg — card”, b – Young scientist R. A. Jumaev is practicing his research on the theme of “Rearing *Trichogramma* in vitro”

Table 1. – Development of *Trichogramma pinto*, reared in vitro laboratory experiences, 2013–2016 y. (+25±3°C, RH 80±5%)

Composition of medium %	The amount of damage %	Development degree of trichogramma generation in artificial medium by days				Genders proportion ♂: ♀			
		Eggs	larva period	Pupa period	Mature period (imago)				
A				66,3	1,4	5,6	4,4	3,4	2:4
A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>						
45.5	15.5	25.5	13.5						
B				46,7	1,4	3.3	–	–	–
B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>						
34.5	12.5	30.5	22.5						
C				34,4	1,2	4,8	2.4	-	-
C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>						
42.5	13.5	23.5	20.5						
D				74,6	1,4	5,6	4,1	3,3	2:6
D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>						
45.5	12.5	30.5	11.5						
E				82,5	1,3	5,8	5,4	3,6	2:8
E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>	E <sub>4</sub>						
45.5	13.5	20.5	20.5						



Picture 2. Developmental stages of *T. evenecens* by in vitro a — egg, b — larvae of 2nd instar, early stage of pre pupae and female adult

It is obvious in the research, prepared all mediums of diets are harmed with *trichogramma* generation and put there eggs. But it is observed dying because of inconvenience medium of diets for developing parasite generation. According to diet mediums component development of *trichogramma* parasite was rather prolonged when *G.melonnella* hemolymph and inorganic salt's quantity was more in diets medium. In fact quantity of protein and oil is more in the structure of hemolymph as well as it is considered convenient for development of parasite maggot.

Thus, from above nominated artificial diet mediums, fifth diet medium (E) pupae hemolymph of *G.melonnella* (E<sub>1</sub>) 45,5%, inorganicsalts (E<sub>2</sub>) 13,5%, chicken yolk (E<sub>3</sub>) 20,5%, milk (E<sub>4</sub>) 20,5% composed medium of diets is defined as a suitable one for normal nourishment and development of *trichogramma* generation in order to rear *trichogramma* parasite.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-13-16>

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## Study on effect of $\alpha$ -lipoic acid on phospholipid composition of rat cardiac tissue under hypobaric hypoxia

**Abstract:** Hypoxia is a rather frequent pathological or borderline state caused by the reduction of oxygen concentrations in the ambient environment or dysmetabolism of oxygen in an organism. The simulated chronic hypoxia similar to the one at the altitude of 7,000 m, caused changes in total sum of phospholipids in rat cardiac tissue and proportions of some phospholipids. Pharmacocorrection of the changes with berliithion containing  $\alpha$ -lipoic acid was found to normalize levels of some rat cardiac tissue phospholipids.

**Key words:** cardiac tissue, hypobaric hypoxia, phospholipid.

#### Introduction

Hypoxia is a rather frequent pathological or borderline state-caused by the reduction of oxygen concentrations in the ambient environment or dysmetabolism of oxygen in an organism [1; 2183]. Hypoxia is capable of causing diseases independently and modifying courses of other diseases, primarily, cardio-vascular ones [2; 634–635].

The findings from numerous recent studies aiming at elucidation of a mechanism underlying the onset and progression of pathological processes associated with hypoxia of cardio-vascular system are the evidence for the fact that changes in a cell membrane's structure and function are the significant link in the chain of the pathology's onset

[3, 49–50; 4, 10]. In many cases damage of integrity of membrane bilayer's lipid phase accounts for fails indicating significant role of lipids in pathogenesis of hypoxic conditions [5, 31–32; 6, 84].

Changes in the lipid composition of cardiac tissue membranes under hypoxia are known to take place because of hypoenergetic condition, excessive lipid peroxidation [7, 140–141; 8, 413–415] and modification of membrane structures under the effect of cytotoxic metabolites [9; 177]. Disorders in cardiac bioelectrical activity, onset and progression of arrhythmia and hypertension [10; 177], atherosclerosis [11; 188], myocardial hypertrophy, ischemic heart disease and myocardium infarctions [12; 380] are among the consequences taking place [13; 199–200].

The work was initiated to study effect of chronic hypobaric hypoxia on concentrations of several fractions of the rat cardiac tissue phospholipids and their total sum with subsequent pharmacocorrection of changes by means of  $\alpha$ -lipoic acid as a constituent of berlithion 300 (Menarini Group, Berlin-Chemie AG, Germany).

#### Materials and methods

Hypobaric hypoxia was simulated in 108 senior outbred male rats weighing 250–280g by means of an altitude test chamber [14;3] with preset pressure of 308 mm Hg similar to the one at the altitude of 7,000m by 8-hour exposures for 10, 20 and 30 days. The animals exposed to hypoxia were divided into two groups; no correction of hypoxia was performed in the first group of rats, in the second group berlithion was intraperitoneally administered in the dose of 100 mg/kg of rat body mass (hypoxia+berlithion).

The control group kept in habitual conditions of the animal facility included 36 rats divided into three groups by 12 animals in a group administered with a physiological solution for 10, 20 and 30 days, respectively. All animals were slaughtered by decapitation with their hearts being weighted and homogenized in liquid nitrogen after the slaughter. Extraction of total lipids and their purification from non-lipid impurities was performed by Folch's method [15; 499] with recommendations of Kates [16; 74] by means of chloroform-methanol mixture (2:1). Extraction was performed within 60 minutes with

regular shaking of flasks at the room temperature. The method allows sufficiently complete extraction of tissue lipids. Crude lipid extract (CLE) was stored at 0–4 °C to measure amounts of phospholipids and their fractionation. Following mineralization of the samples, estimation of phospholipid absolute amounts and separate fractions was performed by amount of phosphorous in them with colorimetric assay of the non-organic phosphorus by Vaskovsky et al. [17; 129–141].

Fraction composition of phospholipids was analyzed by one-dimensional ascending chromatography in thin silica gel on 13x18 cm glass plate in the system of solvents (chloroform-methanol-acetic acid-water, 16:4:1:4). The solvent front achieved, the plates were taken from the chamber and dried for fractions of phospholipids to be developed in iodine vapor.

#### Results and discussion

Prolonged hypoxia both in human beings and animals is known to induce adaptive changes on various levels of cell organization, which allow sustaining proper level of homeostasis in an organism under oxygen deprivation [18, 4–6; 19, 598].

Induced in rats, the simulated chronic hypoxia similar to the one at the altitude of 7,000 m, was found to cause increase in total sum of phospholipids (Fig.1) and oppositely directed alterations in proportions of phospholipid fractions (Table 1–4).

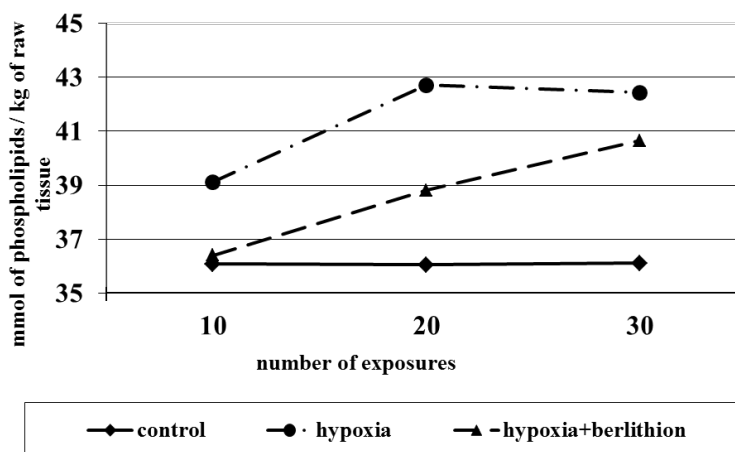


Figure 1. Total sum of phospholipids in rats under chronic regular hypoxia (similar to the one at the altitude of 7,000m)

Figure 1 demonstrates that total sum of phospholipids in hypoxia exposed rats tended to increase, though the changes were not significant all the time ( $P < 0.05$ ). Thus, if on the 10<sup>th</sup> day of experiment amounts of total phospholipids in hypoxia exposed rats not subjected to correction were significantly different from those in the controls (39.109 mmol/kg versus 36.078 mmol/kg of raw tissue), on the 20<sup>th</sup> day of experiment the parameter was higher in all hypoxia exposed rats than in the controls. Total phospholipids in the cardiac tissue of control animals on the 20<sup>th</sup> day of experiment were 36.046 mmol of

phospholipids/kg of raw tissue; 42.704 and 38.805 mmol of phospholipids/kg of raw tissue in the first and second groups of hypoxia exposed rats, respectively. On the 30<sup>th</sup> day of experiment parameters in the first group remained unchanged (42.436 mmol of phospholipids/kg of raw tissue in hypoxia exposed rats versus 36.108 mmol of phospholipids/kg of raw tissue in the controls). Despite correction, the situation in the second group of rats heightened (40.647 mmol of phospholipids/kg of raw tissue in hypoxia exposed rats versus 36.108 mmol of phospholipids/kg of raw tissue in the controls).

Table 1. — Levels of lysophosphatidylcholine (LPC) and phosphatidylcholine (PC) in rat cardiac tissue under correction of hypoxia

	Control	Hypoxia	Hypoxia + berlithion
10 exposures			
lysophosphatidylcholine	0.46±0.02	1.41±0.06	1.02±0.05
phosphatidylcholine	14.57±0.67	13.47±0.61	14.34±0.6
20 exposures			
lysophosphatidylcholine	0.46±0.02	2.5±0.1	1.46±0.07
phosphatidylcholine	14.57±0.67	14.7±0.65	13.6±0.64
30 exposures			
lysophosphatidylcholine	0.46±0.02	2.48±0.08	1.66±0.05
phosphatidylcholine	14.57±0.67	14.82±0.73	14.87±0.65

Levels of lysophosphatidylcholine (LPC) in all hypoxia exposed rats were higher than those in the controls within all periods of study (Table 1). Following administration of berlithion, levels of lysophosphatidylcholine clearly reduced, that is,  $\alpha$ -lipoic acid can be concluded to suppress increase in LPC levels, thus demonstrating efficacy of this type correction for hypoxia.

Though insignificantly, levels of phosphatidylcholine (PC) in hypoxia exposed rats regardless of hypoxia duration was found lower than those in the controls (Table 1). Thus, on the 10<sup>th</sup> day of

experiment average PC levels in the first group of rats were  $13.47 \pm 0.61$  mmol/kg of raw tissue, PC levels on the 20<sup>th</sup> and 30<sup>th</sup> days of experiment were  $14.37 \pm 0.65$  and  $14.82 \pm 0.73$  mmol/kg of raw tissue, respectively. In the second group of hypoxia exposed rats on the 10<sup>th</sup> day of experiment average PC levels were  $14.34 \pm 0.60$  mmol/kg of raw tissue,  $13.96 \pm 0.64$  mmol/kg of raw tissue could be seen on the 20<sup>th</sup> and 30<sup>th</sup> days of experiment. The findings demonstrate efficacy of berlithion for phosphatidylcholine in hypoxia of moderate duration (10 exposures).

Table 2. – Levels of phosphatidylethanolamine (PE) and diphosphatidylglycerol in rat cardiac tissue under correction of hypoxia

	Control	Hypoxia	Hypoxia+berlithion
10 exposures			
phosphatidylethanolamine	10.75 $\pm$ 0.51	13.6 $\pm$ 0.061	11.8 $\pm$ 0.54
diphosphatidylglycerol	4.93 $\pm$ 0.24	2.9 $\pm$ 0.13	2.79 $\pm$ 0.13
20 exposures			
phosphatidylethanolamine	10.75 $\pm$ 0.51	15.15 $\pm$ 0.68	13.4 $\pm$ 0.61
diphosphatidylglycerol	4.93 $\pm$ 0.24	3.19 $\pm$ 0.14	3.15 $\pm$ 0.14
30 exposures			
phosphatidylethanolamine	10.75 $\pm$ 0.51	14.46 $\pm$ 0.59	13.69 $\pm$ 0.58
diphosphatidylglycerol	4.93 $\pm$ 0.24	2.95 $\pm$ 0.14	2.79 $\pm$ 0.13

The findings from study of phosphatidylethanolamine (PE), another significant fraction of neutral phospholipids, deserve special mention. Data in Table 2 demonstrate effect of berlithion on PE levels manifesting specifically on the 20<sup>th</sup> and 30<sup>th</sup> days of experiment. As to diphosphatidylglycerol, the levels of this lipid most regrettably remained unchanged in all hypoxia exposed rats regardless of terms. The findings are indicative of low sensitivity in phospholipids of mitochondrial inner membranes to antioxidants and Krebs cycle stimulation. In our study hypoxia was found to facilitate reduction in the levels of diphosphatidylglycerol in rat cardiac tissues, being indicative of its biosynthesis inhibiting and intensification of degradation; the phenomena impossible to be improved by pharmacocorrection with  $\alpha$ -lipoic acid.

Our findings from studying levels of phosphatidylserine (PS)

and phosphatidylinositol (PI) are of special interest, since increase in the levels of these phospholipids could be observed within all periods and in all hypoxia exposed animals (Table 3). It may well be that, regardless of number of exposure, rapid increase of PS levels is both qualitatively and quantitatively necessary to sustain membrane asymmetry, as well as for adequate function of various ion pumps, such as, Ca<sup>2+</sup> pumps and sodium-potassium pumps, in which phosphatidylserine is directly involved. Increase in PS levels may be facilitated both by increase in its biosynthesis and reduction in PS decarboxylation to phosphatidylethanolamine (PE) associated with the decline in PE methylation to phosphatidylcholine (PC) under the effect of N-methyltransferase to explain the increase in PE levels and the reduction in PC levels versus the values in the controls [20; 212–213].

Table 3. – Levels of phosphatidylserine (PS) and phosphatidylinositol (PI) in rat cardiac tissue under correction of hypoxia

	Control	Hypoxia	Hypoxia+berlithion
10 exposures			
phosphatidylserine	1.19 $\pm$ 0.06	1.43 $\pm$ 0.06	1.52 $\pm$ 0.07
phosphatidylinositol	1.88 $\pm$ 0.09	2.51 $\pm$ 0.11	1.99 $\pm$ 0.09
20 exposures			
phosphatidylserine	1.19 $\pm$ 0.06	1.55 $\pm$ 0.07	1.64 $\pm$ 0.07
phosphatidylinositol	1.88 $\pm$ 0.09	2.93 $\pm$ 0.13	2.17 $\pm$ 0.1
30 exposures			
phosphatidylserine	1.19 $\pm$ 0.06	1.42 $\pm$ 0.06	1.79 $\pm$ 0.08
phosphatidylinositol	1.88 $\pm$ 0.09	2.45 $\pm$ 0.08	2.34 $\pm$ 0.1

In our study, under chronic hypoxia levels of phosphatidylinositol (PI) were found to increase in hypoxia exposed rats not receiving berlithion and to decrease upon its administration. Following administration of berlithion, PI levels in short term exposure to hypoxia (10 exposures) were compared with those in the controls ( $1.99 \pm 0.09$  versus  $1.88 \pm 0.09$  mmol/kg of raw tissue), after 20 and 30 exposures PI levels were significantly different. Berlithion was found to facilitate reduction in PI levels as compared with those in the rats undergoing no correction, but the values were not comparable with those in the controls. Increase in PI levels under in chronic hypoxia is thought to be an adaptive mechanism to optimize energy resources with ATP deficiency. Hypoxia causes oxidative phosphor-

ylation uncoupling to stimulate anaerobic glycolysis and providing PI synthesis by substrates, while stimulation of phosphatidylinositol synthase accelerates adjoining of inositol to cytidin diphosphate-diacylglycerol. After correction of chronic hypoxia with berlithion, stimulation of energy metabolism and optimization of conditions for oxidation of pyruvate and Acetyl-CoA took place resulting in reduction of activation of PI energy system and in PI decline. In addition, berlithion facilitates complete oxidation of carbohydrates in the myocardium, utilization of glucose-6-phosphate for oxidation and synthesis of ATP, but not of inositol with glucose-6-phosphate as its precursor. In addition, pharmacocorrection stabilizes intracellular machinery facilitated by phosphatidylinositol [21; 26].

Levels of sphingomyelin (SPH) in hypoxia exposed rats not undergoing pharmacocorrection were significantly different from those in the controls within all periods of observation. After 10 exposures to hypoxia, berlithion was found to facilitate reduction in SPH absolute content, while in under prolonged hypoxia irrespectively of pharmacocorrection with berlithion SPH levels tended to increase.

The findings demonstrate efficacy of berlithion for sphingomyelin under hypoxia of moderate duration (10 exposures) (Table 4).

Following the pharmacocorrection with berlithion, regardless of hypoxia duration, levels of phosphatidic acid (PA) tended to decrease, yet remaining significantly higher than those in the control group within all periods of observation.

Table 4. – Levels of sphingomyelin (SPH) and phosphatidic acid (PA) in rat cardiac tissue under correction of hypoxia

	Control	Hypoxia	Hypoxia+berlithion
10 exposures			
sphingomyelin	1.86±0.09	2.26±0.1	2.03±0.09
phosphatidic acid	0.44± 0.02	1.51±0.07	0.91±0.04
20 exposures			
sphingomyelin	1.86±0.09	2.06±0.09	2.1±0.1
phosphatidic acid	0.44± 0.02	1.3±0.06	0.92±0.04
30 exposures			
sphingomyelin	1.86±0.09	2.25±0.09	2.15±0.09
phosphatidic acid	0.44± 0.02	1.59±0.06	1.36±0.06

### Conclusions

To sum up, the simulated chronic hypoxia similar to the one at the altitude of 7,000 m, caused increase in total sum of phospholipids in rat cardiac tissue; levels of some phospholipids, such as lysophosphatidylcholine, sphingomyelin, phosphatidylethanol-

amine, phosphatidylserine, phosphatidylinositol and phosphatidic acid were found to increase, while levels of diphosphatidylglycerol markedly decreased. Pharmacocorrection of the changes with berlithion containing  $\alpha$ -lipoic acid was found to normalize levels of some rat cardiac tissue phospholipids.

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## Bacteriocin production by *Lactobacillus plantarum* 42 strain

**Abstract:** Bacteriocins are ribosomally synthesized antibacterial peptides secreted by certain types of bacteria and active against both closely related species, and members of other species. Currently bacteriocins are recommended for use as antimicrobial agents in the food industry and in medicine. Bacteriocin production significantly depends on several factors such as culture conditions — pH, temperature, composition of the growth medium and the growth phase of producer strain. Bacteriocins can both be released to the culture medium, and remain attached to the producer cell. Optimization of growth conditions for bacteriocin production and increase its activity is of great economic importance to reduce its production cost.

The aim of this study was to determine the localization of a bacteriocin of *Lactobacillus plantarum* 42, active against *Enterococcus faecalis* and to determine the optimal culture conditions in which there is its maximum output has been observed.

The *Lactobacillus plantarum* 42 strain synthesizes bacteriocin, which is active against *Enterococcus faecalis*, is released into a solid and a liquid nutrient medium, but found only at 10 times the concentration in MRS broth. Bacteriocin detected at early stationary growth phase (18 hours) and remains active until 76 hours after initiation of fermentation. Maximal amount of bacteriocin was detected after 48 hours of fermentation at the initial pH value of growth media 6. There was no difference in the cultivation temperatures of 30°C and 37°C for bacteriocin production. This bacteriocin proved to be a secondary metabolite.

**Keywords:** *Lactobacillus plantarum* 42; bacteriocin; *Enterococcus faecalis*.

### Introduction

Lactic acid bacteria (LAB) secrete large amounts of antimicrobial agents, including organic acids, reuterin, diacetyl, bacteriocins, hydrogen peroxide and that are able to inhibit the growth of pathogenic microorganisms [1]. Bacteriocins are ribosomally synthesized protein, secreted by certain types of bacteria, possessing antibacterial activity against both a closely related species [2], and members of other species [3]. Currently bacteriocins are recommended for use as antimicrobial agents in the food industry and in medicine [3; 4]. Bacteriocins have different spectrum of susceptible microorganisms, including those causing food spoilage and therefore, they can serve as a natural substitute for synthetic preservatives [5]. In this connection scientific interest to search for new potential sources of these peptides has significantly increased nowadays. It was reported that bacteriocin production depends on several factors such as culture conditions — pH, temperature, composition of the culture medium and the producer strain's growth phase [6]. The bacteriocins can both be released in the culture medium [7], and remain attached to the cell producer [8]. Optimization of conditions for bacteriocin production and increase its activity is of great economic importance to reduce its production cost.

The aim of this study was to determine the localization of a *Lactobacillus plantarum* 42 bacteriocin, active against *Enterococcus faecalis* and to determine the optimal culture conditions for its maximum output.

### Experimental part

**Bacterial cultures.** In the research the bacteriocin synthesizing *Lactobacillus plantarum* 42 strain was used as the test organism [9]. The strain is isolated from sauerkraut and stored in the freeze-dried stock at the laboratory of genetics of lactic acid bacteria of the Institute of microbiology of AS of Uzbekistan [10]. For using in experi-

ment bacteria were recovered by two-times subculturing in MRS (de Mann, Rogosa, Sharp) broth (HiMedia) (amount of inoculum introduced was 1%) and incubation at 37°C for 24 hours. The type strain of *Enterococcus faecalis* was an indicator strain.

**Determining the localization of synthesized bacteriocin.** To determine whether the antimicrobial peptide secreted to the media or left attached to cell, the presence of antimicrobial activity was studied: a) in the MRS agar layer; b) in a cell-free culture medium and c) in the cell lysate. On solid agar medium bacteriocin production was studied by agar spots method described by Harris et al [11]. Briefly, overnight culture of *L. plantarum*, grown in MRS broth was spotted (7 ul) onto the surface of the MRS agar and cultured at 37°C for 48 hours under anaerobic conditions to prevent the synthesis of hydrogen peroxide. *L. plantarum* 43 and *L. plantarum* ATCC strains were used for comparative analysis. To elucidate the proteinaceous nature of antimicrobial substance, proteases pepsin and proteinase K were dropped (5 ul) around grown test culture stains. The plates were then covered with a second layer of soft Brain Heart Infusion agar (BHI, HiMedia), in which 10 ml of *E. faecalis* in stationary growth phase was suspended. After 24 hours of incubation under aerobic conditions the presence of growth inhibition zone in the indicator cell layer and the presence of protease activity were observed.

To determine the antimicrobial activity of the culture supernatant, the recovered cells were grown for 48 hours at 30°C in MRS broth and pelleted by centrifugation at 5000 rpm for 15 minutes. The supernatant was separated, passed through a membrane filter with a pore size of 0.22 µm to remove residual cells, concentrated 10-fold by freeze drying with subsequently dissolving in a smaller amount of water. Additionally, 10% solution was prepared from the dried supernatant by dissolving 100 g in 1 ml of sterile distilled water. 10-fold concentrated nutrient MRS-broth was served as a control.

To determine the antimicrobial activity of the cell lysate, *Lactobacillus plantarum* 42 was recovered by two-fold subculturing on MRS medium and incubated at 30 °C for 24 hours. The culture was centrifuged at 5000 rpm for 15 min, the cell pellet was resuspended in 300 ml of 70% isopropanol and 0.1% trifluoroacetic acid [8] and stirred on a magnetic stirrer at room temperature for 3 hours. Cell debris was removed by centrifugation at 5000 rpm for 15 min and then isopropanol was evaporated from the supernatant on a rotary evaporator.

The crude protein extract from the *L. plantarum* 42 culture supernatant was prepared by ammonium sulfate precipitation followed by dialysis in a dialysis bag with a pore size of 1000 kDa with subsequent freeze-drying.

The antimicrobial activity of the supernatant, cell lysate and crude proteins extract was analyzed by agar well diffusion method [12].

**Selection of the optimal culture conditions for maximum synthesis of bacteriocins.** The time of maximal bacteriocin production was estimated by agar spot method according to the zone of indicator *E. faecalis* strain inhibition after 24, 36, 48, 60 and 72 hours of fermentation.

The optimal cultivation temperature was determined by culturing bacteriocin producing culture at 30 °C and 37 °C and measuring indicator culture growth inhibition zone of the indicator strain in the double-layer agar.

Influence of initial pH of culture medium on bacteriocin synthesis studied when producer was grown in MRS culture medium, with initial pH 4.0, 5.0, 6.0, 7.0 and 8.0 adjusted with HCl and NaOH and the change of diameter of the indicator culture inhibition zone was observed by method described above.

In the next series of experiments the production of bacteriocin under the following fermentation conditions has been studied: 37°C temperature, while stirring on a shaker (200 rpm) in a flask with a narrow and long neck to create partial anaerobic atmosphere, at the 12, 18 24, 36 and 48 hours of cultivation time.

Changes the pH value of growth medium, amount of cells by optical density of the bacterial suspension ( $OD_{600}$ ) and the number of viable cells in 1 ml of medium and antimicrobial activity of supernatant according to zone of *E. faecalis* growth inhibition was monitored.

#### Time of initiation of the bacteriocin synthesis.

The *L. plantarum* 42 culture was grown in MRS broth, then plated on the surface of MRS agar to obtain separated colonies, and after 12 hours of growth plates was exposed to UV rays for 30 seconds to induce bacteriocin production [13]. Bacterial cell suspension in saline with a density of  $10^9$  CFU/ml was prepared from surface colonies and 5% inoculum was added in a flask with 100 ml of MRS broth. Time of initiation of bacteriocin synthesis was determined at 6, 12, 18, 24, 36, 48, 60 hours of fermentation by applying 7  $\mu$ l of centrifuged and passed through a membrane filter with a pore size 0.22  $\mu$ m supernatant onto the surface of the indicator layer seeded in soft BHI agar. After cultivation at 37 °C for 24 hours the zone of growth absence in the indicator layer at the place of supernatant was dropped has been observed.

#### Results and discussion

**The antimicrobial activity of viable *L. plantarum* 42 cells, the cell lysate and its supernatant on solid medium.** It has been shown that *E. faecalis* has a big zone of growth inhibition around *L. plantarum* 42 spot ( $d=20$  mm). The antimicrobial agent of *L. plantarum* 42 loses its activity against enterobacteria after treatment with pepsin and proteinase K, which is appeared as presence of growth at the pepsin and proteinase K spots on the indicator growth inhibition zone. That means the antimicrobial agent has a proteinaceous nature (Fig. 1). Other strains of *L. plantarum* (*L. plantarum* 43 and *L. plantarum* ATCC) have no antimicrobial activity against a given culture.

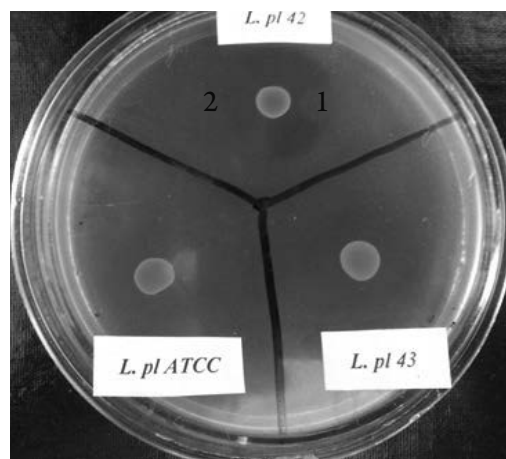


Figure 1. Antimicrobial activity of *L. plantarum* 42, caused by bacteriocin, against *E. faecalis*

- 1 – the zone of bacteriocin disruption by pepsin  
2 – the zone of action of bacteriocin disruption by proteinase K

It is found that cell lysate has no antimicrobial activity against *E. faecalis*, while the culture medium exhibits antimicrobial activity caused by proteinaceous substance, but only at 10-fold concentration. The diameter of *E. faecalis* growth inhibition zone by 10% solution of dried supernatant and 10-fold concentrated supernatant are of 13 mm and 26 mm respectively, while the concentrated MRC broth has no antagonistic activity against the indicator culture (Fig. 2).

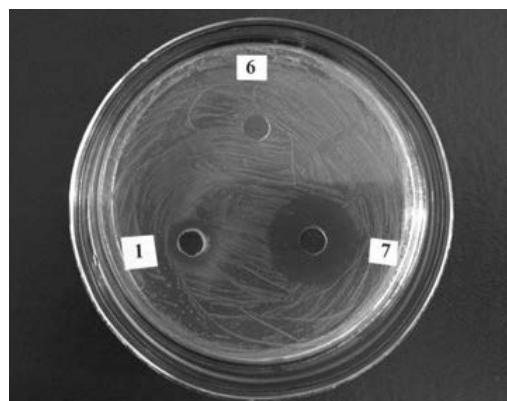


Figure 2. Antimicrobial activity of the *L. plantarum* 42 culture media against *E. faecalis*

1. 10% solution of dried *L. plantarum* 42 supernatant  
6. 10-times concentrated MRS broth  
7. 10-times concentrated supernatant

The crude extract of *L. plantarum* 42 proteins obtained by ammonium sulfate precipitation at a concentrations of 2.5% and 25% also showed antimicrobial activity to *E. faecalis*, where the diameter of the indicator culture growth inhibition zone was 17 and 25 mm, respectively.

According to the published data, most of bacteriocins are accumulated in the supernatant in sufficient amount, as their activity is found not only in the crude supernatant but also when it is diluted several times [14; 15; 16]. However, some bacteriocins such as plantaritsin F [17], lactacin B [18] and plantatsin B [19], is secreted into liquid medium in quite small quantities so it can not be detected without concentrating the supernatant. Despite this, in a solid medium accumulation of such bacteriocins are relatively effective, so the detection of presence and the activity carried out on agar medium. Studied *L. plantarum* 42 bacteriocin, as well as plantaricin F, lactacin B and plantacin B, is secreted mostly in a solid medium.

**The culture conditions for maximum accumulation of bacteriocins.** The results showed that the highest bacteriocin production is observed after 48 hours of fermentation time, and by 60 and

72 hours of cultivation, bacteriocin production decreasing. Incubation temperature (30 °C and 37 °C) does not significantly affect the synthesis of the bacteriocin (Table 1).

Table 1. – Diameter of the indicator strain growth inhibition by *L. plantarum* 42 depending of the time of cultivation and temperature

Temperature	Cultivation time, hours				
	24	36	48	60	72
30 °C	12±0.3	15±0.5	20±0.5	19±0.3	18±0.2
37 °C	13±0.3	16±0.6	19±0.3	19±0.5	18±0.5

Studying the influence of pH value on bacteriocin production showed that the synthesis of the bacteriocin is maximal at pH 6, the diameter of the zone of growth inhibition was 19.6 mm, at pH 5.0 and 7.0 the significant synthesis of bacteriocin has been observ-

ing and the diameter of the zone of growth inhibition is 17.6 and 17.8 mm. At pH below 5 bacteriocin production is not observed and at pH 8 it decreases (Table. 2).

Table 2. – Influence of initial pH of growth media on bacteriocin production by *L. plantarum* 42

The pH of the MRS nutrient medium	The diameter of the growth inhibition zone, mm
4.0	–
5.0	18±0.5
6.0	19±0.3
7.0	18±0.5
8.0	12±0.6

The culture conditions, such as the initial pH value and temperature is an important factor for the production of bacteriocins [20].

Determination of bacteriocin production in dynamics of growth showed that the maximum bacteriocin synthesis occurs under these conditions at 24 hours of fermentation when the maximum number of living cells ( $1.4 \times 10^9$ ) is accumulated in the medium, the diameter

of the zone of growth inhibition of the indicator culture is 15.5 mm. In 48 hours of incubation, along with decreasing the number of living cells in the medium and accumulation of acids (the pH drops to 3.5), the diameter of the zone of growth inhibition has decreased to 14.8 mm (Table. 3).

Table 3. – Chronology of bacteriocinogenic *L. plantarum* 42 strain growth and bacteriocin synthesis

Indicators	Cultivation time, h				
	12	18	24	36	48
pH	4,7	4,5	3, 8	3, 5	3, 5
Optical density of bacterial suspension	2,38	2,71	2,75	2,78	3,1
The number of living cells/ml culture medium	$5,5 \cdot 10^8$	$1,2 \cdot 10^9$	$1,4 \cdot 10^9$	$9,5 \cdot 10^8$	$7, 5 \cdot 10^8$
Zone of bactericidal action, mm	12.2±0.48	14.5±0.45	15.5±0.45	15.1±0.14	14.8±0.59

#### Time of the initial bacteriocin synthesis

When *L. plantarum* 42 supernatant applied onto the surface layer with an indicator culture it was noted that the not all samples exhibit the inhibition of *E. faecalis*. Inhibition zone begins to appear in a sample taken 18 hours after initiation of growth, which corresponds to an early stationary phase of growth of the test culture. Supernatant activity is maintained up to 72 hours, after which observation was stopped. Staying active for a long time suggests that the culture does not produce extracellular proteases.

Unlike many LAB bacteriocins, bacteriocin of *L. plantarum* 42 is not detected in the culture supernatant before beginning the stationary growth phase. In the same growth phase the activity of bacteriocins plantaricin F [17] has been detected, while plantaricin T produced by *L. plantarum* LPC010, detected only during late stationary growth phase [21]. In contrast, plantaricins A, BN, C and S [22; 23; 24; 21] — all *L. plantarum* bacteriocins, detected during active growth phase, as well as pediocin AsH, nisin, sakacin A and leykonocin Lcm 1 [25].

The absence of bacteriocin F activity during the exponential growth phase Paynter et al [17] explained by the following factors: it either is not synthesized in this growth phase, or it is synthesized during active growth but attached to the cell as long as the pH is reduced to a level which causes the desorption. Our study demonstrated that that the actual pH value of the media does not influence on

bacteriocin desorption since it doesn't significantly differ in 12 hours (pH=4.7), then there is no activity and in 18 hours (pH=4.5), then the activity is observed. This confirmed with the absence of antimicrobial activity of the *L. plantarum* 42 cells lysate. Probably bacteriocin synthesis by *L. plantarum* 42 begins at early stationary growth phase, which means that it is a secondary metabolite. In most cases, the synthesis of bacteriocins by LAB occurs during active growth phase [15], but some studies indicate that the LAB can synthesise bacteriocin in the stationary growth phase [17].

The culture conditions, such as the initial pH value of the media and temperature is an important factor for the production of bacteriocins [20]. Prema (2013) [26] reported that the optimal conditions for bacteriocin production by the three strains of *L. plantarum* (IZ, A1, F1), isolated from plant, is the MRS-medium with pH = 6.5, incubation temperature 37 °C and fermentation time is 48 hours. The same culture conditions are optimal for the production of bacteriocin by *L. plantarum* 42 although temperature ranging from 30°C to 37°C did not significantly affect the synthesis of bacteriocins. In another study, the synthesis of bacteriocins by *L. plantarum* ST194BZ [15] the optimum pH is also was higher than 4.5, while the optimum temperature for the synthesis is 30 °C. From our results and published data it can be concluded that the optimum temperature for bacteriocins production by *L. plantarum* is 30 °C to 37 C and optimal pH value is above 4.5.

In addition to temperature and pH the composition of the culture medium is greatly influence on the synthesis of bacteriocins [15], which will be investigated in further studies.

#### Acknowledgement

This research was supported by the Academy of Sciences of the Republic of Uzbekistan (Grant of the Found of Fundamental Researches Support №T. 4–16).

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## Optimization of nutrient medium composition for the Cultivation of *Ostrowskia magnifica* Regel in Vitro Conditions

**Abstract:** This article presents the results of the experiment on the cultivation of *Ostrowskia magnifica* Regel in the Tashkent Botanical garden. Peculiarities of cultivation, the effect of different nutrient medium on the growth and development of regenerated plants *in vitro* are studied.

**Keywords:** *in vitro* culture, callus, organogenesis, phytohormones, nutrient medium.

### 1. Introduction

In recent years there is a trend of downward in biological diversity. Many species of plants and animals become rare and in some areas are met no longer. Therefore, the conservation of biological diversity is one of the most important issues in the world. Along with traditional methods of plant conservation *ex situ*, the use of biotechnological methods of reproduction acquire greater importance. Besides such methods of biotechnology, as microclonal propagation, callus culture *in vitro*, embryoculture and other methods are used.

### 2. Materials and methods

The technology of clonal propagation *in vitro* at the laboratory level developed in the world for more than 2400 species of plants; however, this method is more often used for plants propagated with difficulty by conventional methods, as well as for solving problems, one of which is the conservation of rare and endangered species of plants.

Currently a topical area is the preservation and reproduction of rare and hard-clonal plant species [1]. *Ostrowskia magnifica* Regel, distinct monotype native, rare relic of Central Asia, included in the Red Data Book of the Republic of Uzbekistan [2]. It is a perennial grassy plant, its height up to 170 cm, common in Tashkent and Termez provinces of our Republic: the Western Tien-Shan: the Ugam river basin; the Hissar range: the basin of the river Tupalang and Shargun. The total number does not exceed 30 thousand individuals. It is propagated by seeds.

The study of biology, morphology and reproduction of *Ostrowskia* in the Tashkent Botanical garden is engaged by M. I. Rozanovskaya [3]. According to the author, the best time of sowing of *Ostrowskia magnifica* seeds — autumn and the end of February. In both cases, the shoots appear in early April.

Picking flowers, digging up tubers and low seed production are the reasons for the changes in the population and habitat of this species. And so the question of the introduction in culture *in vitro* of *Ostrowskia magnifica* Regel is highly relevant.

In the scientific literature, studies on the introduction in culture *in vitro* *Ostrowskia magnifica* Regel are absent.

The purpose of this study was optimization of nutrient medium composition for the growth and development of *Ostrowskia magnifica* Regel plant *in vitro*.

Materials and methods of research. It is known that primary explant should be completely freed from all microorganisms (bacteria, fungi, mycoplasmas, etc.) and its continued existence *in vitro* requires the maintenance of absolute asepsis, as fungal and bacterial infection inhibits cell growth and leads to the death of culture [4].

*Ostrowskia magnifica* seeds were stratified in the freezer, at temperatures below — 4 °C for 14 days.

In the first stage of clonal micropropagation is necessary to obtain a sterile and well-growing culture. Great importance has the choice of sterilizing solution and the method of disinfection from which depends the explants infection, their physiological state and level of viability [1].

It is found that the most effective method of sterilization of *Ostrowskia* seeds is the following method: initial treatment in 0.06% of AgNO<sub>3</sub> solution (20 min), then in 70% of ethanol solution (1 min) and subsequent washing in sterile water 3 times (10 min each).

In this arrangement, the step of seeds sterilizing the seeds retained high viability. After sterilization the seeds were sown in agar-agar (0.6 percent), un-hormonal nutrient medium prepared on tracing medium of T. Murashige and F. Skoog (MS) [5], as this medium is the most suitable for microclonal propagation of many herbaceous plants.

The culture was kept at temperature of 23±2 °C, relative humidity 80–85%, light white fluorescent lamps with 16-hour photoperiod.

With this method of sterilization and germ cultivation of *Ostrowskia magnifica* appeared after 17–18 days, true leaves were formed after 10 days. Six weeks after germination *Ostrowskia* seal hypocotyls was observed, leaves started to turn yellow and formed callus tissue.

It is known that cell culture of each plant species and even different organs and tissues of the same species requires a specific nutrient medium composition. Moreover, for the initiation of callus, maintenance its growth, for the induction of organogenesis have in each of these cases. It is necessary to change the composition of the medium in each of these cases.

The callus cells can grow indefinitely *in vitro*, and periodically transplanting them to fresh nutrient medium, but often there are phenomena, which undesirable in micro-propagation of plants, namely: the change in ploidy of the cultured cells; structural chromosome rearrangements and accumulation of gene mutations; loss of morphogenetic potential of cultured cells. Prolonged cultivation of callus cells exacerbates these changes, so the period of unorganized growth in the micropropagation should be reduced to a minimum [6, 11].

Nutrient medium for cultivation contains mineral salts, carbohydrates, vitamins, growth regulators, amino acids. The basis of all nutrient media for cultivation of isolated plant tissues is a mixture of mineral salts, represented as macro- and micronutrients. In most media includes vitamins. Necessary components of any nutrient

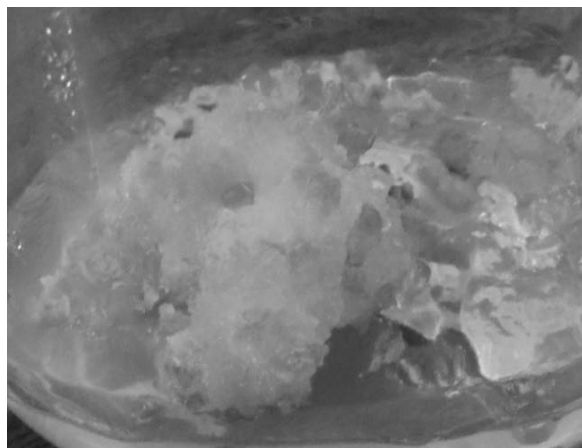


Fig. 1. The callus cells of *Ostrowskia magnifica*



Fig. 2. The callus cells are transferred into organogenesis



Fig. 3. Formation of the flower on the apex of the shoot



Fig. 4. Temp of growth is very good

medium are plant hormones — compounds that are involved in the regulation of physiological processes in plants. For the growth and differentiation of plant cells auxins and cytokinins are required.

Callus tissue of *Ostrowskia* from unihormonal medium was transplanted to the MS medium with addition of hormones IAA/BAP in the ratio of 0.25/0.02 mg/l. In this medium callus cells began to grow (increase in size), has gained a certain critical mass and gave rise to the process of organogenesis (Fig. 1–4). Callus cells are very differ in growth rate, texture, color, ability to turn green in light and other properties. Cell colonies on agar medium can be compact and solid, but also loose, that in removing the callus break into individual pieces.

The last type of callus in the liquid medium very easily separates single cells and gives rise to suspension culture. Noted that the compact callus can give rise to friable tissues, but not vice versa [7; 8]. The consistency of the callus to a large extent depends on the composition of the medium. Anatomical structure of friable callus is characterized by many organized centers of meristematic activity, separated by large undifferentiated cells.

Dense callus cells are less differentiated and contain many large vacuolation cells [9; 10].

Callus cells of *Ostrowskia magnifica* are brown, friable and hydration, splits into individual pieces in extraction (Fig. 1).

Differences in the chemical composition: total amount of polysaccharides of the cell wall is higher in dense callus, but the percentage of cellulose in comparison with pectin substances and hemicelluloses is reduced [11].

Fugitive growing callus cells, characterized by monotonous reproduction and growth, owing to the processes of secondary differentiation can form tissues (histogenesis), organs (organogenesis) and the bud like structures — embryos (embryogenesis, or somatic embryogenesis) [12].

Initially, the callus grows, gains a certain critical mass, and then proceeds to morphogenesis (Fig. 2–3). However, only single cells change their program development. This suggests that the transition to morphogenesis should be strictly appointed combination of external factors action primarily the inductor, in the condition of cells determinancy, i. e., with its willingness to realize their hereditary properties under the action of this inductor.

Apparently, the main reason that causes the differentiation of cells and their transition to the histogenesis followed by the formation of organogenic structures, can be considered the action of phytohormones.

Phytohormones are necessary component of any nutritional medium, as they participate in the regulation of physiological processes in plants. It is important to emphasize that the ratio of auxin and cytokinin in the nutrient medium determines the type of morphogenesis. This pattern was first discovered by Skoog and Miller in 1957, and then confirmed by numerous experiments.

Type of formed meristem depends on the ratio between auxin and cytokinins, but their specific involvement in different stages of morphogenesis remains unclear [12].

The combinations of these two preparations are used for induction of shoots formation. In experiments on the introduction to the culture and the microclonal reproduction of *Ostrowskia magnifica* several variants of culture media were used.

### 3. Results and discussion

During the conducted research it was found that the optimum media for shoots and further growth of *Ostrowskia* cells are: MS medium with the addition of 0.2 mg/l of BAP and 2.0 mg/l of IAA; MS medium with the addition of 2.0 mg/l of BAP and

4.0 mg/l of IAA; MS medium with the addition of 2.0 mg/l of BAP. For the formation of callus and growth of these cells MS medium is an optimal medium without the addition of phytohormones and MS medium with 1.0 mg/l of IAA and 0.5 mg/l of kinetin (table).

Callus cells — the main object during long-term cultivation in vitro. The famous scientist-botanist N. Krenke 50 years ago, part of his works devoted to studying the role of callus tissue in the whole plant. He tied it up with the phases, which passes callus tissue:

- The first phase — the rapid growth of callus cells, protecting the injury site;
- The second phase — the storage of nutrients in callus cells;

Table 1. – Nutrient media for seeds cultivation of *Ostrowskia magnifica* Regel in vitro conditions

Options	MS	BAP	IAA	Kin	Rate of progress
1	MS	–	–	–	In 16–18 days the seeds sprouted, except for cotyledons, four true leaves appeared; the hypocotyls increased in volume and formed a callus.
2	MS	0.2	0.1	–	The nutrient medium for shoots. From the callus cells shoots with leaves formed. The temp of development is fast.
3	MS	0.02	0.25	–	The formed callus cells in unihormonal medium with a fast temp of rising, increasing in volume, give rise to the process of organogenesis.
4	MS	–	1	0.5	The leaves of transplanted explants, rapidly yellowing, again formed callus. But if to this nutrient medium to replant the callus cells, then they will continue to grow, develop and move to the organogenesis.
5	MS	0.2	2.0	–	The optimal nutrient medium, in which regenerated plants grow well, unidentified items are formed, very similar to the flower.
6	MS	0.08	1	–	The transplanted explants' leaves turn yellow, wither, but from the base of the petiole formation of leaves starts again. The pace of development is weak.
7	MS	4.0	4.0	–	The transplanted explants grow well. The formation of callus cells wasn't observed.
8	MS	0.05	0.5		Shoot formation wasn't observed, the leaves are formed from callus cells, but they quickly start to lose their green color.
9	MS	2,0	–	–	An optimal nutrient medium for faster growth of seedlings.
10	MS		4.0	2.0	Transplanted explants grow well.
11	MS	2,0	4,0		From the callus cells shoots with leaves are formed. Growth rate is fast.

With the purpose of taking root of sprouts the plantlets of *Ostrowskia* were transplanted in MS medium with supplementation of phytohormones in combination with 2 mg/l of IAA + 1 mg/l of BAP. Fresh medium was watery than before prepared media, because into 1 litre of the main MS medium we added agar-agar not 6 g per liter, and 5 g per liter. After six weeks in *Ostrowskia* we have observed the formation of roots. The plants have 8–9 leaflets. Regenerated plants developed normally.

As previously noted, the type of forming meristem depends on the ratio between auxin and cytokinins, however, a range of plants not always change in balance of phytohormones to regenerate buds or roots. On the interaction of hormones in regulation of differentiation of buds or roots can be affected by other factors, such as the content of sugars and phosphates, a source of nitrogen and other components of the medium.

Thus, the concept of hormonal regulation of differentiation and morphogenesis in vitro cannot be considered as universal. First, the phytohormones in regulation of differentiation and morphogenesis do not have specificity. The same hormones regulate both cell division with undifferentiated growth of callus and cell division associated with differentiation.

#### 4. Conclusions

As a result of conducted research we can draw the following conclusions:

- Third, the most important phase — the regeneration of callus tissue of lost organs (roots and shoots).

All these three phases were observed in the *Ostrowskia magnifica*.

From the hormonal MS medium (IAA 0.25 mg/0.02 mg of BAP per liter of medium) explant of *Ostrowskia* was transplanted to the medium IAA 2.0 mg/0.2 mg of BAP per liter and in a month the beginnings of white flowers with 5–6 petals are formed on the apex of the shoot (Fig.3).

The choice of a nutrient medium is defined by a type of a plant which is introduced into culture, as well as by tasks of experiment.

We in the experiments on introduction in culture and microclonal propagation of *Ostrowskia magnifica* used some versions of the nutrient media are shown below in table 1.

1) *Ostrowskia magnifica* seeds for germination require stratification at temperatures below — 4 °C for 14–16 days.

2) For sterilization and preservation of viability *Ostrowskia magnifica* one can use the following method: initial treatment in 0.06% of AgNO<sub>3</sub> solution for 20–25 min, followed by washing in 70% of ethanol for 1–2 min, in sterile water several times for 10 minutes each.

3) It is better to use sterile jars with a volume of 200–250 ml for the cultivation of plant material.

4) Optimal conditions for the cultivation of *Ostrowskia magnifica* is 16-hour light regime and temperature — 25 °C.

5) For an introduction to the culture and micropropagation of *Ostrowskia magnifica* the following nutrient media fit: MS with 0.25 mg/l IAA + 0.02 mg/l BAP, MS 2 mg/l IAA + 0.2 mg/l BAP, MS 4.0 mg/l IAA+2.0 mg/l BAP.

6) For the formation of callus and growth of cells the optimal medium is MS medium without hormones and MS medium with addition of 1.0 mg/l IAA and 0.5 mg/l kinetin.

At the moment there is no universal technology of in vitro cultivation, which would be suitable for all plants. For each plant species the development of specific techniques for formation of plants-regenerants in tissue culture are required. The conducted research of the initial stages of the cultivation of *Ostrowskia magnifica* Regel will allow to continue development of micropropagation technology for solving problems of preservation of the given species.

**Acknowledgments**

The work is done within the "Introduction assessment and biology of seed multiplication of promising new species of ornamental and medicinal plants" project (№ F.5 — F A-O-12154, Academy of Sciences of Uzbekistan).

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-24-26>

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## Saline resistance of vegetable and melon crops and valuation factors on the degree of soil salinity

**Abstract:** The article is devoted to the discussion of results obtained from the valuation of saline soils in Golodnaya steppe of Mirzachul oasis, correlation between the crop capacity of vegetable melon crops and salinity degree of soil. As a result of the research there were developed valuation factors for cultivated crops such as potato, onion, tomato and cabbage.

**Keywords:** Golodnaya steppe, valuation, salinity, vegetable crop, crop capacity.

**Introduction.** Practical works on soil evaluation carried out in the Republic revealed that the transition in conditions of market economy requires effective use of every hectare of land. In order to achieve this there is a need in developing bonitation methods which take into account natural, economical and agricultural conditions in the process of evaluating soils used in producing vegetable and melon crops.

At present, soil valuation and assessment of soil's fertility in scoring units in the Republic of Uzbekistan are carried out by the Institute of Soil Sciences and Agricultural Chemistry and regional branches of the land Registry "Uzdavyerloyiha". It is generally known that the data obtained from soil valuation procedures is widely employed by agriculture planning institutions and tax inspections with the aim of planning the productivity of vegetable and melon crops and identifying the amount of tax on land.

**Objective of the study** was to develop valuation factors on the degree of soil salinity for the vegetable crops such as potato, tomato, onion and cabbage.

**Material of the research.** The research was carried out in Golodnaya steppe in developing methodological fundamentals of bonitation of soil found in the Steppe and used for growing main vegetable crops. Thus, irrigated meadow soils of Golodnaya steppe was taken as an object of the present study.

In 2010–2013 field studies were carried out in 20 key areas and 200 areas were chosen for calculation of crop capacity. Areas in dimension of 10X10 meters were located in such a way that they could cover all main soil varieties. Calculation of crop capacity was carried out employing the method developed by Dosphehov [1, 117–290]. Then the statistical data processing obtained from crop capacity calculation was done in order to compute average yields and search of correlation dependencies between certain properties of soil and productivity of vegetable crops.

Soils of Golodnaya steppe are saline in diverse levels where content of chloride sulfate type of salinity prevails. With the increase of salinity, the approach of soil horizons with the content of Mg and Na to the surface occurs.

**Results of the research.** Results of analysis of aqueous extracts obtained from studied soil types revealed (Table 1) that amount of solid residue in the upper horizons is insignificant. In non-saline soils content of water soluble salts is equal to 0.1% whereas in mid-saline soils the content is equal to 1%. Weak saline soils have intermediate position. Up to 1% of salt is concentrated in morphologically observed soil horizon. Formation of the horizon is due to the maneuvering of soil from overlying strata and possibly due to the capillary pulling up from the bottom salt solutions due to evaporation during subsurface soil desiccation after spring rain.



Table 1. – Results of analysis of aqueous extract obtained from cultivated meadow soils of Golodnaya steppe

Depth, Cm	Dry residue, %	Alkalinity overall in HCO <sub>3</sub>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>-</sup>	Ca <sup>++</sup>	Mg <sup>++</sup>	Na <sup>+</sup> K
Nonsaline							
0–37	0,095*	0,037**	0,007	0,017	0,015	1,16	0,16
		0,61	0,20	0,35	0,73	1,00	0,003
37–55	0,080	0,030	0,007	0,017	0,010	1,06	0,31
		0,51	0,20	0,35	0,50	0,75	0,007
80–100	0,165	0,024	0,007	0,085	0,040	2,36	0,11
		0,39	0,20	0,085	2,00	2,25	0,002
120–130	0,180	0,021	0,014	1,77	0,040	2,50	0,25
		0,34	0,39	0,085	2,00	2,25	0,006
Weak saline							
0–36	0,100	0,040	0,010	0,017	0,020	1,29	0,04
		0,66	0,28	0,35	1,00	1,25	0,001
36–54	0,475	0,033	0,024	0,272	0,075	6,87	1,90
		0,54	0,68	5,65	3,74	4,97	0,043
54–80	1,105	0,018	0,040	0,717	0,275	0,009	1,04
		0,30	0,28	14,92	13,72	0,74	0,024
90–100	0,320	0,018	0,031	0,174	0,075	0,012	0,16
		0,30	0,87	3,62	3,74	0,99	0,004
Mid saline							
0–33	0,560	0,024	0,017	0,355	0,135	0,018	0,03
		0,39	0,48	7,38	6,47	1,48	0,0006
33–45	1,125	0,021	0,007	0,760	0,275	0,015	1,42
		0,34	0,20	15,83	13,72	1,23	0,033
55–65	1,160	0,024	0,010	0,780	0,260	0,015	2,75
		0,39	0,28	16,28	12,97	1,23	0,063
75–90	0,545	0,021	0,014	0,348	0,135	0,006	0,73
		0,34	0,39	7,23	6,74	0,49	0,017
110–125	1,050	0,021	0,017	0,696	0,275	0,015	0,33
		0,34	0,48	14,47	13,72	1,23	0,007

\* In numerator – %

\*\* In denominator – mg/eq

**Discussion and analysis of results.** Content of alkali is minor and chlorine is below toxic level — 0.007%. In weak and medium saline soils the content of alkali and chlorine exceed 0.010%. Amount of chlorine on the profile is divided unevenly.

According to the content of solid residue in the depths of 0–05 cm the coefficient of variation show a discrepancy from 14.3 to 24.1. The most amount of solid residue is found in non-saline soils  $M=0.12$ , and in weak saline soils  $M$  is equal to 0.37% whereas in mid-saline lands  $M$  is equal to 0.63% respectively.

Confidence limits of variation (0.95) according to the content of solid residue in non-saline lands are beyond the limits of 0.10–0.14, in weak saline soils 0.30–0.34 and in mid-saline soils 0.59–0.67% respectively.

The soils under study mostly consist of anions and cations. Among the cations which take part in the formation of salts are Na<sup>+</sup>, Mg<sup>++</sup> and Ca<sup>++</sup>. Anions which form salts are — Cl<sup>-</sup>, SO<sub>4</sub><sup>-</sup>, CO<sub>3</sub><sup>-</sup> и HCO<sub>3</sub><sup>-</sup>. Various combinations of these cations and anions form salts, many of which are found in the soils under investigation.

Noxiousness degree of definite salts for the cultivated plants is not equal. The most harmful among them is considered to be the plain soda (Na<sub>2</sub>CO<sub>3</sub>). In aqueous solution it produces caustic soda (NaOH), hydroxyl ion of which is extremely hazardous for plants.

Noxiousness of salts considerably depends on their solubility. Plants are mainly affected by salts which occur in soil tincture e. g. in soluble condition. Additionally, a number of salt types are found in

solid phase of soil in the form of crystals and they do not cause any harm to cultivated plants.

Some soil scientists and specialist in land-reclamation suggested identifying the degree of salification of not soil but of soil tincture, considering that aqueous extract contains marginally soluble salts from the solid phase as well. In natural conditions during temperature variation and change of other conditions salts which occur in soil mass may enter into the tincture.

Li [4, 51–52] suggests that it is better to identify soil salinity degree in total sum of all salts which are found in solid and liquid phase. In this case more accurate results concerning the quantity of salts in soil are indubitably obtained from the analysis of aqueous extract.

It is important to take into account that in various regions depending on natural conditions (quality of soil, content of salts in it and etc.) acceptable limit of soil salinity level for the normal development of cultivated plants varies considerably.

Salinity resistance is a plant property which is genetically acquired and fixed in phylogenesis. In practice, salinity resistance of cultivated plants is explained by the limit values of salt content in soil and their concentration in soil tincture which do not affect normal development of plants and yielding sufficient crop.

In majority of cultivated plants salinity resistance property in various phases is considerably varied. This property is minimal in the early phases of plant development and reaches its maximum level in full-grown plants. Increasing of salinity resistance in definite phases of plant life is stipulated by the growth of sorptive

capacity of cytoplasm for salt ions and the decrease of ion solubility in cellular fluid.

Study of salinity resistance of vegetables, melons and grounds in Golodnaya steppe was carried out by Kabaev [3, 35–38]. As a result of the research Kabaev [3, 35–38] suggested marginal rates of chlorine in soil. Among the studied plants the most saline resistant, normal developing and yielding sufficient crop in conditions which contain 0.007–0.020% chlorine in soil and 0.3–1.4 g/l chlorine in soil tincture is appeared to be cucurbit, tomato, and cabbage. The least saline resistant of them is cucumber [3, 38] for which the rejection number of chlorine is equal to 0.005–0.007% in soil and 0.2–0.3 g/l in soil tincture respectively [3]. Melon, onion and watermelon were in intermediate position and the content of chlorine was 0.007–0.015% and 0.3–0.5 g/l respectively.

In a number of studies of foreign scientists there is a common pattern of relationship concerning vegetable crops — in conditions of growing level of soil salinity there was observed a decrease in productivity and weakening of growth.

Salts' hazardous impact on plants manifests itself in the phase of emergence of seedlings. Swelling seeds absorb water from soil as their osmotic pressure is higher than in soil tincture. In the process of soil tincture concentration increase, matric force advances and the process of water ingress into the seeds weakens or even stops.

Shalvet and Varon [5], Hoffman and Rawlens [2] observed transpiration intensity under the growth of salinity in vegetable crops.

With the growth of freely soluble salt content, sprouting dates of vegetable crops and potato are delayed to some extent, germinating capacity of seeds decreases and sowing becomes more thinned.

According to Zuev [6, 35–43] weakening of growth due to the impact of soil salinity in potatoes is determined by the lower-

ing level of branchiness of caulis and by the decrease in number of leaves. Inhibitory impact of soil salinity on onion is evidenced by the delay in leaves formation and their size loss. It was identified that ions of chlorine are the most toxic according to their impact on crop capacity. Their increase in soil to 0.002–0.003% notable reduces crop capacity of plants and commercial quality of crop.

Soil salinity also influences plants' entering certain phases of development. In onions, leafy vegetables, root vegetables with the increase of content of salt in soil there was observed considerable delay in leaf formation, bulbing, formation of cabbage heads and roots.

Intrusion of salts in the organs of plants accompanied by a number of destructive change, chlorophyll grain are destroyed and in consequence photosynthesis energy decreases, breathing and normal flow carbohydrate metabolism. In cotton plants in saline soils total and protein nitrogen increases and the content of starch in leaves decreases.

Li [4, 76–84] developed bonitation factors on salinity level of soils with reference to cotton plants: weak saline soils — 0.85; mid-saline — 0.60 and strong saline — 0.30. In mid-saline soils by reference to non-saline soils crop capacity of cotton decreases up to 40% and in strong saline soils this index reaches 70%.

Identification of dependencies of crop capacity of vegetable crops with the use of correlation method according to the soil salinity level revealed substantial relation (-0.57–0.71). For potato this index is equal to — 0.71, cabbage — 0.69, tomatoes — 0.58 and onion — 0.57 respectively.

It is established that with the increase of solid residue, crop capacity of plants decrease. Basing on this we have calculated valuation factors on the degree of soil salinity for vegetable crops of Golodnaya steppe. (Table 2).

Table 2. – Valuation factors on the degree of soil salinity

Salinity degree	Potato		Cabbage		Tomato		Onion	
	Crop capacity, centner/hectare	Valuation coef.	Crop capacity, centner/hectare	Valuation coef.	Crop capacity, centner/hectare	Valuation coef.	Crop capacity, centner/hectare	Valuation coef.
Nonsaline	123	1,00	329	1,00	297	1,00	221	1,00
Weak saline	104	0,85	274	0,85	242	0,80	163	0,75
Mid-saline	77	0,65	203	0,65	162	0,55	115	0,50

Among the four vegetable crops the most susceptible to soil salinity is onion and relatively saline resistant is potato. Cabbage and tomato secure intermediate positions.

It is worth mentioning that in weak saline soils crop capacity of potato decreases to 15–20%; cabbage — 15–25%; tomato — 20–30%; and onion 25–30%; in mid-saline soils 35–40%, 40–50%, 40–60%, 50–60% respectively in comparing with nonsaline soils.

Relying on the obtained data there were developed valuation factors on the degree of soil salinity for potato and cabbage: nonsaline soils — 1.00; weak-saline soils — 0.85; mid-saline — 0.65; for tomato: nonsaline — 1.00, weak saline — 0.80, mid-saline — 0.55; for onion: nonsaline — 1.00, weak saline — 0.75, mid-saline — 0.50.

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## Trace elements of indicate-plants on dried bottom of the Aral Sea

**Abstract:** According to the latest scientific data, the decrease of Aral Sea water surface by more than 5.5 million hectares was registered. In a typical salt marsh, with the presence of salts and high mineralization level of groundwater, vegetation of annual halophytes is becoming more diverse. According to our research, the adaptation of various plants to the current natural environment is observed on the dried-up areas in the south-east Aral Sea.

**Keywords:** Aral Sea, element, indicator, plants, soil.

**Introduction.** Biosphere is an environment in a dynamic equilibrium at the macro and micro level. Such characteristics are typical for elements in biosphere with intra- or extracellular space distribution. The biological roles of chemical elements are very diverse and numerous with plenty number of these elements, thus it is a difficult task to cover such a large and controversial material.

Dried bottom of the Aral Sea is an open, desert and unique “laboratory” appeared in Central Asia. Dried areas of the Aral Sea contain mainly various levels of soil salts and sand. The explanation of such chemical composition of the soil in this area is annual increase of mineral content of sulphate, chloride, sodium and magnesium elements. It is important to note that the process of improving the soil in this area is still in progress. Due to the current ecological status of the dried bottom of the Aral Sea, a comprehensive study of biological objects in Aral Sea region is of great scientific and practical significance not only in science and technology, but also in industry of country.

Living organisms, especially plants in their organs and tissues accumulate elements that are vital to their physiological, biochemical and genetic processes. Study of the role of these elements in plants allows a better understanding of the molecular mechanisms of biological and ecological uniqueness of individual species. Due to changes of the environmental indicators, plants react by changes in prevalence and chemical composition of tissues which in its’ turn may vary.

World resources of halophytes are characterized by a wide variety of genus, species, and ecotype populations. Global gene pool of halophytes has 2000–2500 species. While, in Central Asia 700 species of halophytes were identified [1, 220–226]. Increased content of salts in the soil is beneficial for the development and accumulation of biomass of halophytes. Halophytic properties are mainly introduced by salt accumulating representatives of the *Chenopodiaceae* family and less by salts emitting representatives.

The chemical and physical characteristics of the biosphere are determined by other spheres, which have created relatively constant environments that allow the existence of living matter in an ecosystem. The ecosystem consists of community of all living organisms in particular area and has balanced cycle of chemical elements and energy flow. There is a homeostatic relationship between nonliving (abiotic) environment and living organisms (biotic environment) [2, 350–356].

Toderich et al. [3, 245–274] revealed that very few Kyzylkum desert species have the ability to transpose the metal ions with a high concentration. The values lie between 15–4170 (Fe), 9.0–50.0 (Zn), 0.1–7.6 (Pb), 0.0–3.7 (Ni), 0.1–50.0 (Cr), 0.0–793.0 (Sr) mg kg<sup>-1</sup> or a trace amount of 0.1–1.9 (As), 0.1–2.7 (CO), 0.1–2.5 (Th), 0.1–0.18 (Cd) mg kg<sup>-1</sup>. Analysis of composition of trace elements in the various types of soils in Central Kyzylkum Desert showed high mean values of Hg, Cu, U, In, Zn, Mo, Ni, Sr, Co.

**Materials and methods.** The object of study is the flora of dried bottom of the Aral Sea in the southern part: plant materials collected during expeditions in various seasons of 2012–2015 period on the area of about 2.5 million hectares. Taxonomic identification performed in the Laboratory of Genomics, Institute of Bioorganic Chemistry and Laboratory Central Herbarium (TASH), Institute of the Gene pool of plants and animals of the Academy of Sciences of the Republic of Uzbekistan, as well as in the Educational-Experimental Centre for High Technologies in Tashkent. 12 dominant species of salt-tolerant higher plants (dry aboveground parts are used: vegetative and generative organs) from different families and genera, selected according to habitat and ecobiomorphs were analysed.

Communities of these plants are formed and widely distributed in spite of the adverse environmental conditions on the dried bottom of the Aral Sea.

**Methods.** The analysis was performed at the Laboratory of Genomics, Institute of Bioorganic Chemistry and at the Activation Analysis Laboratory, Institute of Nuclear Physics of the Academy of Sciences of the Republic of Uzbekistan. The analysis of plants was performed on the basis of neutron activation analysis (NAA) of elements which include the preparation of samples, the determination of elements (short-lived, long-lived and medium-lived isotopes) and the method of evaluation of the stage analytical parameters. The accuracy of the analysis was determined by comparison of obtained data. Plants were washed from surface contamination and dried in an oven at a temperature of 60 °C to air-dry condition, and then the samples were crushed in a mortar. For the short-lived isotope analysis 30–40 mg of crushed plants were taken and 100 mg for determining the medium- and long-lived isotopes. Weighed samples were sealed in labeled plastic bags. Prepared samples of plants underwent neutron activation analysis on WWR-SM research reactor.

**Results and discussion.** The aim of this study was to define and carry out the comparative analysis of the elements concentration in the composition of certain species of plants growing on the dried bottom of the Aral Sea. During the research, plants growing on soils with different salinity levels and plant organs were examined

for the quantitative presence of Ca, Cl, K, Mg, Na (Table 1). Halophytes were identified on the major dried areas with different levels of soil salinity. For elemental analysis, plant samples were obtained from various parts of dried area of the Aral Sea and, firstly, the concentration of 38 elements was determined.

Table 1. – The content of chemical elements in salt-tolerant plants from dried bottom of the Aral Sea, µg/g

Elements	Chenopodiaceae								Plumbaginaceae	Tamaricaceae	Fabaceae	Solana ceae
	<i>Atriplex pratovii</i>	<i>Kalidium caspicum</i>	<i>Halostachys belangeriana</i>	<i>Salsola dendroides</i>	<i>Salsola orientalis</i>	<i>Salsola richteri</i>	<i>Haloxylon aphyllum</i>	<i>Climacoptera aralensis</i>	<i>Limonium otolepis</i>	<i>Tamarix hispida</i>	<i>Alhagi pseudalhagi</i>	<i>Lycium ruthenicum</i>
Ag	0.043	<0.01	<0.01	0.41	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
As	0.38	<0.1	<0.1	<0.1	0.18	<0.1	<0.1	<0.1	0.86	<0.1	0.19	<0.1
Au	0.002	0.0034	0.037	0.0059	0.0016	0.0042	0.013	0.018	0.0039	0.0089	0.074	0.0047
Ba	110	16	10	<1.0	28	5.0	6.0	16	31	5.9	<1.0	5.5
Br	46	94	52	79	4.3	15	15	140	16	27	2.8	38
Ca	22000	7900	4900	4800	13000	23000	30000	7800	10000	20000	9600	16000
Ce	0.29	1.5	0.75	1.0	1.6	0.19	0.39	1.0	1.7	0.66	0.31	0.70
Cl	28000	140000	33000	25000	13000	5500	11000	10000	11000	23000	3300	68000
Co	0.53	0.27	0.19	0.31	0.38	0.18	0.12	0.23	1.6	0.32	0.086	0.24
Cr	0.99	2.2	1.3	1.7	2.4	0.51	0.62	1.7	2.6	1.1	0.49	1.2
Cs	0.038	0.11	0.069	0.10	0.15	0.031	0.039	0.097	0.13	0.049	0.024	0.079
Cu	110	3600	2900	730	86	360	2300	3000	150	820	550	550
Eu	<0.01	0.025	0.014	0.032	0.030	0.0081	0.01	0.023	0.038	0.017	0.0058	0.014
Fe	280	690	440	670	780	130	190	610	1200	370	180	530
Hf	0.030	0.14	0.73	0.12	0.19	0.015	0.026	0.12	0.16	0.058	0.027	0.059
Hg	<0.001	<0.001	<0.001	0.030	0.037	0.0081	0.014	<0.001	0.028	0.025	<0.001	0.018
K	3500	7300	16000	15000	17000	33000	27000	15000	15000	13000	21000	20000
La	0.21	0.97	0.43	0.73	0.96	0.11	0.29	0.82	0.10	0.36	0.13	0.39
Lu	<0.001	0.0091	<0.001	0.0037	0.0085	<0.001	<0.001	0.0072	0.0073	0.0041	0.0016	<0.001
Mg	5900	<100	<100	<100	2700	18000	17000	<100	5200	9800	4600	12000
Mn	56	38	21	115	51	70	130	31	120	29	24	22
Mo	1.2	1.3	1.3	<0.1	<0.1	0.64	0.94	<0.1	2.7	<0.1	<0.1	1.3
Na	47000	180000	140000	88000	36000	24000	120000	150000	11000	26000	2800	69000
Nd	<1.0	<1.0	<1.0	<0.1	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5
Ni	<1.0	9.7	6.4	40	<1.0	<1.0	6.6	<1.0	68	9.1	6.9	33
Rb	5.4	3.7	3.4	5.8	7.3	12	7.0	4.2	4.3	1.3	4.2	2.6
Re	0.15	0.15	0.025	0.74	0.061	1.1	0.88	0.066	0.021	–	–	0.021
Sb	0.055	0.21	0.21	0.34	0.049	0.27	0.27	0.17	0.21	0.30	0.24	0.32
Sc	0.15	0.28	0.15	0.20	0.29	0.041	0.067	0.24	0.34	0.14	0.058	0.14
Se	0.10	1.6	0.56	1.7	0.10	0.16	0.37	<0.01	2.1	0.26	0.11	0.38
Sm	0.047	0.15	0.069	0.093	0.13	0.022	0.037	0.11	0.13	0.05	0.026	0.057
Sr	1800	140	93	66	270	430	360	160	320	270	400	490
Ta	<0.01	0.024	0.016	<0.01	0.026	<0.01	<0.01	0.016	0.018	0.01	<0.01	<0.01
Tb	<0.01	0.015	0.0098	0.0095	0.015	<0.001	<0.001	0.0085	0.019	0.0072	<0.001	0.0072
Ti	<10	<10	<10	<10	<10	<10	–	–	–	–	–	–
Th	0.082	0.30	0.15	0.20	0.32	0.043	0.073	0.23	0.34	0.13	0.055	0.14
V	<1.0	<1.0	<1.0	<1.0	2.8	<1.0	–	–	–	–	–	–
U	<0.01	0.14	<0.01	<0.01	0.16	<0.01	<0.01	0.12	0.31	0.21	0.045	0.057
Yb	<0.01	0.060	<0.01	<0.01	0.073	<0.01	<0.001	0.043	0.062	0.029	0.0094	<0.01
Zn	19	9.7	27	35	13	15	9.4	21	51	27	64	41

The table shows that the content of chemical elements among the studied plants varies considerably. For example, a high content of sodium defined in 4 plants (*Kalidium caspicum*, *Climacoptera aralensis*, *Halostachys belangeriana*, *Haloxylon aphyllum*) out of 12. Large concentration of chlorine was detected in *Kalidium caspicum*. Magnesium concentration was lower in comparison with other elements,

especially in *Kalidium caspicum*, *Climacoptera aralensis*, *Halostachys belangeriana*.

It was also found that in *Salsola richteri*, *Tamarix hispida*, *Haloxylon aphyllum* the content of calcium, potassium, magnesium, and in *Halostachys belangeriana*, *Tamarix hispida* chlorine content corresponds to an average concentration, characteristic for these plants.

The concentration level of each element depends on the geographical characteristics and those traits are one of the most important indexes of soil. The concentration of the majority of minerals, analyzed in different soil samples depends on the level of soil humus and pH of granulometry of studying areas, and surely, is directly associated with ecotope biological diversity level.

Our results contribute to a better understanding of the fundamental mechanisms of adaptation of plants to stress factors of the environment, as well as developing a strategy of periodic seeding of promising forms and plant species in the area of dried bottom of the Aral Sea.

Conclusion and recommendation. Typical plant of salt marshes, seashores, saltwater shores of rivers, lakes, has a mechanism to reduce the concentration of Na and Cl ions in the cytoplasm by introducing them to the vacuole. Toxic influence of ions in plant tissues is neutralized by the osmotically active substances such as proline and glycine betyne which are formed in the cytoplasm. Halophytes grow on saline

areas and are able to accumulate in their tissues large amounts of salts. It does not cause damage to them, and even a small concentration of salts promotes growth. Especially prone to the accumulation of salts the representatives of the families *Chenopodiaceae* and *Tamaricaceae*.

Soil microelement composition can vary seasonally or over the years due to life cycle of plant and animal species and ecosystem microflora. Elements of soil types and in relation to geographic areas present in different levels, soil-geochemical study and regionalization of current areas gives a lot of possibilities to use in geological exploration. It should be noted that the above-mentioned data are the preliminary results of the study on the analysis of the elemental composition of some promising species of the Aral Sea region. In future, we plan to continue research of other halophytic, salt tolerant and salt accumulating indicator plants having theoretical and practical significance for phytoremediation works in the Aral Sea region.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-29-31>

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## Capnodium fungies in the southern uzbekistan (Examples in the areas as: Karshi, Shahrisabz and Termez)

**Abstract:** The article is devoted to the identification works of Capnodium genus family 4 types of fungies which belong to Capnodiaceae family which is widely spread in the southern cities of Uzbekistan. These identified micromycetes *Juniperus virginiana* Bieb., *Pinus eldarica* Medw., *Ulmus pumila* L., *Biota orientalis* (L)Ende. Observed as mostly met on decorative trees. Identified *Metacapnodium juniperi* and *Capnodium salicinum* micromycetes are met as a new host plant in Uzbekistan. *Capnodium pini*, *Capnodium* sp. species.: are recorded first time for mycobiota of Uzbekistan.

**Keywords:** Capnodium, Metacapnodium, spora, fungi, decoratively trees.

### 1. Introduction:

*Capnodium* Mont., Anns Sci. Nat. type *Ascomycotina* division, *Dothideomycetes* class, *Capnodiiales* order, belong to *Capnodiaceae* family, develops on leaves and stems of the plant. Usually it has a shape of a dust and contains a lot of parasite fungies. Their morphologic feature is creation of black colour filament [1].

*Capnodium* name is first used by Montagne (1849a), and appointed as a new taxonomic type. The fungies which belong to this type usually grow on the leaves and stems of the plants and has a consence of a black dust.

The first observations about the *Capnodium* in Central Asian Republics could be met in the works of Zapometov N. G. (1926) [2]. Later in Uzbekistan it was investigated by several researches as T. S. Panfilova, N. I. Gaponenko (1963) [3], M. G. Gulomova and others (1991) [4], Sh. G. Komilov (1991) [5].

### 2. Materials and Methods.

In 2014–2016 years organized scientific trips to Karshi, Shahrisabz and Termez regions which are situated in the south of Uz-

bekistan, collected plant samples damaged by fungies and made herbarium according to the norms. During the separation of fungies from plants and for determination their sistematic place used by MBC-9 binocular and MBI microscope [6].

During the investigation of micromycetes type content used following micologic indicators for researches and the bibliography as follows [4; 7; 8; 9].

The modern nomenclatura of mycobank is org [11] and names of the plants are given on the basis of S. K. Czerepanov (1995) [10].

Preparation of fumigants from damaged plant parts established directly without additional processes. For this process we need to clean the glass of the equipment and one drop of sterile water and put on it a piece of fungies from observed part of the plant, close with the cover glass. Fumigant first observed in a small afterwards on a big microscopes. Temporarily could be used alcohol and water during the process.

### 3. Results and Discussion.

During the mycologic analysis of samples determined 4 new records types belong to genus *Capnodium*. These defined micro-

mycetes could be met on plants as *Juniperus virginiana* Bieb., *Pinus eldarica* Medw., *Ulmus pumila* L., *Biota orientalis* (L.)Ende.

Below is given morphologic description and systematic information of micromycetes which is observed in southern parts of Uzbekistan.

**1. *Metacapnodium juniperi*** (W. Phillips & Plowr.) Speg., Physis Revista de la Sociedad Argentina de Ciencias Naturales 4 (17):288 (1918) [MB#212907].(fig.1).

The main signal of these types is a black spot on the surface of trees and their bushes. Their *doliolums* placed on surface of the leaves and has sphere shape, its size is 202–222 x 92–112 mkm, small and



black coloured. Its bag is ellipse and does not create pseudoparaphysis. The size of the spores is 25–28x11–13mkm, placed in two lines containing 3 vertical and 1 horizontal barrier.

— *Juniperus virginiana* L. Navruz street of the city of Termez. 19.05.2016, JSh-021 (TASM), 26.08.2016, JSh-T024 (TASM). Against the city. Bahadir Sherqulov street. 23.03.2016, JSh-K015 (TASM).

Explanation: Host plant for the new species. The defined *Metacapnodium juniperifungies* according to previous systematic was named as *Capnodium juniperi*. Bur species and other species that sporalsii larger, 3 across the barrier. Sports set some spherical form.

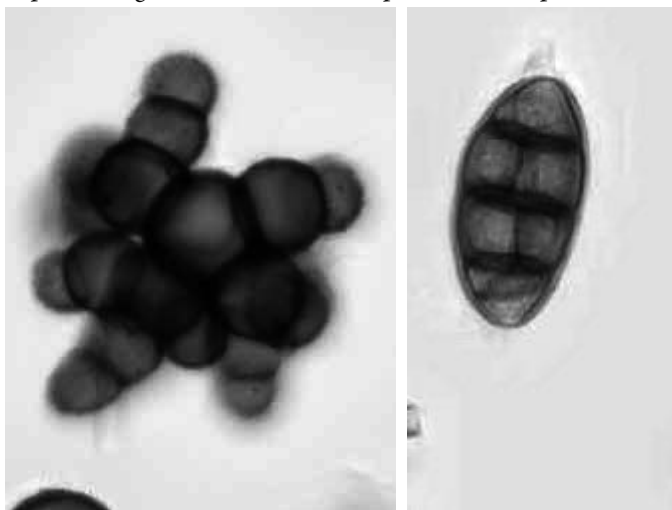


Fig. 1. *Metacapnodium juniperi* (W. Phillips & Plowr.) Speg. — *Juniferus virginiana* Bieb. plant bush

**2. *Capnodium pini*** Berk. & M.A. Curtis, Grevillea 4 (32):157 (1876) (fig.2).

This species of fungi is a black spot on the surface of trees and their bushes. Their *doliolums* placed on surface of the leaves and has sphere shape, its size is 201–221 x 90–111 mkm, black coloured. Its bag is ellipse and does not create pseudoparaphysis. The size of the spores is 20–24x10–12 mkm, placed in two lines containing 1–2 horizontal barrier.

— *Pinus eldarica* Medw.- Juraboeva street of the city Termez of the road around, JSh-T08 (TASM). 26.08.2016, JSh-T023. (TASM). Uzbekistan street of the city. Karshi. 04.05.2016, JSh-K041 (TASM).

Explanation: this species of fungimostly observed with the fungi species named *Cladosporium sp.* Mikobiotasi new round. This fungal plant *Pinus eldarica* meet for the first time.



Fig. 2. *Capnodium pini* Berk et C. *Pinus eldarica* Medw

**3. *Capnodium salicinum*** Mont., Annales des Sciences Naturelles Botanique 11: 234 (1849) [MB#168391] (fig.3). This fungi covers the whole surface of plant leaf and stem with black dust. This micromicent's *doliolums* are placed on the surface of the leaf and has a sphere shape with the size 162–212 mkm, has a small teat shape, black coloured. Has ellipse bag with the size, 44–63x19–25 mkm, surface has sick cover, does not create pseu-

doparaphysis. Its spora has 4 horizontal and 1 vertical barriers, has ellipse or long-pinshape with the size 18–24,2x12–14, placed in 1–2 lines, has grey colour.

— *Ulmus pumila* L. Navruz Street area of the city of Termez. 19.05.2016, JSh-T012 (TASM), 26.08.2016, JSh-T014 (TASM).

Private enterprise of the city Karshi landscape. JSh-T012 (TASM),

Explanation: This species usually observed with fungi named *Alternaria alternata* (Fr.) Keissl.

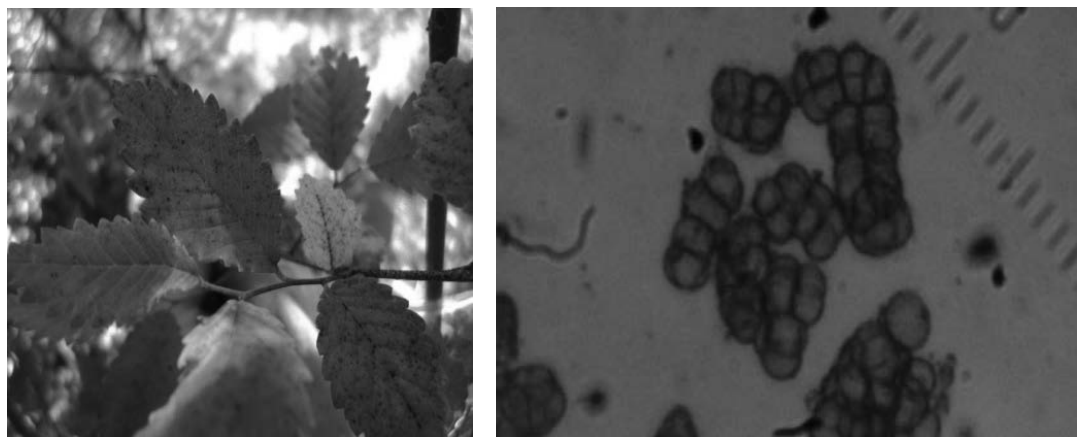


Fig. 3. *Capnodium salicinum* Mont. (*Ulmus pumila* L.)

**4. *Capnodium.sp.*** This fungi covers the whole surface of plant leaf and stem with black dust. Sporas` have ellipse shape, 24–26x12–18 mkm, creates 2 vertical and 1 horizontal barriers and placed 1–2 lines.

*Biota orientalis* (L)Ende. Navruz street of the city of Termez 19.05.2016, JSh-T036 (TASM), 26.08.2016, JSh-, T016. (TASM). Paxtazor street of the city Karshi. JSh-T036 (TASM).

Explanation: usually met with *Cladosporium sp* fungi type.



Fig. 4. *Capnodium.sp.* (*Biota orientalis* (L)Ende)

Table 1. – Preeding of *Capnodium*type in decorative trees

№	Fungi	Plant
1.	<i>Metacapnodium juniperi</i>	<i>Juniperusvirginiana</i> L.
2.	<i>Capnodium pini</i>	<i>Pinus eldarica</i> Medw.
3.	<i>Capnodiumsalicinum</i>	<i>Ulmus pumila</i> L.
4.	<i>Capnodium sp.</i>	<i>Biota orientalis</i> (L)Ende.
Total:	4	4

**4. Conclusion.** In conclusion it was observed that *Capnodium* genus of fungies are met on 4 species of decorative trees as *Juniperus virginiana* L., *Pinus eldarica* Medw., *Ulmus pumila* L., *Biota orientalis* (L)Ende which are spread in southern cities of Uzbekistan.

Discovered species of *Capnodium*, *Metacapnodium juniperi* and *Capnodium salicinum* fungies, are defined as a host plants which are found in the territory of Uzbekistan. *Capnodium pini*, *Capnodium sp* species are recorded first time for Uzbekistan. Though these types does not influence strightaway they influence on it during the years and kill the plant.

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## Section 3. Geography

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-32-34>

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### Reaction of groundwater regime of river basins of south Fergana on global warming

**Abstract:** The article presents the results of the assessment of groundwater reaction regime in the basins of the rivers of South Fergana on global warming.

**Keywords:** global warming, groundwater, underground water level, alluvial cone, river basin, trend.

In Central Asia, particularly in Uzbekistan, increasing of water shortage creates every year a lot of geo-ecological problems. The situation is complicated by the fact that the water resources are fully utilized. If the primary cause of complications is consumers of water resources, the second appears their natural change.

Surface water regime is determined mainly by rainfall regime, their distribution in the territory and within the year, changes in temperature. From the change in global temperature of the twentieth century is divided into 3 periods:

1. Warming 1910–1945;
2. Several cool period 1946–1975;
3. Warming since 1976 and continuing to the present time.

In recent studies it has been found an increase in runoff from glaciers rivers flowing from the northern slopes of the Turkestan and Alai ranges due to increased melting of glaciers in the warming period [1]. This increase in runoff of glacial rivers would lead to changes in the groundwater regime.

As is known, currently it is dominated by the theory the formation of infiltration of groundwater. The amount of accumulation

of infiltration water depends mainly on the amount of precipitation, the porosity of the rock, the surface structure of the ground, its altitude above sea level, and others. Also, in the formation of groundwater involved surface water of rivers, canals, lakes, marshes and reservoirs. Infiltration of water from these sources can form in underground layers of new underground drainage or significantly increase the volumes of groundwater and increase the level of groundwater [2]. All this shows a significant role in the formation of surface runoff groundwater. Therefore, the changes observed in surface runoff as a result of global warming have affected and in the groundwater regime. This article is devoted to the study of this question by the example of the river of South Fergana Valley — Sokh and Isfairam, flowing out from the northern slopes of the Alai Range.

Sokh River is fed mainly by glaciers and alpine snow. Therefore, it is the most full-flowing in July–September due to enhanced melting in the summer at high temperatures.

During the period of warming in river runoffs of Cox and Isfairam there have been significant changes (Table 1).

Table 1. – Average values of annual runoff of rivers of Cokh and Isfairam (m<sup>3</sup>/s) and the level of groundwater in their pool

Names of the rivers and number of wells	1934–2015	1934–1945	1946–1975	1976–2015	1934–2015	1934–1945	1946–1975	1976–2015
	Average value				Trend			
Cokh	44,14	41,36	41,08	47,71	0,02	0,14	–0,01	0,04
21	–2,44	–2,07	–2,30	–2,67	–0,02	0,05	–0,06	0,04
28	–1,62	–1,40	–1,49	–1,80	–0,02	0,22	–0,10	0,03
56	–0,94	–0,69	–0,96	–0,97	0,00	0,24	–0,05	0,06
Isfairam	22,85	22,12	21,83	24,21	0,01	0,05	–0,03	0,04
1	–8,05	–8,52	–7,42	–8,46	–0,01	0,24	–0,06	0,02
3	–1,68	–0,33	–1,17	–2,33	–0,03	0,29	–0,09	0,07

As you can see, the runoff of rivers in the warming period up to 1945 was lower compared to the average long-term for the

1934–2015, in the years 1946–1975 even less, and in the period of warming since 1976 — much more.



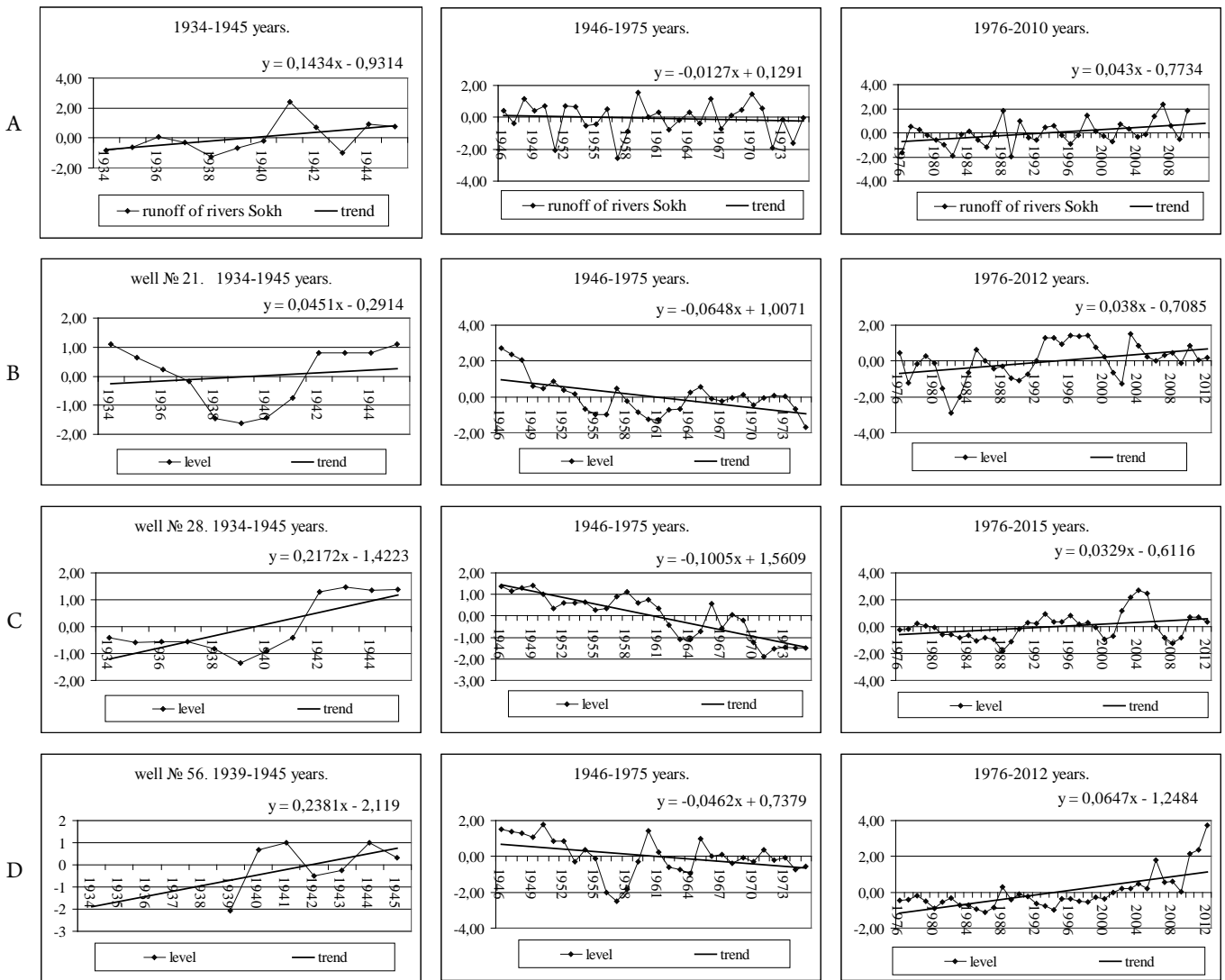


Figure 1. The chronological charts of annual runoff of rivers Sokh, the water level of wells and their trend. The level of groundwater in these periods in most cases from period to period decreased

This is not a change in runoff of water feeding the underground rivers. And the well 1 in the basin of the river Isfairam where during 1946–1975 it was observed rise of groundwater level we can see the opposite scene; in the absence of warming in the 1946–1975 the ground water level was higher than in the periods of warming. However, chronological charts and trend of the annual river runoff and groundwater levels give each other more consistent results.

Figure 1 shows the chronological charts and trend of annual

runoff of the river Sokh corresponding to the three aforementioned periods. In these graphs to facilitate comparison of the average annual runoff is presented in normalized form  $(q - q_0)/y$ , where  $q$  is average annual runoff,  $m^3$ ,  $q_0$  is term average annual runoff,  $y$  is standard deviation of annual runoff. As can be seen from the figure, the changes of runoff of the river Cokh takes place in accordance with changes in temperature. Trend changes in runoff of the river Cokh until 1945 had a positive value, in 1975–1976 — negative, after 1976 again positive.

Table 2. – Glaciers area of the Basin of the river Sokh

Years	Glaciers area, km <sup>2</sup>	Difference, km <sup>2</sup>	Annual change in the area of glaciers, km <sup>2</sup> /year
1948	170		
1968	258,7	+88,7	4,44
1975	282,7	+24,0	3,43
1980	244,1	-38,6	-6,44
2001	198,3	-45,8	-2,20

It should be noted that the increased runoff of the river Cokh during the warming may be temporary, since this increase is not due to increased rainfall in the catchment area of the river, but it is a result of increased melting of glaciers, which quickly reduced area (Table 2) [2]. This may subsequently lead to large changes in the runoff regime of rivers.

Changes in the level of groundwater in the basin of the river Cokh is fixed since 1934 to facilitate of data comparison of the

runoff of the river Cokh and the level of groundwater, the latter is also given in the form of a normalized  $(h - h_0)/y$ , where  $h$  is average groundwater level in a given year,  $h_0$  is a mean value,  $y$  is a standard deviation of annual values of groundwater level.

These normalized values of groundwater level on the aforementioned periods of warming are shown in Figure 1 b-d. Comparison of these graphs shows matching the trend of groundwater level on all three points of observations of the trend of the river Sokh. How-

ever, there are significant differences in the chronological course. Especially striking is the presence in the chronological course of

the groundwater level in the period to 1945 warming deep dip in the middle of the period.

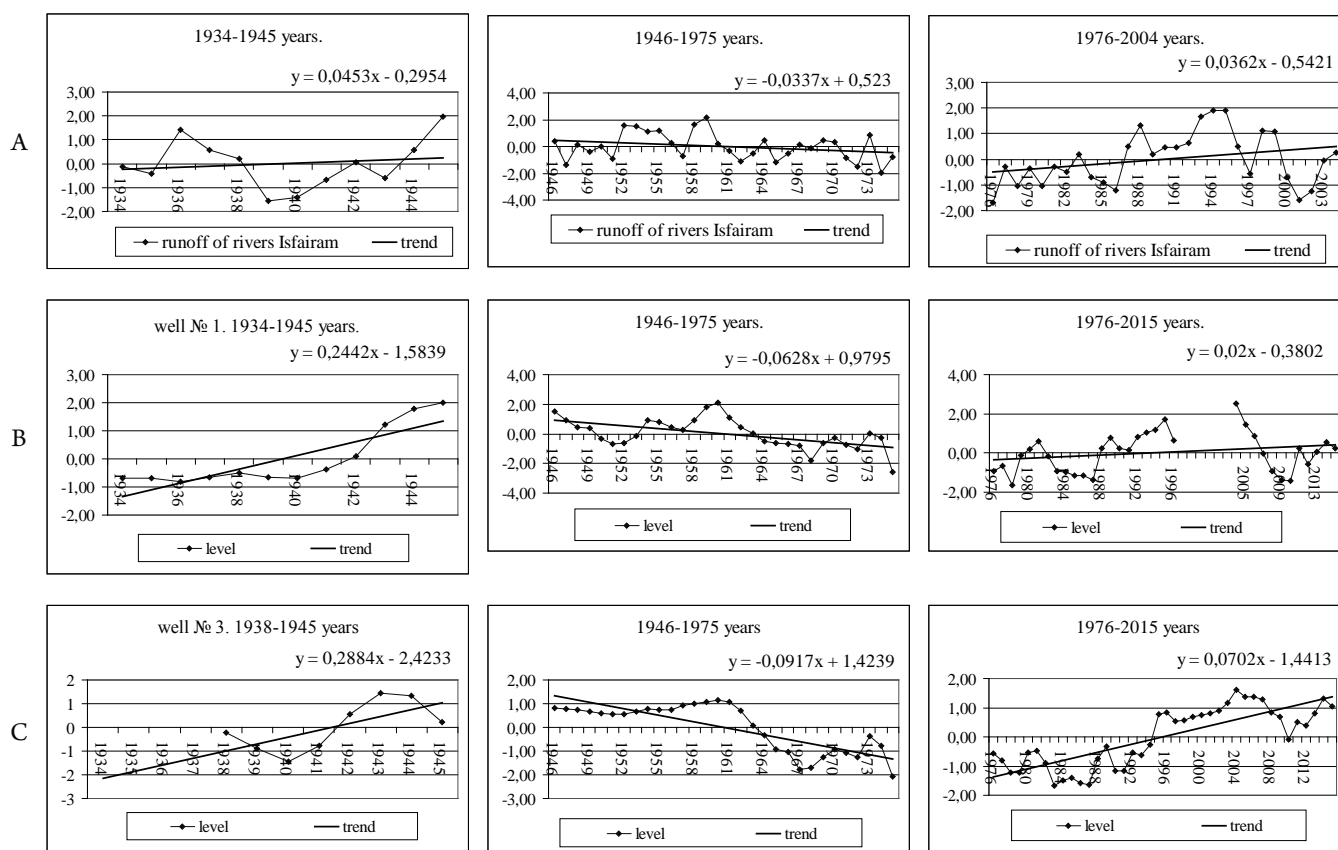


Figure 2. The chronological charts of annual runoff of rivers Isfairam, the water level of wells and their trend

To determine the prevalence of these changes, such charts were made and other river basin. Figure 2 shows similar charts for Isfairam nearby river, it is also a river glacier-snow feeding. As seen in Figure 2, the trend indicators of the runoff of the river Isfairam and groundwater levels in wells in its basin resembles what was observed in the Sokh River.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-34-36>

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## On the formation of soil moisture

**Abstract:** As a result of the discussion of the experimental material it was concluded about tangible role of condensation and adsorption of atmospheric moisture in the formation of soil moisture

**Keywords:** Adsorption, atmospheric moisture, condensation, limnogram, soil moisture, surface air layer, the diurnal variation of the water level.



Table 1. – Soil moisture at the beginning of the growing season and the amount of rainfall from October to March, mm.

Years	Moisture	Precipitations X–III
2001	178	99,7
2002	176	134,5
2003	186	204,8
2004	192	253,2
2005	181	208,4
2006	196	101,5
2007	197	148,2
2008	176	78,2
2009	210	150,4
2010	173	135,4
2011	200	76,2
2012	193	189,7
2013	193	111,6
2014	199	103,5
2015	180	134,8

As for the case of a large amount of precipitation than the moisture in the soil, it may be noted the increased intensity of rainfall in

2003–2005. As is known, when rain is less than 0.5 mm/min to couple infiltration is observed, all evaporates, and infiltration of the plow is 55%; at an intensity of 0.75 mm/min, and steam, and the plow –70–80% at 1.0 mm/min, respectively 19 and 29% with 1.5 mm/min — 15 and 28%, with 2.0 mm/min — 12% and 22 [6]. The possibility of increasing the intensity of the rainfall in these years limited infiltration into the soil.

And so, we can conclude that in the arid conditions of the Fergana Valley to the beginning of the vegetation in the first meter of soil due to precipitation, condensation and adsorption accumulates pretty solid moisture — 150–200 mm. In order to use this moisture at most to grow crops it is necessary to drastically reduce the amount of moisture evaporation. As is known, this can be accomplished by using a plastic mulch film, the buried layer 3–5 cm of soil. Such experiments have been carried out by us in 2011–2013 in Chartak district of Namangan region of Uzbekistan. Which are given positive results [3; 8].

Based on the foregoing, it can be concluded that condensation and adsorption of atmospheric moisture makes a significant contribution to the formation of soil moisture. This is when mulching allows you to grow crops in arid conditions.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-36-37>

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## Development Uzbekistan farm enterprises and specialization of the geographical factors

**Abstract:** This article highlights development geographical factors and specialization of farm enterprises in the regions of the Republic of Uzbekistan.

**Keywords:** agriculture, farm enterprises, land area, development, specialization, agricultural products.

The Republic of Uzbekistan became independent in 1991. It was been paid lot of attention as priority level for implementation of large-scale reforms in agriculture of the leading sector of the national economy.

#### Introduction

In particular, on basis of the Directives of the first President of the Republic of Uzbekistan — Islam Karimov and on international experience were been created farm enterprises. In addition, it was been paid special attention to optimize farm

enterprises. Currently, it is developing more the reforms on the farm enterprises.

Development and specialization of agricultural enterprises are conducted in accordance with different natural and socio-economic factors in the various regions of the country. In this case, most of all:

a) the natural geographical situation, the relief of the place (surface structure), the provision of land and water resources, ecological situation, agroclimatic resources: humidity, temperature and soil cover;

- b) the economic geographic factors — the development of cities and urbanization, transport infrastructure;
- c) the demographic situation — population density, employment, age and ethnic composition;
- g) the market supply and demand relations;
- d) strengthen the export potential of countries and regions and have an impact on the investment.

Therefore, almost all indicators has regional properties. In particular, the number of farm enterprises on January 1, 2015 is more than 79100. From these, 20% or one fifth were been established in Samarkand and Ferghana regions. In this regard, a large number in the regional Kashkadarya and Namangan too, the lowest rate is in the Navoi region, it is 1835.

In the Republic of Uzbekistan have been provided for Farm enterprises 5809.8 thousand hectares of land, from this Bukhara, Kashkadarya, Surkhandarya and Karakalpakstan are leaders. The provided area of lands for farmer enterprises in these regions are almost half of the country's total lands in this category. At the same time, Andijan, Khorezm, Surkhandarya regions have the least quantities in reference and Navoi regions has a large land area, that the area of irrigated land (steppe zone) is not a lot. [2].

The number of employees working on farms in the country a total of 1245.0 thousand people, and this trapped water resources and a relatively well-developed, and on this basis agroiqtisodiyotida intensive agriculture in Andijan, Ferghana, Samarkand and Tashkent regions; they have an average of 20 people working on the farm. This figure Khorezm, Bukhara and the Republic of Karakalpakstan, is much greater than 16–18. On the contrary, Navoiy, and the regions farms an average of 6–9 people. We can say the same geographic features, such as small farmers, is also observed [3].

Farming, economic indicators, the gross agricultural production share of 34.4%. In this respect, the Syr Darya (40.6%), Samarkand (36.8%) and Kashkadarya (36.5%) of the above regions, Navoiy, Bukhara, Namangan, Surkhandarya regions, agricultural production is more than 70 per cent of the farms will be created.

It should be noted that farms more strategic leadership in the cultivation of agricultural products. For example, 99.1% cotton, 79.2% of the grain, grapes and melon are produced by more than half. The share farmer farming sectors of potatoes, vegetables and fruit higher. High livestock production, farmers are obvious. This form of ownership, milk, meat 96.1 95.1 82.8 fleece, karakul skin 67.6 corresponds to 58.0% of the egg (2015). In addition, the num-

ber of cattle farms 93.4 79.2 76.6 pigs, sheep and goats, and poultry kept to 59.8 percent.

Natural conditions in different regions, where farmers specialization has its own importance. In particular, countries with vast deserts, the low and high mountain chain that agro-climatic and water resources and the provision of different reasons. As a result, significantly different from each other 2 major natural and agricultural areas, it formed [1], and farm specialization. First, in the mountain and foothill areas of land, used or old. This area is mainly horticulture, viticulture, horticulture and specialized mountain-pasture farming. Second, the plain areas, which is a relatively new development (the second half of the twentieth century), the desert region. This is the region's farms are mostly cotton, grain, horticulture, specializing in the desert and pasture farming.

Farms have a direct impact on the regional characteristics of their specialization. A market economy and efficient use of available resources, regional organization and specialization of production processes based on the natural and economic characteristics of each region to perform its intended purpose. Specialization, known for the company he understood, or participation in the production of this type of commodity products. There undertakings to improve the specialization of resources and effective use of its production activities mainly in directing the preparation of goods [4]. The sustainable development of agriculture in the regions of the country and its future development and improving the efficiency of the service. In addition, to reduce production costs and increase the export potential of the agricultural sector to solve the problems of seasonal unemployment importance.

Intensification of agriculture specialized in each area's unique natural and socio-economic conditions is required to be conducted. For this reason, felt the need to learn the process georafik. However, in the context of the liberalization of the economy, specialization in the agricultural sector can not be used directly to produce. Because this kind of product to create a system based on supply and demand of the market.

#### Conclusion

At the same time, the country's agriculture, especially in the areas of natural farming conditions and the state of agroclimatic resources to improve the regional organization and specialization of complexity is explained by the presence of government procurement of cotton and wheat cultivation. In this context, the relationship between market specialization to develop scientific-theoretical foundations of today's farmers are among the urgent tasks of the day.

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## Regional peculiarities of motor transport development in Uzbekistan

**Abstract:** This article highlights the territorial peculiarities of motor transport development in Uzbekistan. Also, the condition estimate and the forecast of GRP production imposing the level of development and densities of highways were conducted.

**Keywords:** motor transport, the gross regional product (GRP), infrastructure, transport and geographical model, forecasting, region.

The statements of prominent academic economists and economic geographers of Europe, Russia and other countries such as V. Kristallera, A. Lyosha, N. Kolosovskogo, N. Baranskogo, I. Tyunena, A. Weber and etc. received real, practical confirmation. They state that the role of transport will steadily increase due to the level of economic development and the corresponding transformation of its territorial organization. Besides, a similar process covers almost all countries and regions of the world, including the Republic of Uzbekistan. This article focuses particularly on the condition estimation for the GRP manufacture per capita imposing the level of development and density of highways in the region.

It is known that the most important task for the present stage of the socio-economic development of regions is to ensure sustainable economic growth as a basis for raising the level and quality of life. This task requires a dynamic and balanced development of all the structural components of the regional system, including transport and, primarily, infrastructure of highways, which currently plays a leading role in determining the prospects for socio-economic development of regions.

Based on this, the reinforcement of regional functions of transport infrastructure supports the objectives of the transport system of the Republic of Uzbekistan for the period until 2020 [1]. However, the goals of the regional development determine the need not just to implement transport infrastructure projects on the territory of a region, but to agree on regional and transport strategies of the development taking into account the positive and negative factors of transport infrastructure impacts on the region, which is not being fully taken into account during the current development of regional improvement programs.

The experience of developed countries shows that the development of the road network and transport infrastructure determines the intensity of economic relations and is considered as one of the most important conditions for the growth of the national economy. The rapid and intensive growth of the national economy may be limited and even stopped by infrastructural constraints, which mean poor quality roads and low bandwidth road network infrastructure (bridges, tunnels) [2, 14]. Once again, the world experience shows that due to the increase in the transport dependence, integration and speed of communication between the regions, the standard of living in cities and regions can be leveled out [3, 9]. People would get the opportunity to develop their region and quick access to the central places [4], the poles and the growing points. In addition, well-developed road infrastructure is another indicator determining the level of social development.

To deal with the problems of the restricting development of the region and interregional space, it is necessary to modernize trans-

port infrastructure of the regional economic system which is capable of creating new organizational-economic schemes and algorithms of regional and interregional management of infrastructure development of territories. Herewith, the modernization of the transport infrastructure in the regions must be realized on the basis of rational use of gained and newly acquired foreign and domestic experience of the regional transport infrastructure with the direct management and control at the state level [5].

In European practice, strategic planning of transport infrastructure is based on one of two basic approaches:

— Demand-oriented approach (orientation on demand) — in which the revealed and the desired degree of mobility is taken into account;

— Goal-oriented (orientation on goal) — in which political objectives are taken into account. Both these approaches (demand-oriented and goal-oriented) are confirmed by techno-economic justification and the opportunity of funding a project from a variety of sources [6].

As foreign experience shows, the practice of realizing investment projects in the transport system sets high requirements for the process of reasoning economic efficiency and investment attractiveness of infrastructure projects. One of the fundamental elements of this process is the modeling of causation GRP indicators per capita imposing the density of highways on the 1000 km<sup>2</sup>, the purpose of which is the analysis and forecasting of demands for automotive infrastructure objects [7, 36]. The organization of various correlation models allows evaluating the most popular application objects of investments in road infrastructure (republican, interregional, inter-farm roads and ring roads around major agglomerations) at the regional level. The particular importance in this case is given to the estimate of the transport infrastructure development on a national or regional level; in this case, the implementation of the data about the density of highways per area unit (1000 km<sup>2</sup>, depending on geographical factors (size) and the availability of roads. These tasks can be dealt with the help of transport models. Transport models allow considering short-, medium- and long-term effects, as the most important instrument of justification of the key directions of transport links development. At present, transport and geographical models are ubiquitously and successfully applied with the following purposes:

— to develop planning of road network considering the increase in load;

— to calculate the effectiveness of the projects, their impact on the economic development of the region as a whole;

— to analyze proposed project solutions and their optimization;

— to improve the interaction among different transport systems.

Based on data over the period 1999–2014, (aiming at providing the greater objectivity in the condition estimate of links, Tashkent region and Tashkent city have been excluded from calculations) calculations were carried out to forecast parameters X and Y until the year 2025. Besides, it was determined that  $y=f(t)$  which can be expressed in the form of  $f(t) = a_1t^2 + a_2t + a_3$ , where  $a_1, a_2, a_3$  are coefficients of the least squares method.

Table 1. – Regional indicators of motor road density and GRP per capita\* [8]

	1999		2014		2025	
	GRP, thousand UZ Sum per capita (Y)	Road density km/1000 km <sup>2</sup> (X)	GRP, thousand UZS per capita (Y)	Road density km/1000 km <sup>2</sup> (X)	GRP, thousand UZS per capita (Y)	Road density km/1000 km <sup>2</sup> (X)
The Republic of Karakalpakstan	56	26,4	2075,6	25,2	6545,9	25,5
Regions:						
Andijan	48,8	581,4	3258,6	604,7	9999,7	623,4
Bukhara	97	99,3	4569,2	101,7	13967,6	103,0
Jizzakh	55,2	117,9	2662,1	122,6	8201,4	124,7
Kashkadarya	73,3	122,5	3589,2	133,0	11667,6	139,5
Navoi	116,3	40,5	8349,9	41,4	26025,9	42,3
Namangan	54,1	470,4	2401,5	457,0	7753,1	467,9
Samarkand	62,1	244,5	2643	250,4	8430,3	258,1
Surkhandarya	60,3	139,3	2604,1	144,3	8567,2	147,0
Syrdarya	87,7	327,1	3493,6	350,5	11655,5	369,3
Fergana	95,8	606,5	2846,2	621,3	8709,8	644,0
Khorezm	79,8	380,2	2786,4	380,2	9129,9	410,0

\*At current prices

If in 1999 the difference between Navoi region, where there was a high level of GDP per capita and Namangan region with the lowest GDP per capita was 2,1 times, by 2025 the gap between Navoi region and the Republic of Karakalpakstan is projected to increase, where the lowest GRP per capita is to 3.8 times.

According to the indicators of the density of motor roads until 2025, there is not an observed significant increase by regions. In the future it is anticipated that there will be a further increase in freight rates and passenger traffic in all regions of the country, especially in highly industrialized regions as Navoi, Bukhara and Kashkadarya

Using this method, it has been determined that  $y=17,128t^2-102,37t+277,35$ . Here, the coefficient of determination equals  $RI = 0.986$ , which indicates the high interdependence of variables. On the basis of these data, forecast parameters of growth GRP per capita until 2025 were determined. The data in Table 1 indicate high rates of GRP per capita, almost in all regions of the country. Meanwhile, there is a significant increase in disproportion among the separate regions of the country.

regions. Based on this, the most important trends in reduction of gap level in GRP and the level of road infrastructure development among the regions should be:

- to further improve the quality of road infrastructure in the regions with the highest density of road network;
- to raise the density of highways in regions with high levels of GRP per capita;
- to increase the density of railways in regions with a large area of territory (the Republic of Karakalpakstan, Bukhara and Navoi regions).

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## Section 4. History

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-40-42>

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### Ethnic aspect of the Kazakh-Hungarian relationships

**Abstract:** The article discusses the history of ethnic development of the Kazakh Hungarian people. Distribution of ethnonyms disclosed on the basis of the analysis of written sources

**Keywords:** historical processes, ethnic components, concentration, steppe zone, nomads, migration.

Relevance of the topic related to the study of the past of mankind, nationality. The roots of Kazakh-Hungarian relationships go deep into the past and are associated with the historical processes that occur in the West and North Kazakhstan and in related fields of Western Siberia, the Ural and Volga regions. On this vast expanse of forest-steppe and steppe region in the era of antiquity and the early Middle Ages were observed ethnogenetic processes, the main content of which was the interaction and mixing of Sarmatian-Alan, Ugric, and proto-Turkic tribal groups.

At various stages of the historical process, and in various geographical areas of the ethnic development of Kazakh and Hungarian peoples was due to the participation of various ethnic components in the formation of their tribal groupings during the cultural ties, political vicissitudes and migratory movements of people and tribes. The accumulated archaeological materials ethnohistorical contacts in the era of antiquity suggest that in the I millennium BC in the forest-steppe zone of Western Siberia and North Kazakhstan took place the formation of community and proto-Ugric tribes, which included protomagyar tribes. Herewith the area between the rivers Ishim and Irtysh marked as the area of the largest concentration of ancient Ugric toponymy.

The separate groups of ancient Ugric tribes at the time probably were reaching the Northern Caspian, this is indicated by the osteological material of ancient Hungarians, detecting similarities on major taxonomic characteristics with findings of Sarmatian time of Western Kazakhstan. Hence, there are reasons to believe that the Sarmatian tribes had a certain place in the ethnogenesis of the Hungarians and the Kazakhs.

Giant "corridor" along which passed the migration of the large masses of nomads from east to west, corresponded to the Eurasian arid zone — the steppe zone, alternating with mountain ranges and river valleys, beginning with the vast steppes of Mongolia and northern China and ending in the west with the feather grass plain along the Danube and Tisza.

In this migration the influence of the Sarmatian tribal union on the population of the neighboring regions and countries was significant. Until the invasion of the Huns Sarmatians took an active part in international events of the time. Archaeological evidence points to economic-cultural contacts and interactions of sarmats with people and tribes of Central Asia and Eastern Europe, including Hungary and Kazakhstan.

In the first half of the 1st millennium AD in ethno-political history of Kazakhstan and Hungary increased the role of the nomadic

tribes of Inner Asia. In the II century AD began a massive penetration of the Huns (Xiongnu, Huns by Chinese chronicles) from Mongolia to Eastern Kazakhstan and Semirechye. In the area of Balkhash and Tarbagatai they created Yueban state, which existed until the V century. Another branch of the Huns' association, which included Ugric tribes and Western Siberia, migrated to the Urals, the Aral Sea region, the Aral and Caspian steppes, edging out westward Alans and aces. In the first half of the IV century a large masses of nomadic Huns, sometimes quite dissimilar, but consolidated around a powerful proto-ethnic formation reached the steppes of Central and Eastern Europe. With the migration of the Huns associated an important stage of distribution of Turkic languages throughout their resettlement.

Ethnic aspect of the relationships between the two nations vividly manifested primarily by the example of groups Magyar, Kumanian and Kipchak tribes who played a significant role in the formation of Kazakhs and Hungarians. As we know, the medieval Turkic Kipchaks were the core in the formation of the Kazakh people, and Magyar tribes became a consolidating basis of origin of the Hungarian people.

On the present territory of Hungary Magyar tribes migrated from their ancestral (Magna Hungaria). In this regard, a large group of scientists inclined to think that in IV–V centuries a significant part of the Ugric tribe during the total flow of westward migration moved from Western Siberia to the Urals and the Volga region. Among them were ancestors of hungarians — ancient magyars, who founded there confederation of tribes. According to scientific literature the areal of the conversion process of Hungarian ancestors' facial skeleton was the area from the Volga region to Mugojar mountains.

In this land Madiyars were recorded by medieval Arab and Persian authors, in historical and geographical works, which contain a brief, but at the same time a variety of information about them relating to VIII — beg. IX centuries. Resettlement area of certain groups of the Magyar tribes, apparently was wide enough. Around the second half of the VIII — beg. IX centuries Kipchaks moved to the West, including to the Southern Urals. Precisely to this period belong the information of the Arab-Persian sources (Ibn Rust anonymous "Hudud al-alam," al-Bakri, Gardizi al-Marvazi) which indicate Kypchaks as eastern and northern neighbors of Pechenegs. As it is known, Pecheneg tribes in VIII–IX centuries. lived in the Syr Darya Basin and Aral steppes. Therefore, in the area of Southern Ural Kipchaks were in direct ethno-political and ethno-cultural contacts with the various factions of the Magyar tribes.



At the beginning of the IX. the main part of ancient Magyars moved to the west, then through the North Caucasus and the Black Sea region has reached the western part of the Eurasian steppe belt along the Danube and the Tisza. Here Magyars found all the conditions for a nomadic life, especially extensive cattle pastures, without which they could not exist. In 895, they created a strong Hungarian state.

Not all of the Magyar tribes left their ancient homeland "The Great Hungary", part of the tribal groups remained to the east of Itil (Volga). In 889, Oghuzes ousted Pecheneg tribes from the Caspian and Aral Sea region together with other Turkic tribes. The bulk of the Confederation of Pecheneg tribes migrated to Eastern Europe. As a result of these events, Kipchaks with oghuzes began to nomadize in the valley of the rivers Zhaik (Urals), Chichi (Emba), in Aral and Caspian steppes.

The main content of ethnogenetic processes in the Volga-Urals region were contacts and interaction between Kypchak, kimak, Kuman, Oguz, Pecheniz'ke, Bashkir, Bulgar, Magyar and the Alan tribal groups.

In the first half of the XI century. ethno-cultural influence and consolidating role in the Volga-Urals region goes to the Kipchaks, which was associated with the establishment of the vast territory of the Irtysh to Itil (Volga) military-political hegemony of Kipchak Khans. In all likelihood, this time include information of the connoisseur of history and culture of Turkic peoples and tribes Mahmoud Al-Kashgar (XI c.) That "Itil — is a name of a river in the country Kipchak."

At the same time, the group of Magyar tribes continued to roam by the Itil. Between Itil and the Danube, between the old and new homeland of Hungarians connection was not interrupted for almost three and a half centuries. Remaining in far east Magyars, knew about their relatives who had gone away to the west. So, in 970s under Prince Tokshune from far Bulgaria on the Volga to Hungary comes a significant group of people led by princes Bickle and Bokshay, who were settled in Pest. In the middle of the XII century there, in Hungary and in its major cities, for two years lived Arabian merchant and traveler from Grenada Abu Hamid al-Garnati. Way to Itil was so familiar that al-Garnati, leaving one of his sons in Hungary (Uncaria), went away to the Volga.

Probably the latest information about the descendants of "Old and Great Hungary" delivered Dominican Julian, who took a trip to the East to find a tribesmen and convert them to Christianity. In 1236 near the "big river Itil" he met there eastern Hungarians, who were talking with him in their native language Magyar.. Julian noted that "they were pagans, rich in horses and arms and very courageous in the wars." Only under the pressure of the Mongol invasion, the Magyars on Itil had to migrate to the west.

Lasting for several centuries (VIII-c.) ethno-political contacts between Kypchaks and ancient Magyars in the Volga-Ural interfluvium, obviously, ended in the pre-Mongol era by incorporation of the Magyar tribes in the Kipchak confederation. This is evidenced by indications of the Kazakh genealogy (shezhre). In the tribal structure of the Kazakh people of the Middle Juz (one of the largest ethno-territorial association) as part of the tribe "Kipchak" fixed ethnonym "Magyars" as a generic unit. In the Middle Juz Magyars also marked as a part of the tribe "argyn". Apparently, the Magyars appeared among Argyns not earlier than XVI century. The fact is that at the turn of the XIV–XV centuries part of the Argyns moved from south to north and from the XVI century. settled on the Ishim and Torgay. Obviously, in this period of multilateral processes of communication and interaction between the Kipchak and Argyns, among the Argyns appeared Magyar ethnic groups.

The picture of ethnogenetic ties of Kypchaks with the ancient Hungarian ethnic group — Magyars becomes more expressive, if we turn to the data on the tribal composition of Kypchaks in the second half of the XI — early XIII centuries. The fact of appearance of information on Kypchaks' ethnonymy in Muslim historiography was far from accidental. First of all, it was associated with the international recognition of Kipchak factor as a powerful military and political force. In the middle of the XI century after the formation of Kipchak Khanate in the territory of modern Kazakhstan, the dynastic clan of Kypchaks el Borili began to take active steps in southern and western directions, which led them to direct contacts with the countries of Central Asia, Central and Eastern Europe. Soon the power of Kipchak khans spread over a vast territory from the Irtysh River to the Dniester. By virtue of the laws of development of a nomadic society, the Kipchak Khanate consisted of two major ethno-territorial associations: East and West Kypchak. Border passed along the Itil. The written Arabic manuscripts by Ahmad al-Tini (1235–1318) and al-Dimashqi (1301–1349) contains information about the 16 Kipchak tribals of the eastern Dasht-i-Kipchak, which covers most of the territory of modern Kazakhstan. Structure of tribal composition of Kypchaks was complex and heterogeneous, which has absorbed, Kipchak, also Turkic-speaking, Kimak, Cuman, Pecheneg and Oguz ethnic components and Turkicized elements of Iranian-speaking ethnic formation. In this list of tribal composition of Kypchaks of Kazakhstan were listed three ethnonyms, whose names have parallels in the tribal composition of Hungarian Cumans (Kipchak).

The first of them according to Ahmad al-Tini is read as burdzhoglu. In the registry of tribes they are on the sixth place. Meanwhile, in the Kipchak confederation of the western Dasht-i-Kipchak according to Ibn Khaldun, burdzhoglu are in third place, having a privileged position in the Kipchak union and also being (along with toksoba and etioba) a top Kipchak society in the southern Russian steppes. Representatives of this genus is particularly intensified in Egypt, where some from their midst became a sultan of Mamluk state. Obviously, Burjoglu can be compared with Berish clan of the tribal association Bayuly of the Junior Juz.

As part of the confederation of Magyarian Cumans on the first place there is a tribe borchol (Borchol). This ethnic name, according to the researchers, reconstructed as burchoglu-burdzhoglu.

Thus, separate groups of burdzhoglu tribe participated in the formation of ethnic appearance of Kipchaks in Kazakhstan, and Cumans in Hungary. The name of the second ethnonym — dzhourtan by al-Dimashqi and dzhartan according to Ahmad al-Tini. In the tribal division of the West Kipchak association Arabic spelling of the tribe is read according to Ibn Dukmaku (XIV century) as dzhurtan. This implies that the most appropriate form of transcription of the ethnonym is dzhurtan/dzhortan. From this it follows that there is an obvious concurrency expressed in ethnonymy Kypchaks of Kazakhstan and Hungarian Cumans which allows talk about the particular line of genetic relationship of the two tribal communities on the example of two ethnic components.

Indicated by us the third tribe is of considerable historical and educational interest. At the end of the Kipchak's ethnonymy list given a tribal name, which is traditionally transcribed by researchers as kumanku. In this word you can easily see the distorted spelling of the name Kumani. In its structure it is similar to the kumanlu mentioned first in the list of Kypchaks' dynastic tribe — borilu, which also has been incorrectly written by the manuscript copyist of Arabic writings as a barku. We can state with confidence that the name kumanlu consists of ethnonym Kuman + lu (aff. possession or relation). Therefore, in the texts of Ahmad al-Tini and al-Dimashqi is

given mention of ethnonym Kuman/kumanlu as an independent ethnic units. Kumano is adequate to the name Kipchak-Polovets. With the concept of eastern ancestral home kumanov corresponds K. Menges's opinion, where the tribal name Kuman contains Altai word. Some scientists consider it possible to compare Cumans with the people of Sary relying on the information by al-Marvazi (XII century). We can specify to a different interpretation of the problem, according to which Kuman-Polovetses represent the outcome of mixing of Kipchaks with Kangars (Kangly). Most scientists are take the view of the identity of ethnonyms Kuman and kun. With all the originality of approach and differences of positions red thread that runs provision on accordance of Cumans with Kipchaks.

Significant groups of Cumans and Kipchaks moved to Hungary in 1239 AD under the pressure of Mongols. Among of Hungarian Cumans, written sources indicate such personalized ethnonyms as Bajlo-Bajolo, Kangala, Kapcsag-Kopcsag-Kapcsog, Tabony, Tazlar and others that are easily comparable with names Bayuly, Kangly, Kipchak, Tabyn, Tazlar. Bayuly term comparable to the large tribal union — Kishi Juz (Junior Juz) of the Kazakhs — Bayuly, which includes the tribe tazlar, obviously, is the same as tazlar of the Cumans. Kangly — one of the ancient tribes of Kazakhstan. They were part of Kypchak Khanate as significant ethnic and political power. In the XII century in the area of the Aral Sea region and the lower Syrdarya Kangly formed a large association of tribes, nominally subordinated to Kipchak khans. In Kazakh genealogical legends Kangly considered as one of the oldest tribes of the Ulu Juz (Senior Juz). Kypchaks of Hungary as one of the constituent elements were part

of the Cumans. The Tabyn tribe is part of the association “zhetiru” of the Kishi Juz.

As for tribal names pechenek (Pecheneg), which were part of the ethnic composition of the Cumans of Hungary, according to information the Pechenegs' also participated in the ethnogenesis of the Hungarians and the Kazakhs.

In the Carpathian Basin Hungarians appeared at the end of the IX century, where they came under the guidance of leader Arpad. After the arrival of the Magyars in the Carpathian basin they kept the memory of the East for centuries. This memory would not let them rest, and called them to his native land of their ancestors. Many centuries ago the monk named Otto was the first to go in search of ethnic Hungarians. And he found them to the north of Caucasus. The next seeker was also a monk — Julian. In the area of the Volga and Kama in 1235 he organized an expedition of an impressive size, consisting of the Dominican monks. Julian found tribes, who were speaking in Hungarian, although in the course of a dangerous and full of adventure travel he was the only one to survive. Even his written report preserved to our days. In XVIII century there were a series of thorough research. In 1819 the famous scientist Sandor Quereschi Choma went to Tibet and India in search of his ancestry and historical roots. His studies were continued by Armin Vamberi, the most consistent supporter of Turkish origin Hungarians, Orientalists Uyfalvi, graphs of Secheny and Almash and Hunfalvi and others. Their studies are of great interest not only for the Hungarians, but also other people of the East and including the Kazakhs.

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## Section 5. Materials Science

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-43-44>

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### Rollers processed using powder metallurgy for asymmetric and traditional rolling of sheet metals

**Abstract:** In the article two different sintered alloys provided as options for increasing mechanical and other properties of rollers for asymmetric and traditional rolling of sheet metals. Martensitic steel AISI 440C and hard alloy Mo-TiC-Ni-W-Fe composition properties have been provided.

**Keywords:** rolling metal, sheet metal, hardness, material properties, microstructure.

The development of the metallurgical industry and metal forming is inextricably linked with the solution of topical scientific and technical issues of practical importance.

First, is the creation of sheet materials with increased performance and improved properties, structure, surface quality and accuracy of product dimensions. In this regard, an important role is played by rolling sheet metal using asymmetry development of modern high-performance, cost-effective manufacturing processes.

Reliability and performance tools Rolling mills are mainly determined by the state of their working bodies, which are the most wear. Measures to improve the durability due to high speed of the output system. This is due to severe working conditions due to heavy abrasion and heat. Today produced tool does not meet the requirements imposed on them. Currently, obtaining carbide tools from new alloys and powdered materials in the conditions of our country is relevant and has a scientific and practical importance [1].

Increased durability of tools is one of the basic and effective ways of increasing the service life of, in particular, the use of new materials. This would improve the quality of the tools is guaranteed, and at the same time, the need to cover the mills of the Republic of Uzbekistan due to increased longevity.

In particular, the preparation of the instruments local raw instrument greatly reduces costs and simplifies the process [2].

The studies have shown that one of the main tasks of the work was the choice of materials from local raw materials for the roller asymmetric and traditional rolling of sheet metal. Creating a new type of unit for the asymmetric rolling, which significantly increases the performance of the target material and the target product with high quality output.

Sintering processes can be divided into two basic types: solid state sintering and liquid phase sintering. Solid state sintering is carried out at a temperature at which the powder compacts complete sealing is achieved completely in the solid state, while the liquid phase sintering occurs when the liquid phase is present in the powder compact during sintering [3]. Liquid phase sintering is becoming

increasingly popular because of the time reduction sintering and thus its cost and performance advantages. It is widely used in the process of sintering of steels, tungsten carbide, hard alloys and superalloys. It is estimated that more than 70% of the sintered products processed by this method [2].

Sintered parts made of stainless steel are an important and growing segment of the industry of powder metallurgy. stainless steel powders were chosen to replace the powder metallurgy of ferrous alloys — for their superior characters such as corrosion resistance, oxidation resistance, wear resistance and mechanical properties (ductility and impact strength) [4].

Alloy interest in this work — AISI 440C (95X18 brand chromium steel), is a martensitic stainless steel family. The composition of the martensitic stainless steel such that they are able to transform into martensite. Due to the high hardenability inherent in these alloys, the quench rate needed to achieve the martensite is not high. Water and oil quenching are only used when working with thick sections. Typical formulations range from 12 to 18 wt% chromium (Cr) and from 0.1 to 1.2 wt% C. [5].

Alloy AISI 440C, in particular, a high content of carbon, straight chromium, high hardenability of a martensitic stainless steel has a good corrosion resistance in soft household and industrial applications, including fresh water, organic materials of weak acids of various petroleum products, in combination with an extremely high strength, hardness and abrasion resistance when in the hardened and tempered condition. It is used for parts requiring a combination of excellent wear resistance with moderate corrosion resistance. Typical applications are: ball bearings, camshafts, bushings, cutlery, chisels, knife blades, pump parts, surgical instruments, valve seats and other parts, which are requirements of high hardness and wear resistance, and operating at temperatures up to 500 °C or have been exposed moderate corrosive environments. Low deformability of the group steels, however, significantly limits the applicability of the forged version [6]. This failure can be easily overcome by powder metallurgy (P/M) and metal injection molding (MIM) processing

route, because of their ability to almost pure form. Full seal, however, is necessary to obtain optimal properties of structural parts.

The end result is the development of PM AISI 440C steel with high hardness, and minimal shrinkage moderate corrosion resistance in a cost effective manner.

To achieve this goal, the software used Thermocalc for the thermodynamic simulation and Taguchi method. Thermocalc software is a complete thermodynamic software that allows you to predict the material composition, structure and properties arising from a variety of materials processing. Therefore modeling using the program can produce phase diagrams, which are useful in determining the optimal combinations of these parameters that can produce the desired results [7].

Preliminary results obtained from the test samples of steel (AISI 440C with 1.2wt% C) previously sintered at Sintex a/s formed the core of the approach adopted for solving research problems. Sam-

ples were pressed at a pressure of 550MPa and sintered at 1170 and 1220 °C respectively. On 500ppm boron in the form of FeB it was added to the liquid phase sintering agent. The samples sintered at 1220 °C was too much of the liquid phase and therefore appeared distorted. On the other hand, the samples sintered at 1170 °C had a very high density of about 7.63g/cm<sup>3</sup> and a surprisingly high hardness — 54HRC. While these values are within acceptable limits of these steels, the corrosion resistance, as defined in the cabinet saline was very poor. we had to determine a high degree of chromium depletion as a possible cause for the very poor corrosion properties of test steel Based on a review of results from Sintex A/S vis various literature. The optical micrograph of the samples sintered at 1170 °C (Fig. 4.1) clearly shows the presence of large amounts of carbides around previous austenite grain boundaries. These carbides are usually in the form of M<sub>23</sub>C<sub>6</sub> and M<sub>7</sub>C<sub>3</sub> chromium deplete the grain boundaries of the area around.

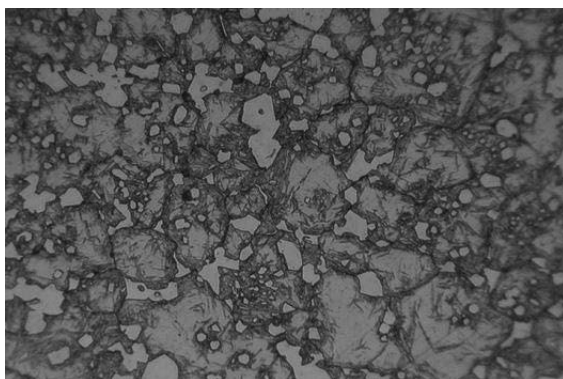


Figure 1. Optical micrograph of the test samples of steel AISI 440C, sintered at 1170 °C

We consider the results of studies on the choice of local raw material for asymmetric and traditional rolling of sheet metal. In order to improve the technological and operational characteristics of the experimental unit it is recommended to use clips from the new production of molybdenum — titanium alloy.

At the choice of the local raw material for the work roll asymmetric and traditional rolling of sheet metal shown that materials obtained by sintering of refractory metal powders meet the requirements imposed on the rollers of rolling mills.

Sintering operation ensures that the powder particles are strongly coupled and that the doping is achieved better. Sintering is typically conducted in a reducing atmosphere in order to protect the surface of the powder against oxidation and possibly to reduce any existing oxides formed during atomization and processing. Commonly used for the sintering atmosphere, hydrogen, carbon monoxide, nitrogen and ammonia.

Powder metallurgy is a key component process of making porous, refractory materials, composite materials, high-strength alloys and special structural elements [8] listed below:

- Porous materials
- Refractory metals
- Special high-strength alloys
- Composite materials
- Structural parts

In order to improve the technological and operational characteristics of the experimental unit is proposed to use clips from the new production of molybdenum — titanium alloy (Table).

Table 1. – The chemical composition of the sintered alloy of molybdenum system Mo-TiC-Ni-W-Fe

Content, wt.%				
TiC	Fe	Ni	W	Mo
60–62	3,5–4,0	20–22	3,5–4,0	rest

Microstructure systems sintered Mo-TiC-Ni-W-Fe alloy molybdenum examined using metallographic microscope MIM-8 and a scanning-electron microscope SEM 200. Microsections Preparation was carried out in accordance with known methods.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-45-47>

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## Investigation of technological parameters of the asymmetric rolling and the physical and mechanical properties of materials

**Abstract:** In the article the results of experimental studies to determine the technical parameters of the asymmetric rolling and physic-mechanical properties of materials. To determine the mechanical properties of materials selected hardness. The hardness was measured on strip hardness tester series KV 250 are designed for the hardness testing method: Brinell, Vickers and Rockwell.

**Keywords:** rolling metal, sheet metal, copper strips, hardness, material properties, microstructure, tensile strength, tearing, stretching and annealing.

**Introduction.** In industry, most of the metal is processed by different types of rolling. When sheet metal rolling main objectives are to reduce the thickness of the sheet metal to the desired size, improve the mechanical and other properties.

Many large industries sheet materials are widely used. The high price and limited characteristics forming the processing of pressure are considered major disadvantages of sheet materials, which limit its wider application in various industries.

Rolling of the strip (sheet material) can be symmetric (conventional) or asymmetric. When the parameters of the upper and lower rollers, a linear velocity and the radii of the friction coefficients of the upper and lower surfaces are rollers is symmetric rolling. If one or more parameters of the upper or lower cylinder has a difference, it has an asymmetric rolling.

**Objects and methods** of investigation of hardness was determined to strip hardness tester series KV 250 are designed for the hardness testing method:

— Brinell (DIN EN ISO 6506 1/1–1/2.5–1/5–1/10–1/30–2.5/6.25–2.5/15.625–2.5/31.25–2.5/62.5–2.5/187.5–5/25–5/62.5–5/125–5/250)

— Vickers (DIN EN ISO 6507 1 –2–3–5–10–20–30–40–50–60–80–100–120)

— Rockwell (DIN EN ISO 6508)

— Hardness of the spherical insertion on plastic (DIN ISO 2039 T1)

All procedures meet the requirements of international standards DIN, DIN-EN, ASTM, ISO, etc.

The depth of the wells was determined in the spherical device Ericson punch with a diameter of 20.0 mm with specifications:

— The measuring range, mm (0 to 15.0); — The price of dividing the vertical scale reading device, mm, 1.0; — The price of dividing the dial reading device, mm, 0.05;

— Limits of permissible absolute error, mm, 0.05.

Elongation, tensile strength was measured on a universal testing machine series SUN/5 with the specifications:

— Nominal capacity, kN, 50; — Speed range, mm/min (0,001–200); — The maximum distance between the gripping fasteners, mm 1000; — Permit movements mm, 0.001;

— Positioning accuracy, mm, 0.02; — Error in the measurement of the load, %,  $\pm 0,5$ .

The microstructure was determined by an industrial microscope Nikon ECLIPSE L150, consisting of the following main components: visual tubes, lenses, illuminator L-UEPI, turning the lens, lens kit (x5, x10, x20, x50, x100), the object holder, microscope base, lamp holder, polarizer, analyzer table.

**Test Methods.** Tensile tests were performed on samples to GOST 1497.

Tests on the hood of a spherical hole were performed according to GOST 10510 with a punch radius of 10 mm.

Determination of the grain size was carried out according to GOST 21073.1.

Laboratory tests were carried out on samples of the rolled copper strip method by asymmetric condensed upstream of the (solid state) and after annealing (soft state) on the intermediate sizes 3.0 mm and 0.5 mm.

The samples were subject to the following types of studies:

— Determination of elongation, tensile strength;  
— The depth of the extrusion Ericson;  
— Determination of the hardness of the rolled and annealed strip;  
— Metallographic: Macro and Micro studies.

For testing samples numbered according to Table 1.

**Results and their analysis.** Identification of technological parameters of the asymmetric rolling and the physical and mechanical properties of materials before and after annealing.

Table 1. – Marking specimens

Strip thickness, mm	Status bar	Type of test	Marking sample
3.0	Hard	Hardness	1–3
	Soft	Elongation, tensile strength	4–7
		Macro and Micro studies	8
0.5	Hard	Hardness	9–11
	Soft	Depth extrusion Erichsen	12–14
		Macro and Micro studies	15

The hardness tests were determined prior to annealing. Annealing rolled coiled strip was carried out in a hydrogen atmosphere in

the bell furnaces f. «EBNER». Modes annealing roll bars are presented in Table 2.

Table 2. – Annealing roll band

The thickness of the rolled metal, mm	The heating temperature, °C	Time, hour		
		heating	exposure	cooling
3.0	480	6	4	5
0.5	450	6	4	4

Elongation and tensile strength were determined for the strip thickness 3.0 mm in the soft state (after annealing).

Ericson extrusion depth determined for strip 0.5 mm thick. The mechanical properties of the strip are shown in Table 4.

The mechanical properties of annealed strip of 3 mm thickness are shown in Table 3.

Table 3. – The mechanical properties of the annealed 3.0 mm strip thickness

Number of the sample	Mechanical properties	
	$\sigma_{inN}/mm^2$	$\delta_{10\%}$
4	226	48
5	221	48
6	213	54
7	215	56

Table 4. – Depth Ericson extrusion (punch diameter 10 mm) for 0.5 mm thick strip

Number of the sample	The depth of the extrusion, mm
12	8.8
13	9.1
14	8.9

The macrostructure of the cast strip in the transverse direction shown in Fig. 1.

Visual inspection of the cast strip surface and the presence of internal defects were detected. In figure 2, and figure 3 the microstructure of the rolled and annealed copper strip is shown.



Figure 1. — The macrostructure of the cast strip (x100)

The microstructure shown in Figure 2 sample studied corresponds № 8 recrystallized state copper after deformation and annealing. The microstructure of the cross-sectional areas of fibrous and no residues cast structure — this is due to a high degree of deformation



Figure 2. — microstructure rolled to 3.0 mm and annealed strip (x100)

by rolling the copper strip annealing and moderate temperatures. The structure consists of equiaxed grains with an average copper grain size of 35–40 microns.

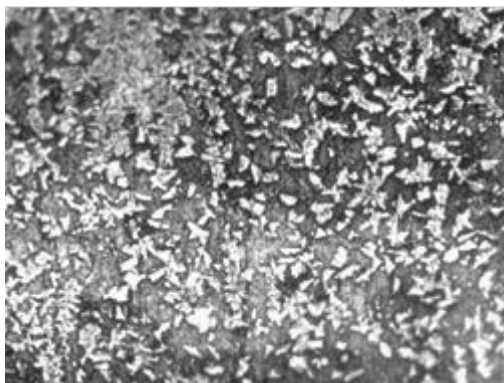


Figure 3. – microstructure rolled to 0.5 mm and annealed strip (x100)

The microstructure shown in Fig. 4.3 sample studied corresponds to № 15 recrystallized state copper after deep deformation and annealing temperature. The microstructure of the cross-sectional areas of no fibrillation. The structure consists of equiaxed grains with an average copper grain size of 15–20 microns.

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## Section 6. Medical science

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-48-49>

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### Surgical treatment approach spondylitis complicated by epidural spinal abscess

**Abstract:** The problem of treatment of complicated forms of spondylitis of the spine up to the present time is still current and delayed treatment of patients will lead to permanent disability. In the article the authors propose surgical treatment approach in complicated forms spondylitis, decompression of the spinal cord, followed by drainage of the affected segment. Active drainage of spinal cord inflammation prevents possible complications and provides favorable conditions for the activation of the patients in the early postoperative period, significantly improving their adaptive capacity and quality of life.

**Keywords:** spondylitis, inflammation, spinal cord, spinal column, disability.

**Actuality:** inflammatory diseases of the spine currently remains one of the most severe crippling orthopedic diseases with a high percentage of disability (85%) [9; 1; 3]. In the practice of vertebral problem of treatment of complicated forms of inflammatory diseases of the spine to date it remains valid. This is evidenced by the increase in the number of patients and an increase in the number of publications on the diagnosis and treatment of inflammatory diseases of the spine [12; 6; 1; 7]. Tuberculous lesions of bones and joints make up about 50% and more of the total number of extrapulmonary manifestations of tuberculosis and tuberculous spondylitis is 40 to 65% of all cases [13; 3; 8; 10]. Nonspecific osteomyelitis of the spine is 1.5–2% of all cases of osteomyelitis, and it is the most difficult to diagnose and difficult flowing localization of the purulent process [2; 4; 5]. In the past decade have greatly improved diagnostic possibilities for early detection of inflammatory diseases of the spine (CT, MRI, scintigraphy of the skeleton).

However, diagnostic errors make up 70–80% and the average time patients entering the clinic is 3–4 months [11]. In this regard a timely diagnosis and verification process in the spinal column is an urgent problem in the Spine and significantly affects the effectiveness of therapy.

**Objective:** To improve the results of treatment of inflammatory diseases of the spine.

**Materials and methods:** under our supervision there were 34 patients with tuberculous and nonspecific spondylitis who were treated at the Republican Specialized Scientific and Practical Medical Center of Tuberculosis and Pulmonology in the bone department. Of these 18 patients male (52%) and 16 females (48%) age ranged from 20 to 60 years. Patients on the basis of clinical, radiological and microscopic examinations were divided into two groups: one group of 19 patients (51%) with tuberculous spondylitis, including 11 men (58%) and 8 women (42%), second group of 15 patients (46%) with nonspecific spondylitis including 6 men (40%), 9 women (60%). Localization process: in the first group in the cervical region, two patients (10%), thoracic 8 patients (42%) in the thoracolumbar section 6 patients (20%) in the lumbar 3 patients (16%). In tuberculous lesions most often affected thorax. In the second group, in the cervical region 1 patient (7%), thoracic

4 patients (27%) in the thoracolumbar section 3 patients (20%) in the lumbar 7 patients (46%). Microscopy of sputum for acid-fast bacilli detected environment of tuberculosis in 12 patients (64%) from the first group. All patients underwent computed tomography study. Needle biopsy performed 7 (22%) patients. From the observed 31 (91%) patients after conservative treatment (an average of 25–30 days) are routinely performed surgery (resection of the defeat of the vertebral bodies, sequestrectomy and fusion with bone autograft and drainage of the spinal cord). The final diagnosis is made after histological verification of the material. All patients received antibiotics spondylitis of the spine, antibacterial, restorative therapy before and postoperative period.

**Results and discussion:** the epidural space (ES) has a minimum content of the vessels in the cervical and thoracic spine, the maximum — in the lumbar spine, epidural veins which have a maximum diameter. Anterior-posterior size ES progressively narrows with lumbar level (5–6 mm) to breastfeeding (3–5 mm) and becomes the minimum at the level of C 3–6, and under normal conditions of ES pressure has a negative value. The lowest it is in the cervical and thoracic spine. On this basis it can be assumed that the inflammatory process extends to the ES usually at the transition where the ES size is more and more often formed epidural infiltration. Because of the smaller sagittal cut cervical-thoracic complications of the spinal cord was observed in almost 66% of patients with lumbar localization abscess complications were observed in 25% of patients. Pelvic disorders was observed in 14%, movement disorders in 30%, sensory disturbances 21% and 35% of cases of radicular pain. All the patients produced anterolateral access reconstructive surgery using autobone, decompression of the spinal cord at the level of injury, followed by leaving mikroirrigation tube on the epidural area with drainage tube. After surgery, an average of 8–10 days through mikroirrigation tube washing their epidural area with isotonic solution then administered broad-spectrum antibiotics. After 10 days after spinal surgery complications in 26 patients underwent, at the 1-st patient remained stable paraplegia, in 2 patients did not reinstated pelvic disorders, radicular pain in 5 patients. One month after surgery for an MRI study in 28 patients the patency of cerebrospinal fluid spaces completely



restored, and in 4 patients infiltration preserved in 2 patients were followed epidural sequesters and 2 months 31 patients activated with hard corset.

**Conclusion:**

Complex treatment of patients with inflammatory diseases of the spine complicated with epidural abscess through the use mik-

roirrigation tube on the site of the lesion prevents possible inflammatory complications in the postoperative period, allow recovery and active rehabilitation of patients and provides favorable conditions for seam and autograft reconstruction without resorption in the early postoperative period and significantly increasing their adaptation opportunities and quality of life.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-49-51>

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## Phenotypic and genotypic resistance to antimicrobial performance in stains of Salmonella Typhimurium

**Abstract:** We studied 39 strains of Salmonella Typhimurium, which were allocated from patients in 2012–2013 by bacteriological and molecular genetic methods, strains sensitivity to antimicrobial agents. It revealed an extremely high proportion of strains resistant to the antibiotic medicines, including —  $\beta$ -lactams (84.6%) and fluoroquinolones (92.3%). Strains of S. Typhimurium characterized by multiple resistances to different classes of the antibiotics. About half of the isolates (43.6%) have the same resistance phenotype A-AC-T-C-CO-CTX-CA-NA-CPM, which may indicate the clonal propagation of the pathogen. Resistant strains of S. Typhimurium to  $\beta$ -lactams (including cephalosporins of 3–4 generations) is due to produce  $\beta$ -lactamase

genetic families TEM and CTX-M, with 66,7% of the strains are characterized by the same genotype and resistance genes have four  $\beta$ -lactamases: TEM, CTX-M1, CTX-M2 and CTX-M25, it can also indicate the clonal propagation of the pathogen.

**Keywords:** antibiotic, resistance, gen, phenotype, genotype, *S. Typhimurium*. Introduction.

Antimicrobial resistance (the term “antibiotic” and “antimicrobial agents” in this document interchangeably) — a resistance to the action of a microorganism of the antimicrobial substance to which microorganism was previously sensitive. Resistance is not a new phenomenon and has been studied for the past 50–60 years. World Health Assembly in 1998 adopted the first resolution, directed at rational and efficient use of antimicrobial agents. In 2001 was published by the WHO strategy to contain antimicrobial resistance [1]. In 2011, WHO dedicated World Health Day the problem of antimicrobial resistance.

Excessive use of antibiotics in farm animals has serious consequences for public health, as it promotes the appearance of antibiotic resistant bacteria and resistance genes that can be transmitted to humans [7]. Resistance food related infections of zoonotic bacterial types *Salmonella* certainly associated with the use of antibiotics in farm animals; foodborne infection caused by such resistant bacteria repeatedly documented in humans. Of particular concern is the stability of the so-called “critically important antibiotics” used in medicine. For example, the use of fluoroquinolones in farm animals led to the appropriate antibiotic resistance in *Salmonella* which cause infectious diseases in humans. In diseases caused by multiresistant strains of *Salmonella typhimurium* specific phage type (DT) 104 with resistance to quinolones, we observed treatment failure, a higher frequency of hospitalization and greater risk of death [5; 8].

**The aim of the research** are study of the sensitivity of antibiotic strains of *Salmonella Typhimurium* isolated from patients with acute enteric infections in Tashkent in 2012–2013.

#### Materials and methods.

The study included 39 strains of *Salmonella Typhimurium* isolated in 2012–2013 from patients with acute intestinal infection in the bacteriological laboratory of Scientific Research Institute Epidemiology, Microbiology and Infectious Diseases Ministry of Health of Uzbekistan, Tashkent, and sent for further examination to the “national collection of microbial infections of human” of Scientific Research Institute Epidemiology, Microbiology and Infectious Diseases Ministry of Health of Uzbekistan.

The study of morphological, biochemical and tinctorial properties of the strains of *Salmonella* spp. was performed according to WHO protocols [9], the determination of sensitivity to antimicrobial agents performed by disc — diffusion method and serial dilutions as recommended by CLSI M02-A11 and M07-A10 [10]. Полученные результаты интерпретировали согласно рекомендациям CLSI M100-S22 [11]. The results are interpreted according to the recommendations CLSI M100-S22 [11]. We used Mueller-Hinton agar and disks with antibiotics production of Hi-Media, India, as well as chemically pure substance of antimicrobials (HIMEDIA, India). We studied the sensitivity of *Salmonella* to the following AMD:  $\beta$ -lactams (ampicillin, amoxicillin/clavulanic acid, cefotaxime, cefotaxime/clavulanic acid, ceftazidime, ceftazidime/clavulanic acid, cefepime, imipenem, meropenem), quinolones (nalidixic acid, ciprofloxacin, oflaksatsin), aminoglycosides (gentamicin) and other groups of drugs (tetracycline, chloramphenicol, trimethoprim-sulfamethoxazole). For internal quality control of the studies we have used *E. coli* ATCC 25922 and control strains *K. pneumoniae* ATCC 700603.

Mechanisms of resistance strains  $\beta$ -lactam ILA studied by molecular genetic methods: PCR, electrophoretic detec-

tion and PCR in real time. Performed the detection of genes encoding products of  $\beta$ -lactamase wide and spread spectrum genetic families SHV, TEM, CTX-M (genetic groups CTX-M1, CTX-M9 CTX-M8/25 CTX-M2), and various carbapenemases — OXA-48, KPC and metallo  $\beta$ -lactamase NDM, VIM, IMP. Isolation of DNA by the method of Shevchenko O. V. et al. (3). For PCR amplification was used sets of reagents of production «Evrogen» (Moscow, Russia). The final reaction volume was 25  $\mu$ l with the addition of template DNA. Reaction components were added according to the manufacturer’s instructions. Amplification was performed according to the protocols [12; 2; 6; 3; 4]. The PCR products were visualized by electrophoresis (in 0.5X TBE buffer) in a 2% agarose gel containing ethidium bromide (electric field intensity at 6 V/cm for 30 min), and then view a UV transilluminator.

#### Results and discussion

Included in the research *Salmonella* strains isolated from patients with acute intestinal infections in the city of Tashkent in 2012–2013, according to the culture-morphological, biochemical and antigenic properties consistent with *S. Typhimurium*. All studied strains were resistant to one or more classes of the AMD. Moreover, the proportion of strains resistant to critically important for medicine classes AMD (beta-lactams and fluoroquinolones) is extremely high. Thus, resistant to various  $\beta$ -lactam antibiotics (both unprotected and protected by clavulanic acid) of 84.6% (the spread spectrum cephalosporins) to 89.7% (ampicillin), the strains were characterized by very high stability — and MIC<sub>50</sub> ampicillin and cefotaxime MIC<sub>90</sub> amounted to 512 mcg/ml ceftazidime 64 mg/ml and 128 mg/ml, respectively. In the group of  $\beta$ -lactam antibiotics have retained their activity against *S. Typhimurium* only carbapenems (imipenem, meropenem). Currently, the use of fluoroquinolones for the treatment of *Salmonella* infection is limited to the prevalence of strains that are insensitive (resistant or moderately resistant) to this group of drugs. Thus, 92.3% of subjects *S. Typhimurium* strains were resistant to nalidixic acid, while MIC<sub>50</sub> and MIC<sub>90</sub> amounted to 512 mcg/mL. Insensitive to fluoroquinolones (ciprofloxacin) strains accounted for 74.3% (moderately resistant — 69.2%, stable — 5.1%), the sensitivity retained 25.7%. It is noteworthy that the disc-diffusion method can not significantly determine the sensitivity of *Salmonella* strains to ciprofloxacin. When determining the sensitivity to this drug is necessary to use methods for determining MIC. According to the current international guidelines treatment with high probability fluoroquinolones *Salmonella* infection is ineffective in case the MIC for ciprofloxacin-pathogen strain greater than 0.06 mg/l. Our research revealed that MIC<sub>50</sub> and ciprofloxacin MIC<sub>90</sub> was 1 mg/ml, indicating a high probability of clinical inefficiency use of fluoroquinolones for the treatment of *Salmonella* infections in patients Tashkent.

Our research showed that among the studied strains *S. Typhimurium* 84.6% resistant to chloramphenicol, and MIC<sub>50</sub> and MIC<sub>90</sub> amounted to 512 mkg/mL. Also with the high frequency observed resistance to antibiotics tetracycline (97,4% resistant, MIC<sub>50</sub> and MIC<sub>90</sub>–128 mg/ml), gentamicin (76.9% MIC<sub>50</sub> = 64 micrograms/ml and MIC<sub>90</sub> = 128 mcg/ml) co-trimoxazol (64.1% of strains MIC<sub>90</sub> = 512 mcg/ml).

Research has shown that most of the investigated strains were characterized by combined multiple resistance to AMP.

Among dominated *Salmonella* strains tested multiple phenotypes with AMP resistance: 79.5% of the strains were characterized

by resistance 8 and more AMP, and combine these strains resistant to  $\beta$ -lactams, products  $\beta$ -lactamase a spread spectrum (PBLSS), with resistance to drugs other groups. The most frequently met phenotype resistance to ampicillin, amoxicillin/clavulanic acid, cefotaxime, ceftazidime, cefepime, tetracycline, chloramphenicol, co-trimoxazole, nalidixic acid (A/AC/CTX/CA/CPM/T/C/CO/NA), such strains accounted for 43.6%.

In *S. Typhimurium* strains resistant to  $\beta$ -lactams, detection genes was performed, responsible for the production of  $\beta$ -lactamases and extended broad spectrum of different genetic families.

The research did not reveal the genes encoding  $\beta$ -lactamase production of a wide range of genetic and extended family the SHV, and carbapenemases genetic families OXA-48, RNC, VIM, NDM, IMP. Almost all studied strains of *S. Typhimurium* identified genes  $\beta$ -lactamase TEM of genetic family (97.4% of the strains). Moreover, more than 80.0% of the strains had the  $\beta$ -lactamase gene of genetic family CTX-M (92.3%), related to the genetic groups CTX-M 1 (87.2%), CTX-M 25 (87.2%) and CTX-M 2 (76.9%). The studied strains were characterized by a combination of  $\beta$ -lactamase genes TEM and CTX-M of different genetic groups.

In 36 of the 39 investigated strains (92.3%) at the same time identified several genes  $\beta$ -lactamases. Thus, more than 60% of the strains were predominantly genotype resistance genes including four  $\beta$ -lactamases: TEM, CTX-M1, CTX-M2 and CTX-M25

(27 strains, 69.2%). Eight strains (20.5%) had three genes simultaneously  $\beta$ -lactamase in various combinations, one strain — genes of two  $\beta$ -lactamase (TEM and CTX-M1). Two strains identified a gene  $\beta$ -lactamase (TEM). In one of strain *S. Typhimurium*  $\beta$ -lactamases are not identified from above mentioned genetic families.

Thus, must be noted that in determining the sensitivity to flohinolonam necessary to use methods for determining the MIC of ciprofloxacin as a disco-diffusion method is not reliable enough.

#### Conclusions:

1. The population *S. Typhimurium* of strains isolated from patients with acute intestinal infections in Tashkent in 2012–2013, characterized by an extremely high percentage of strains resistant to the AMD, including critical to medicine —  $\beta$ -lactams (84.6%) and fluoroquinolones (92.3%).

2. Strains *S. Typhimurium* characterized by multiple resistance to different classes of the AMD. About half of the isolates (43.6%) have the same resistance phenotype A-AC-T-C-CO-CTX-CA-NA-CPM, which may indicate the clonal propagation of the pathogen.

3. Resistance of strains *S. Typhimurium* to beta-lactams (including cephalosporins 3–4 generations) is due to produce beta-lactamase genetic families TEM and CTX-M, 66.7% of the strains are characterized by the same genotype resistance and have four beta-lactamases genes: TEM, CTX-M1, CTX-M2 and CTX-M25, it can also indicate the clonal propagation of the pathogen.

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## The study of laxative activity of polysaccharides from the fruit of *Prunus Domestica L.*

**Abstract:** In the modern society are very popular laxatives, for a constipation treatment and for the prevention of activity of the gastrointestinal tract that stimulates the development of safe and effective herbal medicines.

In the present paper we investigated the laxative activity of various polysaccharide fractions isolated from prunes, individually and in mixture (natural ratio).

During studying experimental constipation on mice for all selected polysaccharide fractions is shown presence of laxative action at dose of 125 and 250 mg/kg, but with a different dose-effect. The studies of laxative activity of the mixture of individually polysaccharide fractions at the natural ratio are shown that the most beneficial effect is observed at a dose of 250 mg/kg.

**Keyword:** laxatives remedies, constipation, fruits of *Prunus domestica L.*, Polysaccharides.

According to statistical data from constipation is suffering 10–15% of the population of countries with high levels of economic development. This problem has long acquired a social character [1]. Also, there is a tendency of use of laxatives as a means for weight loss. For this widely used dietary supplement, teas for weight loss and other product [1, 2].

Currently, there are several types of action of laxatives remedies according to the mechanism: saline laxatives/osmotic action which cause an increase in the volume and dilution of feces; herbal laxatives — irritate the intestinal receptor; preparations, prebiotics, that normalizing intestinal micro flora and natural neutral substances/excipients which absorbs water.

Existing drugs belonging to one of the above mentioned the group of laxatives remedy, showing unilateral therapeutic effect, which stimulates receptors of large intestine, increases peristalsis and promote intestinal emptying, or only helps to the softening of fecal masses.

Although the drugs of osmotic actions are inorganic salts which at long reception cause loss of electrolytes from the organism.

In addition, laxatives are based on herbs possess more favorable and harmless effect to the organism.

In search of an effective laxative at the Institute of Bioorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan was developed a new remedy named Ravonol.

In this research work is presented of the laxative action of different polysaccharides fractions as individually and as mixtures in natural ratio.

**Materials and methods:** The experiments on the white laboratory mice ( $n=75$ ) of both genders weighing of  $25 \pm 2,7$  g were performed. Experimental animals contained in conditions of vivarium. Before setting the experiment the animals were at the quarantine during 14 days.

In order to achieve the state of constipation, during the week before the start of the experiment, feed ration of mice consisted of: dry whole grain, mixed with a food starch and activated charcoal (25mg/mouse for per day); Crackers of bread; and with free access to water [3].

Studied polysaccharide fractions (1, 2, 3, 4 IVF) in individually and their sum (natural ratio), were introduced intragastrically at doses of 125 and 250 mg/kg.

Control animals received saline. During the next 4 hours we observed the quantity and quality of boluses (solid, soft, liquid).

As a positive control, we used a condensed prunes' extract — 0.5 ml/per mouse, and as reference the herbal drugs Fitolaks (92 mg/kg) and Senadeksin (13 mg/kg) [4; 5].

**Results and discussion:** Comparative analysis of laxative action of polysaccharides of prunes individually or in admixture showed that each of the selected fractions at the doses of 125 and 250 mg/kg has laxative activity (picture 1).

Laxative activity of samples was determined by changes in the quantity and quality of fecal bolus (softening of feces).

Most bright laxative activity was shown by fractions — IFP-1 and IFP-2. However, increasing the dose two-fold from 125 to 250 mg/kg for both samples leads to a reduction in laxative activity. When using samples — IFP-1 and 2 at a dose of 250 mg/kg, boluses constituted 33.3 and 25.4%, while a dose of 125 mg/kg — constituted 43.5% and 64.8%, respectively.

It was identified that the lowest activity had both doses of samples of IFP-3, since 78–79.0% of boluses of fecal were solid. The small number of accounted for soft boluses of — 15.5–16.5%, the remaining amount of liquid. It says, that explore this fraction not expedient further.

During using IFP-4 fractions with increasing doses twice has not caused change in the character of excrement in mice (the quality and quantity of excrement). At a dose of 125 and 250 mg/kg soft boluses output was 24.2% and 35.8%, respectively. A significant part of boluses were solid which accounted for 60 to 65% and it showed that laxative activity of IFP-4 is weakly expressed.

For the concentrated extract of prunes (CEP) in studied dose (0.5 ml/mouse) 25.5% of total amount of fecal masses was a soft and a hard, and 49.0% was a liquid.

Since the liquid boluses were almost half of the total quantity of excrement, we observed a sharp transition of solid boluses to a liquid state (development of diarrhea). This fact did not favorably impact on the motility, intestinal micro flora and for the whole digestive system.

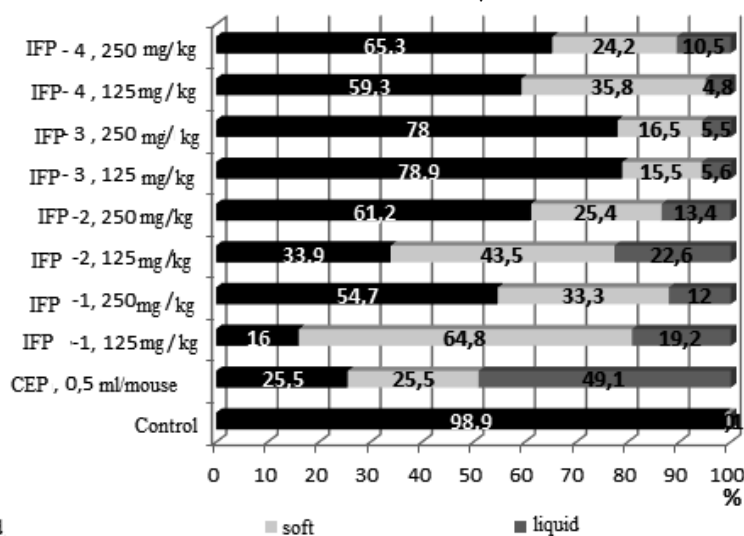


Fig 1. Effect of polysaccharides fractions from prunes on the excretory function of the intestine with experimental constipation on mouse

Thus, it was shown that the selected three fractions of the four have laxative activity depending of applied dose. Most pronounced laxative effect was detected at using fractions IFP-1 and IFP-2 at a dose of 125 mg/kg. The presence in mouse excrements of more than half of the soft bolus after using the IFP-2 fraction, gives a guarantee for use of this fraction as an effective laxative.

After identifying a pronounced laxative effect for the individual fractions of IFP-1 and IFP-2, in order to identifying a possible synergism of activity of polysaccharides was studied activity of mixture of these fractions (MFP), taken in their natural ratio. The study of the activity of a mixture of individual fractions of polysaccharides

(MFP), were carried out in contrasting with a condensed plum fruit extract (CEP) and reference preparation Fitolaks.

The results obtained after using MFP and references, ranked by qualitative and quantitative of fecal boluses are shown in picture 2. The weakest laxative activity observed for MFP at dose 125 mg/kg, when an output of boluses were for: hard forms — 14.3%, soft — 85.7% and liquid were not observed.

When using Fitolaks at therapeutic dose (92 mg/kg), the number of soft boluses increases up to half to compared to MFP at dose 125 mg/kg and also the presence of the liquid forms of feces was not observed.

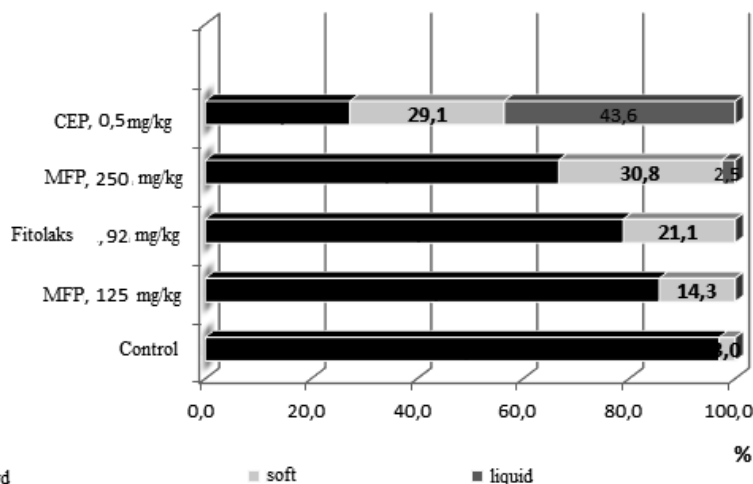


Fig2. Effect of mixture of polysaccharides fractions (MFP) from prunes on the excretory function of the intestine with experimental constipation on mouse

The most favorable softening of feces for the mixture of MFP at a dose of 250 mg/kg within 4 hours was observed: hard forms — 66.7%, soft — 30.8% and liquid -only 2.5%. When receiving laxatives important is the fact that a small amount of liquid boluses that occur when using MFP at a dose of 250 mg/kg have not given rise to diarrhea effect.

The reference drug Senadeksin at a dose of 13 mg/kg has provided a sharp transition from the state of constipation (62.4% of hard boluses) to diarrheal state (33% liquid boluses). It is an undesirable factor which destabilizing the motility and the intestinal micro flora. Condensed extract (CEP), as in the previous experiments had showed high laxative activity, causing a sharp increase in volume of liquid bolus.

Thus, based on experimental results, found that, the most effective a laxative action have the mixture of individual fractions of polysaccharides (MFP) at dose 250 mg/kg.

#### Conclusions:

1. Experimentally determined that, all isolated fractions of polysaccharides from prunes have a specific therapeutically action, so they can be used as a basis for creation a laxative remedy.

2. The laxative effect of each of obtained polysaccharides fractions dependent on used dose.

3. It was found, that the most favorable laxative effect has the mixture of individual fractions of polysaccharides (MFP) at dose 250 mg/kg.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-54-57>

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## A morphological state of vascular tissue structures of the small bowel in the generation born to mothers with chronic toxic hepatitis in conditions of hepatitis correction

**Abstract:** We studied the processes of early postnatal development of vascular and tissue structures of the liver in infant rats born from mothers with chronic toxic hepatitis in conditions of hepatitis correction in the mother.

Our research data have demonstrated that maternal liver pathology produces a negative effect on postnatal growth, development and formation as well as a morphofunctional state of gastrointestinal tract organs and the liver of the breed. It seems that the reason of the pathomorphologic alterations in the vascular tissue structures of the stomach, small and large intestines and the liver lies, first of all, in deficiency of a plastic, trophic and energy material of the fetus during the fetal period of development due to maternal liver pathology. For these reasons it is necessary to develop substantiated medical and preventive measures aimed at prevention of pathology in children born and fed by mothers with hepatic pathology.

**Keywords:** Chronic toxic hepatitis, maternal liver, gastrointestinal tract organs.

**Introduction.** Maternal liver diseases are a reason of fetal pathology and can become a reason of a delay in general development of the new generation and its predisposition to various diseases.

Despite the numerous studies, a problem of toxic lesions of organs and tissues in men and animals remains to be important. It is stipulated, first of all, by a rapid development in the chemical industry, incorrect recycling of chemical wastes, spread of toxicomania and drug addiction [1; 2].

A wide use of pesticides and other toxic chemicals have caused negative shifts not only on the environment, but also became a reason of occurrence of acute and chronic toxic poisoning, substantial functional and structural shifts in the internal organs [3].

We studied the processes of early postnatal development of vascular and tissue structures of the liver in infant rats born from moth-

ers with chronic toxic hepatitis in conditions of hepatitis correction in the mother — that was the aim of our research.

**Materials and methods.** The model of chronic heliothrine hepatitis in female rats was reproduced weekly with an injection of heliothrine in a dose of 0.5 mg per 100 gr of mass during 6 weeks. The animals were divided into two groups after the last injection as follows: the first group included rats with chronic toxic hepatitis and the second one comprised rats with chronic toxic hepatitis, which were given essential forte and carsil for 30 days. Male rats were placed to the monotherapy treatment completion. Male rats were placed to females of the first group 10 days after the last injection. The generation of rats was studied on 3, 7, 21, 30 and 120 days after birth.

Pieces of a tissue were taken from the liver of infant rats on the 3<sup>rd</sup>, 7<sup>th</sup>, 21<sup>st</sup> and 30<sup>th</sup> day of postnatal development and they were

studied by using conventional morphological, morphometric and electron microscopic research methods.

To study intra-organ vessels of the liver, a solution of black ink was administered intracardially through the left ventricle of heart according to the original technique developed by M. A. Kolesov [4]. The vessel clearing was performed according to the method developed by A. G. Malygin [5].

**Results and discussion.** The study of small bowel structures during the first week of life of young rats has shown that all four coatings are seen distinctly in their wall, viz. mucosal, submucosal and serous muscular ones. The mucosa is presented by villi and lined by one-layer cylindrical epithelium. Villi are correct, thin and finger-shaped. Their basis is wider than in the apical portion. The stroma of villi is slightly infiltrated with globocellular elements. The height of duodenal villi as well as the depth of crypts of the jejunum and the ileum differs slightly from the control. The crypt lumen is narrowed; their stroma is moderately infiltrated with cellular elements. Goblet cells at various synthesis stage and excretion of secretion are found between absorbing epithelial cells. Alongside with formed villi, those at the stage of formation can be seen. Mitotically dividing cells, a number of which is increasing in the distal direction of the intestine, can be found among less differentiated cells.

Short microvilli can be found on the apical portion of absorbing epithelial cells. Large, oval or spherical cell nuclei are located at the cellular base. Their cytoplasm is fine-grained, rich in mitochondria and a rough reticulum. The mitochondrial matrix is moderately electron dense. Fine mitochondria are located by nuclei. The Golgi complex is well developed. The cytoplasm is saturated with

electron dense secretory granules. It is rich with free ribosomes and polysomes.

A submucous membrane consists of a loose fibrous cribriform tissue with vascular and nervous plexuses.

The muscular tunic is thin and consists of two layers: the internal one is circular and the external one is longitudinal. The internal muscular layer is developed more strongly than the external one.

The serous membrane presents a layer of mesothelial cells. Development and differentiation of intestinal tissue structures go on in 14-day old infant rats. In comparison with a week period of development, the thickness of all layers of the intestinal wall increases; an amount of formed villi decreases in the mucosa, their height and the depth of crypts, a number of enterocytes, villi and crypts as well as mitotically dividing cells increase.

By 21–30 days of postnatal development we observed the completion of formation processes of tissue structures of the small bowel wall. All types of cells of its layers are clearly differentiated. Mucosal villi are high, finger-shaped and crypts are deep. The epithelial layer on villi consists of highly prismatic cells, among which goblet cells at various stages of secretion can be found (fig. 1). Goblet cell secretion contains the special reaction positive material.

Crypts have a shape of narrow tubules. Mitotically dividing cells can be found in the area of the middle and bottom thirds of crypts. Their number is somewhat higher than in the control group.

The submucosal membrane consists of a loose fibrous connecting tissue rich with vascular and nervous plexuses.

Layers of a fibrous connecting tissue with blood vessels can be observed between muscular fascicles of the muscular membrane.

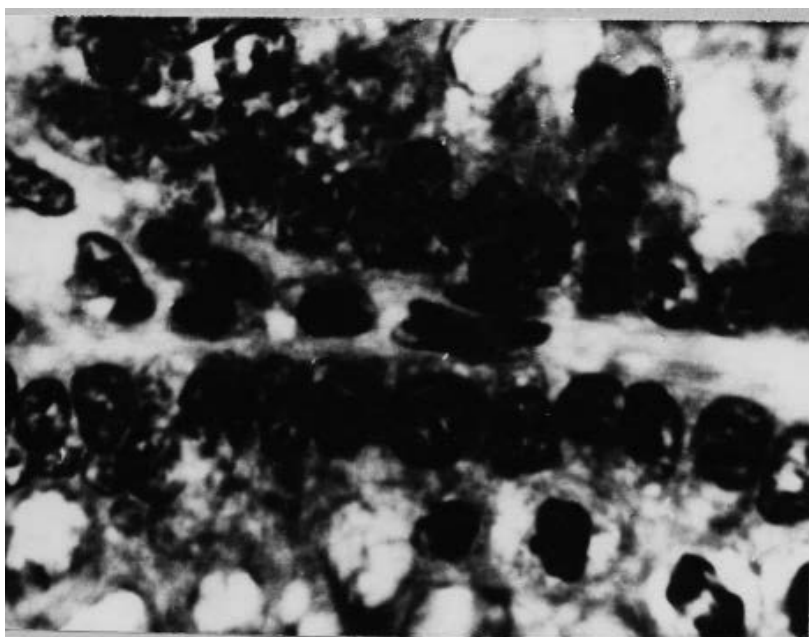


Figure 1. The mucosal membrane of the ileum in 30-day old infant rats. Hematoxylin — eosine. Object 20. ocul. 10.

The serous membrane presents one layer of mesothelial cells. The thickness of the serous-muscular membrane is within normal ranges.

The general architectonics and relief of all coatings of the small bowel wall corresponded to that of mature animals. The processes of proliferation, differentiation and extrusion of cells in the crypts and villi in the intestinal mucosa are in the state of equilibrium.

Enterocytes are highly differentiated. Well developed microvilli are located on their apical surface. The cell cytoplasm contains a complex of organellas. Mitochondria are oval or extended. A rough reticulum contacts to mitochondria. Some ribosomes and poly-

somes can be observed. The Golgi complex is well developed, somewhat hypertrophied and located above the nucleus; it consists of lamellas, vesicles and vacuoles. The basal membrane is even thicker than in the previous period of development.

The architectonics of microvessels of the small bowel wall of week old infant rats essentially does not differ from the controls. However, processes of morphological and morphometric formation of intra-organ vessels of the small bowel have not completed yet.

Diameter of precapillaries and capillaries of the mucosal membrane is within normal ranges. Capillaries and plethorical venous vessels located in a convoluted way occurred only occasionally.

Diameter of venules is slightly larger and the vessel density is reliably lower than that of the control. We also observed similar alterations in vessels of submucosal and serous muscular membranes. Immature collagenic fibers and poorly differentiated connective tissue cells were found in the structure of arteriole walls.

No significant pathological changes were observed in the architectonics of microvessels of all layers of the small bowel wall in 14–30-day old infant rats (fig. 2). We have noted the increased density of mucosal capillaries in comparison with the previous follow-up periods. The sinuous, non-uniformly narrowed capillaries were occasionally taped. The wall of villus capillaries consists of 3 coatings, viz. an endothelium with the basal membrane, a layer of pericytes and adventitious cells and thin reticular fibers. Elastic fibers and single smooth muscle cells are found in the wall of venules. Differentiation processes still go on. All links of vessels of the microcirculatory bed can be detected in the submucosal membrane. The wall of arterioles has well devel-

oped smooth muscle cells. Their wall is somewhat thickened. In sites, where precapillaries branch from arterioles, aggregation of muscular cells can be seen. Diameter of post capillaries and venules is more than that of arterioles. A comparatively greater amount of smooth muscle cells can be seen in the wall of venules. It is only occasionally that venules are dilated and overfilled with blood. Differentiation processes continued in vessels of the muscular membrane.

In long-term studies (on the 120<sup>th</sup> day of life) we established that all links of vessels of the microcirculatory bed were highly differentiated (fig. 3.).

Vessels of an organ muscular membrane anastomose widely among themselves and form a vascular lattice between muscular fascicles. Well developed capillaries prevail.

All morphological and morphometric indicators of small bowel micro vessels are maximally close to the norm during this period of the postnatal life of animals.

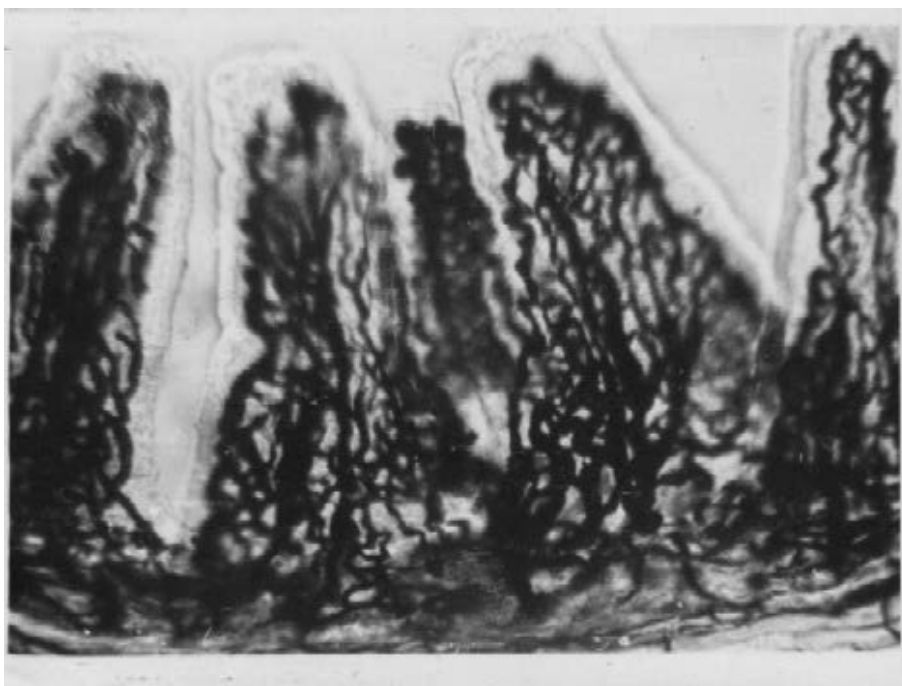


Fig. 2. Blood vessels of the ileum in 21-day old infant rats. The vessels are cast with black ink. Object 10. ocul. 10. 1: arteriole; 2: venule; 3: capillary network

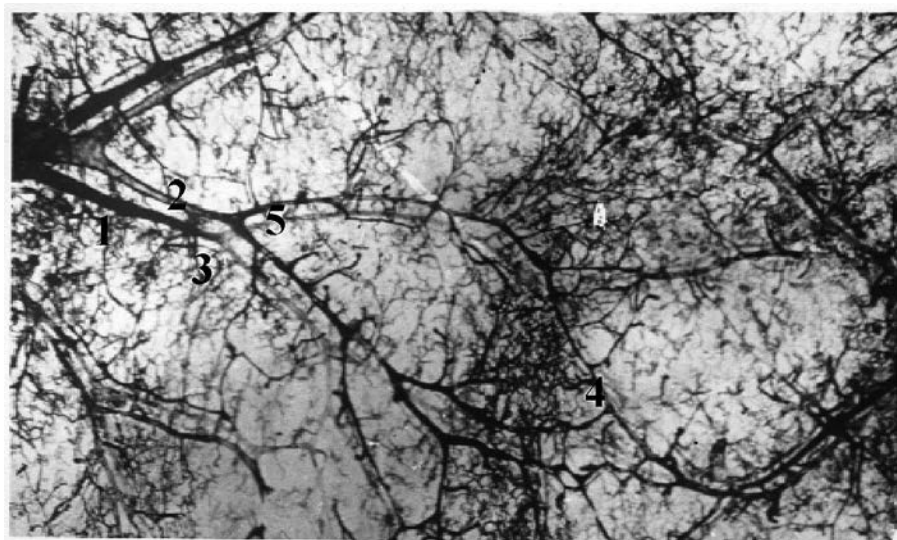


Fig. 3. Blood vessels of the serous muscular membrane of the small bowel in 120 day old infant rats. Vessel cast with Herot mass. Object 10-ocul. 10. 1-artery; 2-vein; 3-arteriole; 4-capillaries; 5-venule



Thus, our research data have demonstrated that maternal liver pathology produces a negative effect on postnatal growth, development and formation as well as a morphofunctional state of gastrointestinal tract organs and the liver of the breed. It seems that the reason of the pathomorphologic alterations in the vascular tissue structures of the stomach, small and large intestines and the liver lies, first of all, in deficiency of a plastic, trophic and energy material of the fetus during the fetal period of development due to maternal liver pathology. Besides, according to medical sources [4, 5, 6], compensatory-adaptive processes in the liver begin early and

actively in fetuses from mothers suffering from hepatic pathology and that, in its turn, can result in delay and retardation of development and formation of other organs.

At the same time, we cannot exclude other factors such as a disordered antitoxic function of the liver and resultant hepatotoxins and their metabolites in mother's blood entering the fetus through the placenta, breast milk and causing inflammatory reactive alterations in its body. For these reasons it is necessary to develop substantiated medical and preventive measures aimed at prevention of pathology in children born and fed by mothers with hepatic pathology.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-57-60>

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## Dynamics of changes of immunologic parameters in children with chronic colostasis in relation to method of treatment

**Abstract:** The conservative therapy of colostasis in young children with inclusion of drugs having immunomodulating properties (duphalac, lynex, detoxicants, vitamins) showed significant increase of the parameters of T-cellular immunity (CD3+, CD4+, CD8+ lymphocytes) with normalization of immunoregulatory index, decrease in expression of apoptosis markers and natural cells of killers. The early postoperative period was characterized by monocytopenia, lymphopenia, neutrophilia, some lowering of the concentration of immunoglobulins, growth of apoptosis markers expression, and it is also accompanied by improvement of the parameters of T-cellular immunity due to growth of CD4+ and CD8+ lymphocytes.

**Keywords:** chronic colostasis, immunology, treatment, children.

**Background.** In the various countries from 28 to 50% of adults and more than 5% of children are suffering from constipation. In the native literature the analogous parameters in children fluctuate from 16 to 25%, and all authors agree about the opinion that they have tendency to growth every year [1].

Delayed correction of constipation results in various complications in rough changes of microbe landscape (disbacteriosis), the

activity of intestine as organ of digestion and as immune organ disturbs [6; 9].

The normal microbe flora with its specific functions determine intestine biocenosis and ecological balance, and disturbance of these functions results in various metabolic disorders, occurrence of deficit of vitamins and microelements, attenuation of immunologic status, that lead to the irreversible processes in the various organs and systems [4].

It has been proved that change or sharp reduction of quantitative and qualitative contents of intestinal microflora effect on morphology and function of the intestinal tract: motor, reduction of the quantity of lymphocytes and lymphatic vessels, level of immunoglobulin G and immune response, rising of the risk of autoimmune and inflammatory diseases [8].

In case of immunity attenuation the risk increases of intestine contamination by pathogenic flora characteristic for disbiotic disorders [6].

At present time in the native and foreign literature there are studied questions of the effect of chronic colostasis (CC) on the state of immune system in children [6; 9].

The development of immune deficit states which progress on the background of chronic feces intoxication, colitis and disbacteriosis appeared to be additional factor significantly aggravating clinical course of disease. They simultaneously provide progressing of the constipations due to cinergism in functioning of the gastrointestinal tract and immune system closing the "vicious circle" of pathogenesis [2; 5].

There has been proved the most important function of the gastrointestinal tract, that is, its participation in the formation of reaction of the local and general immune response. This is expressed by closed interaction of immunocompetent formations associated with intestine with contaminating them by bacteria, viruses and other microorganisms as well as presenting in the chyme of foreign molecules with antigen properties. The presented intercommunications and interrelations provide the state of dynamic equilibrium between physiologic status of child's organism, his immune system and microbes associations occupying superficial surface of body and organs communicating with the environment. Dysfunction of gastrointestinal colostasis is one of the most important mechanisms of development of the secondary immunodeficiency state [2; 7; 10]

**Purpose of research.** Analysis of the results of changes of immunologic parameters in children with chronic colostasis in relation to method of treatment.

**Materials and methods.** There have been performed investigations of immunologic status of 30 children with chronic constipations induced by one or other pathology of the colon. All

children were treated in the Department of Children Surgery of the Republican Research Center of emergency medical care from 2012 to 2015.

Evaluation of the state of cellular immunity was performed by expression of the superficial antigen of lymphocytes in the reaction of immunofluorescence according to application of instruction with use of monoclonal antibodies of series LT to differential antigens of human leucocytes: CD3 (T-lymphocyte marker), CD4 (marker of helpers/inductors), CD8 (marker of supressor/cytotoxic T-lymphocytes), CD16 (marker of natural killers), CD25 ( $\alpha$ -chain of interleukine-2 receptor), CD45 RA (marker of native T- and B-lymphocytes), CD95 (FAS/APO-1 antigen, causing apoptosis). Immunoregulatory index was calculated by the ratio CD4+ and CD8+ cells. The parameters of humoral immunity were studied with method of radial immunodiffusion with analysis of the levels in the peripheral blood of immunoglobulins G, A, M with use of monospecific serums to various classes of immunoglobulins [3].

**Results and discussion.** Analysis of data obtained during study of parameters of cellular and humoral immunity after conservative treatment for 5–10 days in children at the age to 5 years is presented in table 1.

There was noted unreliable increase in number of leucocytes and lymphocytes in relation to data before treatment ( $p>0,05$ ). The absolute number of T-lymphocytes (CD3+) has grown significantly in comparison with initial parameters ( $P<0,05$ , but did not achieve the control level ( $p,0,05$ ). Subpopulations of T-cells (helpers/inductors and suppressive-cytotoxic cells) increased significantly, and CD4+ lymphocytes increased reliably to level of control parameters ( $p<0,05$ ). Immunoregulatory index reliably was increased not only in relation to initial data ( $p<0,01$ ), but also according to control data. Increase in expression of CD4+ receptors can partially indicates about activation of thymic maturation of T-lymphocytes, strengthening of intercellular interaction that results in tendency to growth of B-lymphocytes and immunoglobulins A and G ( $p>0,05$ ). There was revealed rising of expression of activation marker CD25+ and reduction of CD95+ leading to observation of increased ratio of marker of positive activation to negative not only in relation to initial data ( $9p<0,01$ ) but also to control data ( $p<0,05$ ).

Table 1.

Parameters	Before treatment	After conservative treatment	After operation	Control group
1	2	3	4	5
Leucocytes, abs	6440±900*	6700±120	6570±130*	5725±409
Lymphocytes,%	40,1±2,4*	42,8±2,1	38,0±4,0*	45,85±2,1
Lymphocytes, abs	2582±380	2867±140	2496±262	2619±120
CD3 <sup>+</sup> ,%	34,4±2,38**	44,7±2,5*	36,3±1,8*	54,0±2,2
CD3 <sup>+</sup> , abs	888±54***	1281±71*	906±45***	1414±57
CD4 <sup>+</sup> ,%	23,4±1,0**	30,4±1,4	26,3±1,9*	32,1±2,3
CD4 <sup>+</sup> , abs	604±26**	872±40	656±47*	840±60
CD8 <sup>+</sup> ,%	16,9±1,0*	18,3±1,3	21,0±0,9	22,1±1,8
CD8 <sup>+</sup> , abs	436± 22*	524± 37	524±22	579 ±47
CD4/CD8	1,38±0,06	1,66± 0,05*	1,25±0,04*	1,48±0,06
CD20,%	32,7±2,57*	34,9±1,8**	29,3±1,6±	26,7±1,3
CD20 <sup>+</sup> , abs	844±66*	1001± 51*	731±39	699±34
IgA mg%	99,7± 13,97	108,7±12,3	105± 25,8	91,6 ±5,8
IgM mg%	70 ±4,47	76±5,1	74,3± 2,2	80,9± 6,4
IgG mg%	973± 141	1041±112	900± 90	963± 35
CD25 <sup>+</sup> ,%	22,4± 1,68	24,6±1,5	21,7 ±1,2*	24,5± 1,2
CD25 <sup>+</sup> ,%	586± 44	705±42	541± 30	642 ±31

1	2	3	4	5
CD95 <sup>+</sup> ,%	22,5±2,2	20,9±1,9	25,3±0,8	25,6±1,5
CD95 <sup>+</sup> ,%	58,1±56	599±54	631±20	670±38
CD45/CD95	1,0±0,02	1,17±0,03*	0,86±0,015	0,95±0,06
Monocytes,%	5,2±0,4	5,57±0,3	4,6±0,4	5,1±1,2
Monocytes, abs	335±25	319±17	302±26	282±73
Neutrophils,%	61,4±2,3*	51,5±3,4	70,2±2,5*	50,0±5,4
Neutrophils, abs	3954±148	2948±192	4612±164	2862±309
CD16 <sup>+</sup> ,%	23,9±2,4	21,4±1,8	22,0±1,6	21,7±1,9
CD16 <sup>+</sup> , abs	617±66	613±51	549±39	568±49

Note: \* – <0,05; \*\*p<0,01; \*\*\*p<0,001 in comparison with control

Reduction of the level of CD95+ receptor expression indicates about decrease in lymphocytes readiness to programmed death — apoptosis and appeared to be favorite sign of the treatment performed. On the background of treatment there is noted reduction of neutrophils to the level of controls, reliable in relation to initial parameters (p<0,05). The grow of monocyte number shows improvement of monocyte-macrophage chain (p<0,05). With regard to natural cells killers there were no reliable changes during the process of treatment, however the tendency to their reduction was noted.

**Clinical case.** Patient E.B of 3-year-old-age. History of illness N883/243. Admitted with complaints of colicky pains in the abdominal cavity, nausea, vomiting, abdominal distention, stool and gas retention.

From anamnesis: abdominal pains began on 05.01.14, pains were colicky, because a child was under dispensary observation due to chronic constipation. On 05.01.14 and 06.01.14 the patient mother did cleansing enema after which there was stool, pains attenuated, and night was relatively calm. On 07.01.14 pains repeatedly occur, and to the morning there was noted nausea, vomiting, colicky pains in the abdomen, abdominal distention. The child has become naughty, weak, the pains in the abdomen increased due to which there was admission to the Republican Research Center.

The child was suffering from the chronic constipations from 2012. There fore the child received conservative treatment some times from the pediatricians gastroenterologists with short time effect. The child was treated in the Department of Children's surgery in the Children's Hospital N 2 during the period 08.11.13–14.11.13, where there was made diagnosis of dolichomegacolon. Subcompensated form. Chronic constipation. Chronic colitis. Hemorrhoids. There was offered operative treatment from which there was temporary refusal. Duration of constipation may last to 8–10 days.

There has been established diagnosis: Malformation of the colon. Dolichomegacolon. Colostasis in the stage of subcompensation. Hemorrhoids. Intestinal disbacteriosis.

Laboratory examination at admission: Hb-92 g/l; Color index-0,86; Er.-3.2 g/l; Leuc.-5.4 g/l; Seg.-61; Eos.-1; Lym.-35; Mon.-3; ESR-4.

Immunogramm: Lymf.-35%; CD3-Ig-22%; CD19-VI-32%; CD4 helpers/inductors –18%; CD8-suppressive/cytotoxic Ig-12%; CD25 –29%; CD95–22%; CD16–14%; CD45–26%; IgG-627 mg%; IgA-63mg%; IgM-45 mg%.

Marked T-cellular immunodeficiency in combination with deficit of humoral immunity.

The patient began to receive cleaning of the large intestine every day by method of siphon enemas with 1% solution of sodium chloride.

There were prescribed: duphalac, diet therapy, mesim, nospa, linex and vitamin complex "B" every second day intramuscularly

The independent stool was obtained on the 10 day.

Laboratory data before discharge: Hb-106 g/l; Color ind.-0,88; Er.-3,6 g/l; Leuc.-8.0 g/l; Seg.-48; Lym.-44; Mon.-6; ESR-4.

Immunogramm: lymf. —42%; CD3–39%; CD4–24% CD8–17%; CD20-B-Ig-30%; CD25–23%; CD95–21%; CD16–14%; IgG-820 mg%; IgA-68 mg%; IgM-70 mg%.

The therapy performed with inclusion of vitaminotherapy and linex allowed significantly improvement of clinical-immunological status of the child on the 10 day after onset of treatment.

This example indicated about stopping of clinical signs of dolichomegacolon and secondary immunodeficiency state.

Thus, the conservative therapy in children with chronic colostasis provided improvement of T-cellular immunity with restoration of CD4+ helper/inductor cells with tendency to positive changes of humoral and monocytic-macrophagal chains of immunity at the short-term period after onset of treatment.

Analysis of the immune status, performed on the 5–10 day after operation, revealed immunosuppression that is explained by surgical postoperative stress, using of antibiotics. As it is known, antibiotics inhibit immune system.

In the postoperative period on the 5–10 day there was observed reduction of the relative and absolute number of lymphocytes, monocytes (p<0,05) on the background of reliable increase in neutrophils (p<0,05). At the same time there was found some increase in CD3+ T-lymphocytes at the expense of growth of CD4+ helpers/inductors and reliable growth of CD8+ suppressor/cytotoxic cells (p<0,05). There was noted increased expression of CD95+ receptors, change in the ratio of positive/negative markers of activation to reduction of relatively initial data (p<0,05) and control (p<0,01). The changes occurred after surgery in the populations of immunocompetent cells was reflected in the synthesis of immunoglobulin G, level of which reduced in 1.1 times. It is possible this is related to ability of T-suppressors to block production of immunoglobulins in the observed postoperative period.

The investigations performed showed that operation in children with chronic colostasis in the nearest postoperative period is accompanied by specific immune disorders. The complexity of pathogenesis in children with chronic colostasis as well as deepness and duration of immune disorders on the basis of immaturity of immune system in children under 5 years old show impossibility of the fast restoration of the immunity functions. This induces necessity to develop various schemes of immunocorrecting therapy including probiotics contributing to normolization of the intestinal microflora, restoration of local and systemic reactions.

Thus, in children with chronic colostasis of the young age (1–5 years) the chronic intoxication on the background of the immaturity of immune system is accompanied by marked T-cellular immunodeficiency (decrease in CD3+. CD4+, CD8+ lymphocytes), without significant changes of the functional activity of B-immunity, neutrophilia, activation of natural killer cells (NKC).

**Conclusions.**

1. Conservative therapy of colostasis in young children with inclusion of preparations having immunomodulating properties (duphalac, linex, detoxicants, vitamins) revealed significant increase in parameters of T-cellular immunity (CD3+, CD4+, CD8+, lymphocytes) with normalization of immunoregulating index, reduction of expression of apoptosis markers and NKC.

2. The early postoperative period in children of young age was characterized by monocytopenia, lymphopenia, neutrophilia, some reducing of the immunoglobulin concentration, growth of apop-

tosis marker expression, but it was accompanied by improvement of parameters of T-cellular immunity at the expense of growth of CD4+ and CD8+ — lymphocytes. These data reflect tendency to restoration of the damaged parameters of immunity in children of young age after surgery performed.

3. In the children with chronic colostasis immune system id differed by marked cellular and humoral deficit on the background of immaturity of immune system, characterized for these patients that requires inclusion of immunomodulating therapy into the complex of treatment.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-60-63>

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## Effect of lipid peroxidation on severity of clinical course and recurrence of aphthous stomatitis

**Abstract:** A study to assess lipid peroxidation oral fluid and blood serum in 110 patients with recurrent aphthous stomatitis of varying severity in the periods of exacerbation and remission.

The period of convalescence in patients with RAS clinical course of moderate and severe saved local and systemic imbalance in the system POL-AOS, which is a factor in determining the severity of the clinical course and risk of recurrence.

The research results indicate the need for antirecurrent treatment of patients with RAS in the period of remission of clinical manifestations in the mucous.

**Keywords:** recurrent aphthous stomatitis; peroxide oxidation of lipid; antioxidant; malondialdehyde; superoxide dismutase.

In everyday clinical practice patients with diseases of oral mucous membrane (OMM) represent one of the most difficult problems in dentistry due to diagnostics and treatment difficulties [1,485–491].

Recurrent aphthous stomatitis (RAS) currently represents one of the most urgent issues of modern dentistry due to the prevalence, both in Uzbekistan and around the world. Increase in the proportion of severe forms, absence of tendency to decrease the frequency of relapses were noted [5, 30–33; 11, 76–79; 9, 229–232; 18, 1286–1287].

Recurrent aphthous stomatitis is one of the common diseases of OMM. According to Rybakov A. I. and Banchenko G. V. (1978), it was 5% of all the diseases of oral mucosa. According to other researches, 20% of population suffer from aphtae in that or another life period. It was found that the age of most of patients ranged from 20 to 40 years. Persons of both genders suffer equally before puberty, but females predominate among adults [4, 9–11].

Etiology and pathogenesis of RAS have not been clarified till the end. It was found that state of microbiocenosis of oral mucosa play significant role in the pathogenesis of inflammatory processes [10, 225–

231;12, 49–58]. It was proved its involvement in metabolism, vitamin synthesis, formation of the immune status and nonspecific resistance. Clinical and experiment are evidence of role of gastrointestinal pathology and liver diseases in pathogenesis of RAS [15; 16, 8601–8612]. Question of allergic genesis of diseases is widely discussed. At the same time problem of free-radical processes and antioxidant protection in the saliva remains less studied. It is known that the immunological and free-radical disorders may affect clinical course and prognosis of chronic diseases of oral mucosa [14, 826–831; 17, 316–321].

It is known that RAS is characterized by failure of cellular and humoral immunity, enhanced sensitization, chronic clinical current of the disease [5, 30–33; 11, 76–79].

In the pathogenesis of RAS immune mechanisms caused by an abnormal accumulation of aggressive inflammatory mediators play big role [5, 30–33; 7, 22; 11, 76–79].

Any pathological process takes place against the background of the formation of reactive oxygen species (ROS) and the activation of free radical oxidation of biological substrates. Oxidative stress develops in the presence of a serious imbalance in production of free radicals and antioxidant protection attenuation, which leads to degradation of the cellular, tissue and organism level. Free radicals are the part of complex reasons for the origin of various diseases [2, 42–45; 3, 24–28, 6, 20–25].

Free radical oxidation level of unsaturated fatty acids in the form of lipid peroxidation (LPO) is one of universal metabolic control mechanisms in the organism under physiological conditions, and non-specific cellular damage pathogenic factor in pathological conditions where there is a development of oxidative stress [2, 42–45; 3, 24–28, 7, 22; 6, 45–55].

Therefore, laboratory data on the content of lipid peroxidation products in biological fluids may carry information about the depth and severity of the pathological process. The study of the state of lipid peroxidation and antioxidant system (AOS) is highly informative in assessing the severity and the effectiveness of the treatment of many inflammatory oral diseases [2, 42–45, 7, 22].

The problem of RAS treatment is to achieve long-term resistant remission. In this regard research of pathgenetic mechanisms of RAS recurrence and development of differentiate treatment principles is the urgent task.

Promising in this respect are targeted study to assess the nature of the violations of free-radical processes of the oral cavity and the blood serum in different periods of the disease, their role in the formation of clinical manifestations of RAS relapses.

**The object** of research was to compare rates of lipid peroxidation and anti-oxidant system of oral liquid and blood serum in patients with RAS of different severity in exacerbation and remission periods.

**Materials and methods.** According to variety of the clinical picture, which characterizes the erosive and ulcerative lesions of the oral mucosa, the lack of clear differential diagnostic criteria between different variants of the clinical course of RAS, the severity of the clinical manifestations of the disease was evaluated on a point system developed. We took into account the main symptoms and signs of the disease: the general condition of patients, body temperature, state of the regional lymph nodes, the size and number of the AFL, the state of the edges and the bottom of the AFL, the degree of pain, recurrence frequency. Index of disease severity (IDS) was taken into account as the average score of the selected indices. IDS in the range of 0.5 to 1.0 was taken as a mild course of the disease; IDS equal to 1.1–2.0 and 2,1–3,0, were assessed as medium and severe RAS respectively [8, 16].

From a total of 110 patients with RAS 68 patients were diagnosed with medium RAS; 32 patients were estimated as mild RAS and 10 patients had severe RAS.

The mean duration of disease was  $5,82 \pm 0,44$  years. In patients with different clinical forms, in both men and women, these figures did not have significant differences.

Evaluation of peroxidation and antioxidant system of blood serum and oral fluid was carried out on a level of malonic dialdehyde (MDA) and activity of superoxide dismutase (SOD), determined by the spectrophotometric method (L. P. Andreeva et al, 1988; Dubinin B. B. et al, 1983). To assess the state of free radical oxidation and antioxidant system we used MDA/SOD ratio 1000 (Kichenko E. M., 2004). Anti-peroxide activity (APA) of studied biological fluids was determined by chemiluminescence method (A. H. Kogan et al., 1996).

To estimate the pathogenic mechanisms of disease recurrence, these figures were assessed at the height of the disease in remission.

Statistical processing of the results of studies was determined by the software Microsoft Excel Statistika 6.0 software. By comparing the data obtained during the study we used a t-coefficient.

**Results and discussion.** In patients with RAS indicators, characterizing the intensity of lipid peroxidation processes in the acute phase of the disease, were within the above standard values ( $P < 0.05$ ), with a significant decrease in performance counter AOS systems ( $P < 0.05$ ). The greatest changes were observed in patients with medium to severe clinical current.

At the period of convalescence LPO-AOS levels were determined by the severity of the clinical course of RAS: at mild RAS they were restored to the levels of control values ( $P > 0.05$ ); at medium and severe clinical course in oral fluid and blood serum the normalization of lipid peroxidation-AOS process did not occur (table).

Table 1. – LPO-AOS process in patients with different severity of RAS in dependence on disease period

Group		MDA, micromoles/ml	SOD, au/ml	MDA/SOD • 1000	APA
1	2	3	4	5	6
Oral liquid					
Control, without RAS		0,22±0,01	71,8±3,32	2,65±0,11	5,62±0,25
Patients with RAS: Acute period					
1	Mild	0,44±0,02 <sup>*</sup>	57,1±2,65 <sup>*</sup>	6,60±0,22 <sup>*</sup>	7,22±0,35 <sup>*</sup>
2	Medium	0,63±0,03 <sup>•°</sup>	44,32±1,88 <sup>•°</sup>	14,32±0,62 <sup>•°</sup>	11,32±0,50 <sup>•°</sup>
3	Severe	0,81±0,03 <sup>•° x</sup>	37,2±1,55 <sup>•° x</sup>	21,90±0,87 <sup>•° x</sup>	14,69±0,67 <sup>•° x</sup>
Decubation period					
1	Mild	0,24±0,01 <sup>Δ</sup>	69,81±2,95 <sup>Δ</sup>	2,89±0,4 <sup>Δ</sup>	6,02±0,28 <sup>Δ</sup>
2	Medium	0,32±0,02 <sup>•°Δ</sup>	53,26±2,48 <sup>•°Δ</sup>	5,81±0,23 <sup>•°Δ</sup>	8,53±0,35 <sup>•°Δ</sup>
3	Severe	0,41±0,02 <sup>•° xΔ</sup>	48,32±2,03 <sup>•° xΔ</sup>	9,11±0,41 <sup>•° xΔ</sup>	11,32±0,42 <sup>•° xΔ</sup>

1	2	3	4	5	6
Blood serum					
Control, without RAS		0,16±0,01	63,21±2,32	2,53±0,07	4,83±0,11
<i>Patients with RAS: Acute period</i>					
1	Mild	0,22±0,01 <sup>*</sup>	56,21±2,14 <sup>*</sup>	3,80±0,21 <sup>*</sup>	5,62±0,24 <sup>*</sup>
2	Medium	0,32±0,02 <sup>°</sup>	40,82±1,83 <sup>°</sup>	8,18±0,42 <sup>°</sup>	7,11±0,27 <sup>°</sup>
3	Severe	0,42±0,02 <sup>°</sup> x	36,44±1,14 <sup>°</sup> x	11,27±0,61 <sup>°</sup> x	8,32±0,37 <sup>°</sup> x
<i>Decubation period</i>					
1	Mild	0,17±0,01 <sup>Δ</sup>	61,31±3,11 <sup>Δ</sup>	2,63±0,06 <sup>Δ</sup>	5,11±0,23 <sup>*</sup>
2	Medium	0,21±0,01 <sup>°</sup> Δ	52,11±2,51 <sup>°</sup>	4,25±0,11 <sup>°</sup> Δ	5,81±0,27 <sup>°</sup> Δ
3	Severe	0,30±0,01 <sup>*</sup>	44,32±2,11 <sup>°</sup> x Δ	7,81±0,25 <sup>°</sup> x Δ	6,62±0,31 <sup>°</sup> x Δ

Note: \* —  $P < 0.05$  compared to control;

° —  $P < 0.05$  in relation to mild clinical current;

x —  $p < 0.05$  relative to medium clinical current;

Δ —  $P < 0.05$  in relation to the acute period

Thus, in patients with mild RAS in the period of convalescence MDA value in the oral fluid was only 9.09% ( $P > 0.05$ ) higher than control indicators; SOD has been below the reference value by 2.77% ( $P > 0.05$ ); MDA/SOD ratio 1000 was higher than the control values at 9.06% ( $P > 0.05$ ); APA and oral liquid increased by 7.11% ( $P > 0.05$ ); corresponding dynamics at medium and severe amounted to 45.45% ( $P < 0.01$ ); 2.8% ( $P < 0.01$ ); 119.25% ( $P < 0.01$ ); 51.78% ( $P < 0.01$ ) and 86.36% ( $P < 0.01$ ); 32.70% ( $P < 0.01$ ); 243.77% ( $P < 0.01$ ) and 101.42% ( $P < 0.01$ ) (Table).

As the results of research, the formation of recurrent course RAS occurs in the interaction of exogenous and endogenous factors, while an imbalance in the system of LPO-AOC in serum satisfactorily coincide with the state of these processes in the oral fluid.

Thus, in the convalescence period of patients with mild RAS MDA serum had no significant difference with the control group: index exceeding 6.25% ( $P > 0.05$ ); SOD reduced by 3,0% ( $P > 0.05$ ); ratio of MDA/SOD 1000 was higher by 3.95% ( $P > 0.05$ ); and the value of APA exceeded control values at 5.80% ( $P > 0.05$ ); similar relations with the PAC of average weight amounted to 31.25% ( $P < 0.01$ ); 17.5% ( $P < 0.05$ ); 67.98% ( $P < 0.01$ ) and 20.30% ( $P < 0.01$ ); corresponding dynamics in severe PAC was already 87.50% ( $P < 0.01$ ); 29.88% ( $P < 0.05$ ); 208.70% ( $P < 0.01$ ) and 37.07% ( $P < 0.01$ ) (Table).

Continued imbalances in the LPO-AOC system indicate the activity of the biochemical and pathophysiological disorders in severe

RAS. It is obvious that the constant presence of high levels of lipid peroxidation in the body's environment plays a role in maintaining the activity of the process and determines the severity and frequency of relapses of RAS.

Studies have established the importance of lipid peroxidation-AOS processes at the local and systemic levels in the pathogenesis of the formation of various severity of clinical forms of RAS, verified a group of patients at high risk for recurrence.

#### Conclusions:

1. The development of severe forms of aphthous stomatitis with frequent relapses occurs in the interaction of exogenous and endogenous factors, an imbalance in the LPO-AOS system.

The clinical course of the RAS with a pronounced imbalance in the system of LPO-AOS local manifestations of the pathological process most pronounced reconstructed moderate and severe forms of disease, increasing the number of relapses.

2. The period of convalescence in patients with medium to severe RAS saved local and systemic imbalance of LPO-AOS, indicating the severity of the clinical course and exposure to extreme risk of relapse.

3. The high level of activity of LPO in remission is an important diagnostic sign, indicating the necessity of anti-treatment, and whether to include antioxidant therapy in the complex treatment.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-63-65>

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## The program of cochlear implantation in children with profound hearing loss in the republic of Uzbekistan («Uzbek model»)

**Abstract:** The «Uzbek model» of cochlear implantation, developed and implemented at the Republic specialized scientific research medical center for pediatrics of the Ministry of Healthcare of the Republic of Uzbekistan, showed high efficiency of hearing and speech rehabilitation in children with profound hearing loss and deafness, expressed reduction of the indicator of hearing disability in Uzbekistan, increase of the quality of life and integration of the children of the given cohort in the process of studying and society.

**Keywords:** hearing disorder, cochlear implantation in children, «Uzbek model», efficiency of treatment.

According to the data of the World Health Organization (WHO), hearing loss, in worldwide scale, is one of the six leading factors deteriorating the quality of life. 360 million people suffer from hearing function disorder, which forms 5,3% of the population of the world, out of which, 328 million are adults and 32 million are children (WHO, 2012). Among patients with hearing disorder, the hearing loss in 80% is determined by the damage of sound-perceiving apparatus. Out of every 1000 newborns, one is born with sensorineural hearing loss of 3–4 degree. WHO stated that by 2020, the number of people with hearing disorder would increase by not less than 30% [1–3].

30 years ago, the diagnosis of «Deafness» was nearly a verdict and, today, provided early diagnosis with further cochlear implantation and rehabilitation measures, it is a quite solvable problem.

Cochlear implantation is a highly effective means of rehabilitation of children with profound hearing disorders that allows achieving significant results in the pre-lingual period and in people with profound hearing loss occurred at mature age. There are over 450 thousand users of the systems of cochlear implantation in the world today.

Until 2014, only technical means — hearing devices, were used in Uzbekistan for the rehabilitation of children and adults with light and medium degree of hearing loss. Hearing devices transfer only signals allowing hearing to some degree, and are not efficient in the rehabilitation of the patients with profound hearing loss or deafness. In this respect, patients with this pathology had to go to other countries for the operation of cochlear implantation, which required a lot of expenses. This, in turn, also didn't solve the problem com-

pletely, because, factually, post-operative rehabilitation of implanted children was not conducted, and, even if it was conducted, it was not done fully and was done on non-system basis.

Due to the care of the state about the health of the children with hearing loss and deafness, it became possible to conduct operations of cochlear operation from 2014 in Uzbekistan.

Within the frame of the state program «Year of a healthy child» (2014), it was planned to perform 300 operations of cochlear implantation in 2014–2016 with the use of the most advanced hearing implants. To conduct these operations, the government allocates annually around 7 billion soms for the children up to 5 years old, and for the children above 5 years old, the mechanisms of soft loan on the acquisition of cochlear implant were defined.

To realize the state program at the Republic specialized scientific research medical center for pediatrics of the Ministry of Healthcare of the Republic of Uzbekistan, «the department for the inborn and acquired ENT diseases», which is an educational-methodical base for prevention and treatment of ENT diseases in children, was established.

The department is equipped with advanced, world standard, highly technologic equipment by the state: diagnostic audiologic complex that includes 3 «neurosoft» devices performing expanded diagnostics of the hearing; 16 screening devices «neurosoft» for early detection of hearing pathology in newborns, two tympanometers «interacoustics» (Denmark), operational complex — 2 operational microscopes, 2 inspection microscopes (Germany), operational stand system for the conduct of endoscopic operations, AIDA system for recording and demonstration during master classes, set of micro-surgical tools for minimally invasive interferences in middle ear and inner ear (Germany), mobile endo-video system (Germany), diagnostic inspection equipment — 2 ENT workstations with video-endoscopic devices (Germany and South Korea); computer vestibulometer (Denmark).

For effective realization of the program on cochlear implantation, the Order № 20 as of December 9, 2014 of the Ministry of healthcare was published and the PROVISION about cochlear implantation as of January 8, 2015 was approved, which is registered under № 2648 (chapter 1, part 12) in the Ministry of Justice of the Republic of Uzbekistan.

At the RSSRMC for Pediatrics, all stages of the system of cochlear implantation are implemented:

1<sup>st</sup> stage — selection of children for cochlear implantation. This stage is the most responsible stage, where the degree of hearing disorder based on clinical-audiologic and surdo-pedagogic methods is defined. For this purpose, the department is equipped with modern treatment-diagnostic equipment, which allows performing the 1<sup>st</sup> stage of cochlear implantation in accordance with world standard.

2<sup>nd</sup> stage is the main stage, at which, the operation on the installation of cochlear implant is conducted. Operations are performed by local surgeons together with experienced specialists from the leading clinics and centers of the world. A group of Uzbek surgeons performing this operation was prepared at the leading clinics and centers during the training period of two years.

3<sup>rd</sup> stage — post-operative rehabilitation of implanted children. This is the most difficult stage, where the child is taught sounds and speech skills are developed. Surdo-pedagogical teaching of children at the RSSRMC for Pediatrics and in the regions was associated. Specialists, surdo-pedagogues and parents of the operated children take active part in this process. Significant work is done with the parents in respect of further care and classes with their children, which is one of the most important chains of post-operative reha-

bilitation for proper integration of the children in the future general education process and in the society in the whole.

For the effective implementation of all stages, a big organizational-methodical and scientific research work is done at the Center. According to the program of the rehabilitation of children with hearing loss and deafness in the republic, audio-screening in all regions of the republic is performed under the guidance of the RSSRMC for Pediatrics for the purpose of early detection of hearing disorders. Neuroaudioscreening devices «Neurosoft» were given by the Center for pediatrics to all perinatal centers, branches of RSSRMC for obstetrics and gynecology as well as regional children multi-profile medical centers. In 2015, neuroaudioscreening allowed detecting hearing disorder in 78 children from birth, which was 0,2% of newborns, who underwent screening. 2 children aged 12 months undergone cochlear implantation operation, others are at preparatory stage for cochlear implantation operation.

For the effective rehabilitation, a methodical base with the development of a set of documents for the specialists of all levels and, which is very important, for parents, was created at the Center. There is an opportunity for free technical maintenance of implants during 1 year post operation at the Center. For the effective integration of children in the society, a parent committee was created at the Center and conditions for the communication of parents and implanted children are ensured.

In 2015, the RSSRMC for Pediatrics received an innovative grant within which, researches on the implementation of new highly sensitive tests for hearing study, development of working program and a set of educational material in the form of books, discs for teachers, children and parents in Uzbek language are performed.

For the effective implementation of rehabilitation of children with hearing loss and deafness in the republic, the specialists of the RSSRMC for Pediatrics have performed and perform master-classes on all stages of realization. The training of neonatologists, ENT doctors and general practice doctors on audioscreening and management of patients with profound hearing loss and deafness; surdo-pedagogues on rehabilitation in the system of cochlear implantation was conducted in all regions of the republic. The specialists of the Center are trained and serve internship at the leading clinics and centers of the world: surgeons in France, Slovenia, Austria, Germany, Russia; audiologists — in Russia, Lithuania; surdo-pedagogues — in Austria, Russia, Kazakhstan.

In 2014–2015, cochlear implantation was conducted on 200 children at the RSSRMC for Pediatrics. According to the state budget, the operations were conducted together with the leading surgeons of Russia, Ukraine, Lithuania, Turkey, Italy, Austria and Slovakia. Currently, operations are conducted by Uzbek surgeons on their own.

The monitoring showed that as result of post-operative rehabilitation, all children hear fully and distinguish sounds; over 90% of children started speaking and continue learning oral speech due to the system-based work of surdo-pedagogues.

«Uzbek model» of cochlear implantation developed and implemented by us has own peculiarities and differences from foreign analogues:

1. A unified center for effective realization of all stages of the system of cochlear implantation and rehabilitation (selection and screening, surgical stage, medical and surdo-pedagogical rehabilitation) was created.

2. The conduct of neuroaudioscreening from birth was organized in all regions of the republic for the purpose of early detection of hearing disorders.



3. A commission of the Ministry of healthcare on selection of candidates for cochlear implantation was created.

4. A system of individual audiologic and surdo-pedagogical monitoring of implanted children is organized.

5. A set of documents and information materials on rehabilitation of implanted children is developed for parents for further activities in the family.

6. Work with parents and guardians of the patients is performed in order to establish social partnership and consolidate individual responsibility.

7. All-round consultation and methodical help is provided in the regions of the republic through the unified center of cochlear implantation.

8. Cooperation with all world centers for cochlear implantation is established in order to apply and implement latest world achievements in the sphere of rehabilitation of children with hearing disorders.

The program of cochlear implantation in children with profound hearing loss and deafness and results obtained over a short

period (2 years) received high evaluation and are recognized in terms of their uniqueness and efficiency as «Uzbek model» by the specialists from leading clinics and centers of the world.

Thus, at the RSSRMC for Pediatrics, a program on cochlear implantation in children with profound hearing loss and deafness conforming to the world standards, herewith, beneficially different from the programs in other countries in terms of complex and stage-by-stage approach in rehabilitation, is developed and successfully implemented. The complexity of the program lies in the fact that it includes and monitors all stages of cochlear implantation and rehabilitation of children with profound hearing loss and deafness. All this determined high efficiency of hearing and speech rehabilitation in children with profound hearing loss and deafness, expressed reduction of the indicator of hearing disability in Uzbekistan, increase of the quality of life and integration of the children of the given cohort in the process of studying and society.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-65-70>

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## Animal models of peritonitis

**Abstract:** Understanding the role of pathogens and endotoxin in peritonitis and its complications may improve accuracy of diagnosis and development of therapeutic options. The etiology of peritonitis is multifactorial and affects cardiovascular, immunological and endocrine systems of the human body. Animal models are the essential contributor in the evaluation of efficacy and safety of potential therapeutic agents. However, their physiological limitations often restrict their usefulness and cause barriers to translate study results into clinical practice. Careful differentiation of models can help study different aspects of the disease. Evidence-based information could potentially contribute to the interpretation of results of animal studies, which can be successfully used in clinical trials.

**Keywords:** peritonitis, spontaneous bacterial peritonitis (SBP), infections, sepsis, immune system, lipopolysaccharide (LPS), endotoxins, zymosan, inflammation, Toll-like receptor 4 (TLR4), Tumour Necrosis Factor alpha (TNF- $\alpha$ ), Interleukin, Polymorphonuclear Leukocytes (PMNs), macrophages, cytokines, cecal ligation and puncture (CLP).

### Introduction

Intra-abdominal infections remain a major challenge in clinical practice and represent a leading cause of morbidity and mortality. Intra-abdominal infections represent a wide variety of pathological conditions that involve lesions of all the intra-abdominal organs. The most common cause of peritoneal infections is contamination of the peritoneal cavity by the loss of integrity of endogenous gastrointestinal microflora, which results in secondary peritonitis. Primary peritonitis or spontaneous bacterial peritonitis is less common and generally happens in the occurrence of ascites without an evident source of infection.

Spontaneous bacterial peritonitis (SBP) is an infection of the peritoneal layer of the abdomen caused by bacteria that have no known cause. Spontaneous peritonitis is usually a complication of liver disease, such as cirrhosis. Advanced cirrhosis causes

a large extent of fluid build-up in the abdominal cavity (ascites) [40]. Ascites is predisposed to bacterial infection. SBP diagnosis is based on testing of the ascitic fluid obtained by paracentesis. Polymorphonuclear (PMN) cell count in the ascitic fluid is important for the diagnosis and management of spontaneous bacterial peritonitis (SBP). In more recent Prospective studies reported inpatient non-infection-related mortality rates have still been quite high at 20% to 40%.

The intestinal microflora and bacterial translocation (BT) are considered to be significant factors in the pathogenesis of SBP. The translocation of bacteria from the intestine to mesenteric lymph nodes occurs normally. When this physiological occurrence of BT increases in frequency or severity it leads on to bacteremia and following colonization of ascitic fluid. Additionally, invasive procedures can cause hospital-acquired SBP. *Escherichia coli*, *Klebsiella*

pneumonia, and streptococci are the widespread microorganisms being the most frequent isolated microorganisms. The most common pathogen organisms associated with secondary peritonitis were Enterococcus species, Candida species, and Staphylococcus epidermidis, followed by E. coli, Enterobacter species, B. fragilis, and Pseudomonas species [1].

A contamination may appear during peritoneal dialysis due to unclean surroundings, poor hygiene or contaminated equipment. Peritonitis also may be caused by the complication of gastrointestinal surgery, using the nourishing tubes or by a procedure of fluid withdrawal from the abdomen (paracentesis). A ruptured appendix, stomach ulcer or intestine perforation may trigger bacteria leakage to the peritoneum. Injury or trauma may also lead to peritonitis by spreading bacteria or chemicals from other organs of the body to allocate to the peritoneum.

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Animal models play a crucial role in creating clinical changes for studying pathogenesis and initial assessment of prospective therapeutic agents. Experimental animal models have high fundamental adaptability, differences within animal species and are also not entirely understood. The determined advantages of testing treatments in experimental animal studies have rarely been transformed into human clinical trials. This review summarizes the most common animal peritonitis animal models and explains animals study difference and limitations, which affect the process of turning experimental treatment into clinical trials.

### Discussion

Several types of animal models of peritonitis are currently used to study the cause of bacterial peritonitis and investigate the molecular changes in the body. The purpose of this review is to review common animal models of infected peritonitis, also determine additional aspects, which need to be further designed.

Animal models of peritonitis can be divided into three categories: exogenously administered toxins (lipopolysaccharide (LPS), endotoxins or zymosan); administration of an exogenous viable pathogen (bacteria); alteration of the animal's endogenous protective barrier (intestinal permeability and bacterial translocation) [21, 23]. All these models have advantages of using as potential experimental models to help study mechanisms as well as new treatments for peritonitis. Nonetheless, when reflecting the translation of ani-

mal models to the development of effective therapeutics approaches, there are many examples of limitations and inconsistencies.

While conducting pre-clinical studies it would be the optimal methodology when using the model that closely enough imitates the progression of human disease. Each model has its own tactic to study disease, however, it is still in the stage of development of the design animal model which perfectly mimics the disease.

### Bacterial endotoxin and zymosan

Gram-negative bacteria and their endotoxins may be a trigger factor in many serious diseases. Overwhelming innate immune responses to systemic inflammation contribute to the clinical manifestation of sepsis and septic shock. Systemic infections (septicemias) caused by invasive Gram-negative bacteria are the basis of endotoxin exposure. Endotoxin-induced acute peritonitis showed the kinetics of intraperitoneal LPS resorption and its steadfast translocation into the vascular compartment [3; 4].

Exposure to endotoxin induces a systemic inflammatory response that engages immune cells, blood vessels, and molecular mediator. *Acute inflammation* is the early response of the body to destructive inducements and is accomplished by the boosted extrapolation of leukocytes (particularly granulocytes) and plasma into the injured tissues. Clinical signs of inflammation are fever, increased heart and respiratory rates, and other systemic symptoms. *Chronic inflammation* causes change cell type at the place of inflammation, such as mononuclear cells (lymphocytes, monocytes, and macrophages).

Endotoxins are complex lipopolysaccharides (LPS), which consist of a hydrophobic domain as lipid A, of a non-repetitive oligosaccharide, and a distal polysaccharide termed O-antigen. Lipid A is a glucosamine-based phospholipid that builds up the outer monolayer of the outer membranes of most Gram-negative bacteria [47, 52].

Lipopolysaccharides typically consist of a hydrophobic domain known as lipid A (or endotoxin), a non-repeating "core" oligosaccharide, and a distal polysaccharide (or O-antigen). Lipid A (endotoxin), the hydrophobic anchor of lipopolysaccharide (LPS), is a glucosamine-based phospholipid that makes up the outer monolayer of the outer membranes of most Gram-negative bacteria. Lipopolysaccharide (LPS) is the ligand of Toll-like receptor 4 (TLR4), which plays a crucial role in the early native immune reaction to attacking pathogens by recognizing microorganism [1].

Latest studies propose that the administration of LPS produces and releases of several cytokines, such as tumour necrosis factor alpha (TNF- $\alpha$ ), interleukin 1 (IL-1), IL-6, and gamma interferon [1; 52]. Attachment of LPS to TLR4 leads to the activation of NF- $\kappa$ B through the enrolment and activation of MyD88, IL-1R kinase (IRAK), TNFR associated factor 6 (TRAF-6), as well as NADPH oxidase [1; 27; 32]. NF- $\kappa$ B is crucial element in the transcription of genes, which is associated with innate immunity and inflammation reactions [2; 12; 14]. The massive production of inflammatory cytokines causes systemic inflammatory response syndrome (SIRS), which is the main cause of death in septic patients [42; 26; 27].

The animal model with LPS can stipulate important insights into mechanisms of the host response to pathogens. Inoculation of animals with pure or mixed bacterial flora has been a common tool for studying sepsis mechanisms. Nevertheless, high doses of bacteria frequently cause intoxication with endotoxins rather than mimic the infection [8; 12].

Zymosan is prepared from the cell wall of *Saccharomyces cerevisiae* and consists of protein-carbohydrate complexes. It is often used to induce experimental sterile inflammation, including proinflammatory cytokines, protein phosphorylation and inositol phosphate formation.

Peritoneal injection of zymosan A induces local and systemic inflammation with 58% mortality [35]. Recent studies showed that zymosan induces double-hit model with raised systemic proinflammatory and local peritoneal cytokine response (interleukin [IL]-1, tumor necrosis factor, IL-6) and moderately increased anti-inflammatory cytokines (IL-10, transforming growth factor) [7; 8; 32].

A lower dose of zymosan causes transient (temporary) inflammation characterized by neutrophil clearance followed by infiltration of resolution-phase macrophages, whereas a higher dose of zymosan induces more destructive and prolonged inflammation. It was shown, that a low dose of 0.1 mg Zymosan, triggers a mild and temporary inflammation leading to full recovery, and a higher dose of 10 mg, which causes a more progressive and prolonged reaction leading to systemic inflammation. Experiments revealed, in acute zymosan-induced inflammation, polymorphonuclear leukocytes (PMNs) elevated in 8–24 hours and cleared thereafter. The level of macrophages had risen at 72 hours and remained in the peritoneum for up to 3 weeks after induction. Whereas, high-dose zymosan caused elevation of PMN and macrophages in 72 hours. Innate immune is illustrated by the early influx of polymorphonuclear leukocytes followed by monocyte-derived macrophages, with further returning injured tissues to normal physiological state.

Recent studies, presented correlation between plasma and peritoneal inflammatory mediators in patients with secondary peritonitis. Levels of IL-1, TNF $\alpha$ , IL-6, IL-10 and IFN $\gamma$  were detected at high concentrations in the peritoneal fluid of the patients with peritonitis [37]. The higher plasma cytokines is occurred in patients with bacteremia, where monocytes involvement can be affected. Only 16% of patients were positive for blood culture in the first 48 hours [41]. Results confirmed the fact that both pro- and anti-inflammatory mediators were involved concurrently in the peritoneum of patients with peritonitis [16].

#### **Chemical Peritonitis- Brewer thioglycollate method**

Macrophages are one of the first immune cells to respond to infection or injury of the host tissue. Macrophages initiate a pro-inflammatory reaction, apoptosis, and phagocytosis [44]. Sterile inflammation is a tissue response to cellular damage in the absence of pathogens. Tissue-resident macrophages produce cytokines and chemokines that activate neutrophils and other macrophages. Monocytes and macrophages are the secondary line of inflammatory cells after neutrophils. Neutrophils have a short lifetime due to apoptosis [26; 48], whereas macrophages have longer lifetime and are an essential component in the clearance of neutrophils through phagocytosis. Apart from to leukocyte enrolment, another early immune response includes of secretion of the inflammatory mediators, such as interleukin (IL)-1, IL-6, and tumor necrosis factor (TNF)- $\alpha$ , and anti-inflammatory mediators such as IL-10 [21; 22].

Thioglycollate (TG) stimulated peritonitis is a suitable model, which stimulate most clinical features of inflammation, inflammatory mediator production and leukocyte accumulation. Intraperitoneal injections of thioglycollate in mice induce rapid and abundant enrolment of neutrophils into peritoneum without stimulating degranulation [36; 6]. Neutrophils are afterward gradually cleared from the peritoneal cavity by apoptosis and are replaced by a population of monocytes, macrophages and leukocytes.

P. C. J. Leijh etc revealed, that increased number of peritoneal exudate macrophages was present at 4-day post injection. TG-elicited cells were double sized compare to resident macrophages. Whereas, the size and number of cells were back normal on 5-day post injection [22]. The high recruitment of granulocytes was observed at the 1-day post TG injection.

Acute TG induced peritonitis, is an optimal source for simulating cardiovascular M $\phi$  responses, M $\phi$  recruitment, M $\phi$  apoptosis [48], and cytokine production. Early stage of inflammatory diseases, with mimicking activation and involvement of inflammatory mediators are essential in understanding leukocytes recruitment to inflamed tissue. It has been suggested that the optimal period of therapeutic intervention with potential enhancement of clinical outcome is expected to be in the early stage of inflammation [28].

#### **Cecal ligation and puncture.**

Cecal ligation and puncture (CLP) characterize a peritonitis model with clinical features of polymicrobial infection similar to peritonitis in humans [13]. Bacterial invasion of the peritoneal cavity due to intestinal leakage is the most common cause of septic peritonitis. In comparison to other animal models of polymicrobial septic peritonitis, CLP can be initiated in any mouse strain of different age and sex. It is a comparatively easy and low-cost surgical procedure. Septic peritonitis is caused by vast infiltration of neutrophils and macrophages into the peritoneum. The CLP model imitates the human diseases of ruptured appendicitis or perforated diverticulitis [14]. This model produces a bowel perforation with leakage of fecal contents into the peritoneum, which creates a mixed infection and causes an inflammatory reaction with tissue destruction, tissue necrosis, and systemic toxicity.

CLP model mimics the hemodynamic and metabolic phases of human sepsis. However, the load of fecal material that leaks from the ligated caecum is problematic to control for different studies. Plasma IL-6 levels have been known as a potential marker of disease severity and mortality indicator. Elevation of IL-6 levels was associated with mortality, with no evidence of a correlation between early and late death.

Schietroma, M etc presented acute response, immunologic status, and bacterial translocation from laparoscopic surgery. The cecum contains a high concentration of gram-negative and gram-positive bacteria. After planting the punctured cecum into the peritoneum, feces content translocate into the abdomen creating a severe peritonitis. Depending on conditions, CLP causes a local infection followed by a systemic bacteremia [43].

The pro-inflammatory period in early sepsis is associated with elevation cytokines and chemokines in the plasma, such as IL-6 and macrophage inflammatory protein 1-alpha (MIP-1 $\alpha$ ) [10]. Inflammatory mediators promote leukocyte transmigration to sites of inflammation. This model causes early death (in 48 hours), which can be explained by overstressed inflammatory reaction, hypovolemic shock, and ineffective tissue perfusion. CLP is considered a clinically applicable model of sepsis. It imitates most relevant clinical features of the disease and is associated with an early hyper-inflammatory following by hypo-inflammatory reactions. Innate immune effector cells such as macrophage produce anti-inflammatory cytokine, IL-10 and Th2 cytokine, IL-4 [30; 53]. Slow change from a pro-inflammatory to an anti-inflammatory state might affect the septic patient to develop nosocomial infections, which can lead to further organ compromise, organ failure, and death. Many researchers support the fact that sepsis causes immune suppression. This model appears to prolong survival of animals, which might be compromised with inadequately repossess of necrotic cecum and development of an abscess. Healthy mice are able to trigger an effective immune reaction in CLP model with an elevation of cytokine levels in 2–6 h and an initial peritoneal neutrophil invasion, causing a clearance of the systemic infection in 2–3 days.

#### **Bacterial peritonitis (BP)**

Acute bacterial peritonitis is the development of a bacterial infection in the peritoneal cavity causing peritonitis. 60% of the BP incidents are caused by **enteric Gram-negative bacilli- *Escherichia***

*coli* and *Klebsiella spp.*, which can be found in up to 60% of the cases [34; 9]. Contrary to innovations in surgery and antimicrobial therapy, the mortality rates of peritonitis vary from 30% to 50% [15,49]. A serious complication of peritonitis includes systemic inflammation and sepsis with a **fatality rate** more than 80%. Retrospectively analyzes of patients with severe intra-abdominal infection revealed, predominant bacteria isolated from pus flora were *Escherichia coli* (*E. coli*), *Staphylococcus aureus* (*S. aureus*), *Klebsiella pneumoniae* (*K. pneumoniae*), *Enterococcus faecalis* and *Pseudomonas aeruginosa* (*P. aeruginosa*). [19; 24; 31]

*Escherichia coli* (*E. coli*) is one of the most common organisms that cause gram-negative peritonitis and is associated with a high probability of mortality and technique failure. Multiple bacteria can cause peritoneal infection, but *Escherichia coli* is the most commonly isolated in peritonitis (60%) [29]. Host, as well as bacterial factors, may be involved in the development of the bacterial peritonitis. Pathogen-associated molecule patterns with the involvement of lipopolysaccharide and lipid A, lipoteichoic acid and peptidoglycan may cause a systemic inflammatory response [46; 50].

LPS is a main immunogenic component of *E. coli* can stimulate activation of inflammatory responses to these pathogens. LPS is recognized by Toll-like receptor 4, CD14 and MD-2 on host innate immune cells and can activate the transcription factor NF $\kappa$ B, which is an important key in controlling the immune response to infection by production of pro-inflammatory cytokines that initiate the adaptive immune response [38, 39]. However, studies show that infecting peritoneal cavity with *E. coli* does not activate a cytokine host response [5, 45]. *E. coli* has pathogenic features to the host mostly through endotoxin, causing systemic septic reaction and, initially, the local response of the peritoneal cavity [18]. According to some authors, low plasma IFN $\gamma$  is associated with increased mortality [30, 51] while others reported that prophylactic inhibition of IFN $\gamma$  improves survival [20; 53].

Postoperative patients have completely special host defense mechanisms in comparison to patients with peritonitis and post-trauma [11]. Mouse peritonitis models are important to imitate particular processes of disease but can't manipulate all spectrums of physiological variations that appear in humans. Clinical data confirmed that IL-1, TNF $\alpha$ , IL-6, IL-10, and IFN $\gamma$  appear at high concentrations in the peritoneal fluid of patients with peritonitis. Florence Riché etc conducted comparable laboratory analysis of peritoneal fluids of patients with peritonitis revealed higher plasma levels of all cytokines whereas peritoneal fluid showed no elevation of cytokines [25; 37].

### Conclusions

Animal models have limitations to imitate the complexity of human disease, pathophysiology, and progression. The question "how effectively translate scientific findings into clinical practice" remains unanswered. Experimental discoveries are part of the basic research, where pre-clinical animal studies can be translated into human clinical trials. Animal models still remain as essential contributor in the evaluation of efficacy and safety of new therapeutic agents. However, their physiological limitations often restrict their usefulness. In spite of significant success achieved through pre-clinical studies, almost 85% of early clinical trials for new therapeutic drugs fail.

The failure of translation of animal studies to humans might be due to inaccurate methodology and differences of experimental models to precisely imitate the physiological features of human disease.

Animal models of peritonitis are not well established and cannot completely recreate the human disease. Lack of evidence, different organism, and not accurate modeling can cause inconsistencies in results. Careful differentiation of models can help study different aspects of the disease. Evidence-based information could potentially contribute to the interpretation of results of animal studies, which can eventually be used in clinical trials.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-70-73>

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## Staged surgery of deep midline tumors. Comparative analysis and literature review

**Abstract:** This article analyzes the results of clinical observation of 255 patients with deep midline tumors accompanied by secondary obstructive hydrocephalus. Of them 75 (29.41%) patients underwent endoscopic third ventriculostomy (ETV) as a first step, followed a week later by tumor resection as a second step of treatment. In 85 (33.33%) patients ETV and tumor resection was performed simultaneously, and 95 (37.25%) patients tumor resection with ventriculocisternostomy by Torkildsen's method was done. In ETV group condition of the patients is significantly improved after adequate correction of CSF circulation. All patients complained of headaches, symptoms of raised intracranial pressure or visual disturbances and vomiting or cerebellar ataxia. Complete tumor removal was achieved in 190 cases and partial removal or biopsy in the remaining 65. ETV was successful in 177 (87.50%) cases but failed in one. Two patients experienced intraoperative transitory bradycardia. Two postoperative complications occurred (one meningitis and one CSF leak). No death related to procedures occurred. Hospital stay ranged from 9 to 21 days (mean, 12.71 days). Follow up range was 4 months to 10 months.

**Keywords:** posterior fossa tumors, third ventricular tumors, ETV, staged surgery.

The posterior cranial fossa considered not only the largest and deepest fossa, it is the fossa that containing most complex anatomical structures. All the vital pathways regulating consciousness, motor, sensory and balance functions. Only 2 of the 12 pairs of cranial nerves are located entirely outside of posterior cranial fossa, the 10 other pairs have a segment within posterior fossa [1].

The surgery of posterior cranial fossa tumors are still remaining one of the challenging cases of practical neurosurgery [1; 2; 5;

13]. The features of brain tumors associated with hydrocephalus, requires the solution of two important issues. Firstly, elimination of a progression of the hydrocephalic syndrome; secondly, resection of brain tumor itself [2–4]. Conventional methods of surgical correction of hydrocephalic syndrome are ventriculocisternostomy (VCS) by Torkildsen, ventriculoperitoneal shunting, ventriculoatriostomy have a number of contraindications and are traumatic in some point. Most these interventions often contribute to the development of

several complications, such as infection and occlusion of shunts, particularly in decompensated patients [1; 3; 5; 9; 10].

An alternative way of solving this problem is endoscopic ventriculocisternostomy of third ventricle (ETV), which creates new CSF pathway provides drainage of excessive CSF to subarachnoidal space via cisterns. [2; 5; 11; 12]. This surgery is should be performed by experienced neurosurgeons, it should be noted that removing of tumor has to be at the second stage after eliminating the hydrocephalus. However, if the patient's condition, cerebral symptoms are relatively compensated, this operations are performed significantly less.

Objective of the research is to make a comparison between results of one and two staged surgery after ETV and ventriculocisternostomy by Torkildsen's method in deep midline brain tumors.

Materials and methods. We have analyzed 255 patients, with midline brain tumors associated hydrocephalus in Republican Scientific Center of Neurosurgery. Most of our patients admitted to hospital in a severe complicated stage of disease. Age group ranged from 1,5 to 50 years which is shown in Table № 1.

Table 1.

Age group	Amount (%)	Age group	Amount (%)
1,5 -5y.	10 (3,92%)	20-25	20 (7,84%)
5 -10	53 (20,78%)	25-30	25 (9,81%)
10-15	57 (22,35%)	30-35	22 (8,62%)
15-20	43 (16,86%)	35-40	8 (3,15%)
		40-50	17 (6,67%)

What is noticeable, 76,47% of patients were male and only 23,53% were female. It is remarkable that, close location of tumor to the CSF pathways, plays basic role in developing hydrocephalus, rather than size of a tumor. Clinical state of patients evaluated using standard neurological examination. The degree of common cerebral symptoms evaluated due to patients complaints. Ophthalmological examination includes detailed study of structures of eye fundus (arterioles, venules, optic disc). 3 stages of papilledema assessed.

There are direct correlations of stage of papilledema to the extent of ventricular dilation on MRI. The results of treatment assessed by dynamic changes in clinical presentation, regress of hydrocephalic syndrome, positive changes in eye fundus, and data of neurovisualisation.

ETV was performed using neuroendoscopic complex of «Aesculap» (Germany) with the set of microneurosurgical instruments (Fig.1).



Figure 1. Neuroendoscopic complex of «Aesculap»

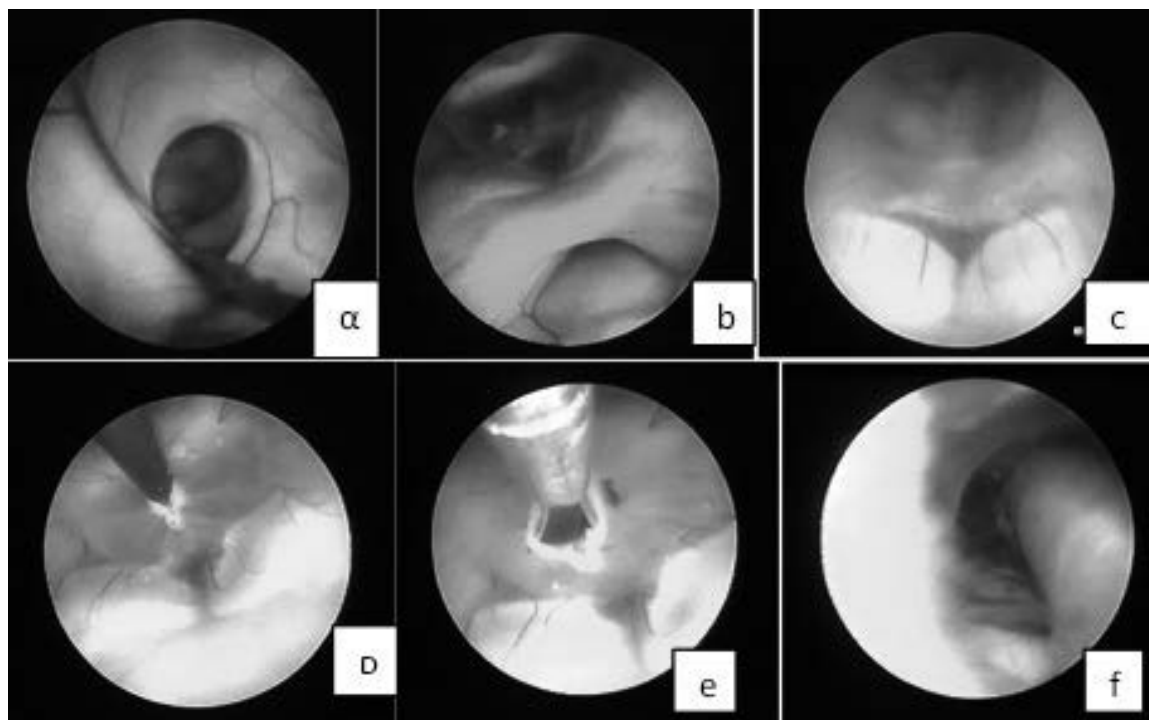


Figure 2. Stages of ETV of patient with severe hydrocephalus: a) view from anterior horn of right lateral ventricle. (foramen of Monroe, tela chorioida, septal vein) b) a view of third ventricle through foramen of Monroe. (mammillary bodies and premammillary membrane is visible). c) before fenestration (the membrane distorted and fixed to the wall of basilar artery.). d, e) preliminary coagulation of membrane. f) ETV is performed, basilar artery is visible within interpeduncular cistern

In figure 2 on the right side, we can see the fenestration process. The first anatomic landmark that we should evaluate is foramen of Monroe (Fig.2., a). Perforation was done using Fogarti's catheter, passing it through external surgical sheath of endoscope. Considering all detailed MRI visualization of tumor localization the approach was planned. In case of foramen of Monroe occlusion by the tumors located at the anterior or middle part of the 3<sup>rd</sup> ventricle ETV was not feasible, therefore, planned ventriculocisternostomy by Torkildsen. A direct indication for ETV was enough space into 3<sup>rd</sup> ventricle. (usually occlusion caused by aqueductal stenosis or mass lesions in posterior cranial fossa).

All 255 patients were divided into 3 group regarding method of surgery:

1<sup>st</sup> group — patients who underwent surgery resection of tumor along with ventriculocisternostomy by Torkildsen; 2<sup>nd</sup> group underwent surgery simultaneously ETV with tumor resection; 3<sup>rd</sup> group who underwent 2 staged surgery –ETV followed by tumor removal after 5–35 days, after regression of symptoms of hydrocephalus. The

criteria for appointing second stage of treatment were elimination of common cerebral symptoms and regress of papilledema. Papilledema was evaluated according to Tron E. D. gradation I to V stage of papilledema. Statistical analysis was done using Students criteria. Difference between 2 groups considered as trustworthy in case statistical significance was not less than 95% ( $p < 0,05$ ).

**Results and discussion.** Most of (22%) patients were admitted to our clinic in a severe state of disease with symptoms of secondary hydrocephalus. In 52 (20,39%) patients admitted with extremely high risk of brain herniation syndrome with bradycardia severe papilledema complicated with retinal hemorrhage. Most of patients experienced diffuse headaches 245 (96,07%), followed by vertigo 218 (85,49%), and nausea in 227 (89,02%) and vomiting in 192 (75,29%) patients. Ophthalmologically in 95 (37,25%) patients found papilledema of 1<sup>st</sup> degree, in 107 (42,96%) patients 2<sup>nd</sup> degree, in 53 (20,78%) patients 3<sup>rd</sup> degree of papilledema. In 90 (76,59%) patients detected bradycardia. All the the patients by CT and MRI revealed signs of hydrocephalus- ventriculomegaly with periventricular edema.

Table 2. – Distribution of patients by the site and cause of occlusion

Localization of brain tumors	Site of occlusion					
	3 <sup>rd</sup> ventricle, cerebral aqueduct		4 <sup>th</sup> ventricle, cerebellar hemispheres		Overall	
	Abs	%	Abs	%	Abs	%
Pineal and quadrigeminal plate	15	28,30	38	71,70	53	20,78
Posterior fossa tumors	25	12,38	177	87,62	202	79,22
Overall	40	15,68	215	84,31	255	100

The site of occlusion was one of the indications for surgery in brain tumors with secondary hydrocephalus, table1 depicts distribution of patients regarding site of occlusive process thereby chosen surgical procedure. All patients of 3<sup>rd</sup> group underwent ETV without any complications and postoperatively clearly seen regressed signs of hydrocephalus. Significantly decreased headaches in 55 patients (73,33%) and local occipital pains in 20patients (26,66%). Postoperative CT and MRI at the 2–3<sup>rd</sup> found decreased dilation of ven-

tricles and no periventricular edema 62 (82,66%) clear opening of subarachnoid spaces in 35 (46,66%) “Flow-void” phenomenon at the anterior third ventricular region.

85 patients underwent (33,33%) ETV with simultaneous tumor removal, 95patients (37,25%) ventriculocisternostomy by Torkildsen. The analysis of results of surgical treatment (table.2) considering morbidity, improving or deterioration state of patients let us to make a clear comparison of outcome of surgeries.

Table 3. – Outcome of surgical intervention first time operated patients using various methods of CSF diversion with tumor removal

Method of operation	Improved		Deteriorated		Morbidity		Overall	
	Abs	%	Abs	%	Abs	%	Abs	%
VCS by Torkildsen	38	40,00	35	36,84	22	23,16	95	37,25
Simultaneous ETV	52	61,18**	20	23,53**	13	15,29**	85	33,33*
2 staged ETV	55	73,34***	13	17,33***	7	9,33***	75	29,41*
Overall	145	56,86	68	26,67	42	16,47	255	100

Note: Credibility among groups assigned with asterisk: \* –  $P < 0,05$ ; \*\* –  $P < 0,01$ ; \*\*\* –  $P < 0,001$ .

If when ETV was performed simultaneously 52 patients from 85 (61,18%) experienced significant improvement, 20 patients 23,53% experienced deterioration and 13 (15,29%) exitus lethalis, while 2 staged operation gave 73,34% of improvement, 13 (17,33%) patients deteriorated, morbidity in 7 (9,33%) from 75 operated patients. In group of operated patients with ventriculocisternostomy by Torkildsen (95 patients) 38 (40,00%) patients experienced good outcome and 35 (36,84%) patients with deterioration, and rate of morbidity — 22 (23,16%).

In conclusion, the study of 3 group of patients whom performed 3 method of surgery, showed advantage of endoscopic minimally invasive intervention, preserving anatomical structures in contrast to

open surgery. Comparative study of one and two staged ETV procedures showed the advantage of two staged surgery, more smooth postoperative course of rehabilitation and much easier surgery when hydrocephalic symptoms are eliminated.

#### Conclusion.

1. ETV considered as minimally invasive highly informative method of diagnostics and treatment helping neurosurgeon to do a surgery much easier.

2. In case of predominant occlusive hydrocephalus the method of choice is staged operation using ETV as a first stage and after stabilization of general state of patient, removing the brain tumor gives better outcome.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-73-75>

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## Impact of diabetes mellitus compensation on pregnancy outcomes

**Abstract:** 40 pregnant women with type 1 DM were recruited for the study and divided into two groups by terms of DM compensation. Pregnancy outcomes significantly improved with pregnancy planning and adequate and timely self-control over glycemia, and regular visits to a physician for examination.

**Keywords:** diabetes mellitus, pregnancy, compensation, complication.

High percent of complications both in pregnancy and delivery taken into account [3, 11], management of pregnant women with diabetes mellitus (DM) ever was and still is a challenging task. Leading experts in the sphere believe that among the most important issues to be determined prior to conception in every patient are the degree of DM compensation, presence and stage of microangiopathies, presence of arterial hypertension, and thyroid pathology as well as changes in lipid metabolism, and presence of anemia [1; 7].

DM compensation prior to conception is the most important issue of all above, since it contributes to reduction in the rate of congenital anomalies, stillbirths, neonatal mortality and premature deliveries. As compared with the patients who get antenatal consultation, incidence of fetal and neonatal mortality and congenital anomalies is four times higher in women who do not get it [2; 3]. Hyperglycemia is a teratogen, and it may result in cardiac defects, anomalies in the central nervous system, such as anencephaly and *spina bifida*, skeletal and urogenital anomalies [4; 11]. Ideally, any pregnancy should be the planned one. A woman should be capable of self-control, and she should have as few diabetic complications as possible. She should be informed that the risk of diabetic complications increases by duration of the disease. 3–4 months before con-

ception ideal DM compensation should be achieved. Changes in the targets of self-control, more frequent decompensation events due to changes in insulin requirements, and potential obstetric complications taken into account, patients who were trained in the “diabetes school” should be trained repeatedly when getting pregnant.

The work was initiated to compare pregnancy outcomes in patients with compensated and decompensated type 1 diabetes mellitus.

### Materials and methods

We recruited 40 pregnant women aged 21 to 28 years with type 1 diabetes mellitus to divide them into two groups by terms of DM compensation. Thus, 20 women referred for medical care after 8 weeks of gestation (late term referral and, consequently, late compensation) were included into the 1<sup>st</sup> group, 20 women referred before conception or under 8 weeks of gestation (early term and, consequently, early carbohydrate metabolism compensation) comprised the 2<sup>nd</sup> group. The disease duration was 2–13 and 1–10 years in the 1<sup>st</sup> and 2<sup>nd</sup> group, respectively.

The fasting glucose and postprandial 1-hour glucose, urinary glucose, HbA1c and lipid profiles were measured during the first visit and subsequently once in 1–3 months. All patients were capable of self-control. 17 of 40 patients (42.5%) had glucometers

to measure the fasting and postprandial glycemia by themselves. According to international recommendations, control over diabetic complications was performed during the first visit and subsequently by trimesters [7]. Concentrations of TTH, free T<sub>4</sub>, Ab-TPO were measured to assess the thyroid status of patients.

Concentrations of  $\alpha$ -fetoprotein and chorionic gonadotropin were measured to control condition of a fetus at early terms; clinical ultrasound, Doppler sonography and cardiotocography were used to assess it at the late terms. Apgar score was used to assess condition of a newborn; glycemia and bilirubinemia were measured. Control over status of obstetrics was performed by specialists from the Tertiary Center of Obstetrics and Gynecology.

### Results

The changes in the HbA1c levels in two groups were as follows: mean levels in the beginning of gestation were respectively  $9.41 \pm 0.4\%$  and  $8.38 \pm 0.36\%$ ; by the end of gestation it was  $7.29 \pm 0.26\%$  ( $p < 0.05$ ) in the 1<sup>st</sup> group and decreased in the 2<sup>nd</sup> one to  $6.56 \pm 0.21\%$  ( $p < 0.05$ ). Changes in lipid profiles of the patients, such as, increase in total cholesterol, triglycerides and LDL, were observed in 6 of 20 patients (30%) of the 1<sup>st</sup> group during the first visit and at the second trimester, the changes during the first visit were found in 4 of 20 patients (20%) of the 2<sup>nd</sup> group. All patients received folic acid, iodine preparations and L-thyroxine, if necessary.

As to diabetic complications, non-proliferative, preproliferative and proliferative retinopathies were registered in 10 (50%), 2 (10%) and 2 (10%) patients in the 1<sup>st</sup> group, respectively. In the 2<sup>nd</sup> group non-proliferative and preproliferative retinopathy was in 9 patients (45%) and 1 patient (5%), respectively. First examination revealed I degree polyneuropathy in 7 (35%) and 6 (30%) patients in the 1<sup>st</sup> and 2<sup>nd</sup> group, respectively; the II degree polyneuropathy was found in 9 (45%) and 5 (25%) patients in the groups, respectively. 5 (25%) patients in the 1<sup>st</sup> group and 2 (10%) patients in the 2<sup>nd</sup> one had nephropathy. Diabetic encephalopathy was observed in 13 (65%) and 7 (35%) patients of the 1<sup>st</sup> and 2<sup>nd</sup> group, respectively. During gestation in patients with the decompensated diabetes mellitus urinary tract infections or chronic pyelonephritis exacerbation ( $n=13$ , 65%), I degree diffuse goiter ( $n=10$ , 50%) and II degree diffuse goiter ( $n=6$ , 30%) occurred. In the group of patients with the compensated diabetes mellitus urinary tract infections or chronic pyelonephritis exacerbation were registered in 7 (35%), 8 (40%) and 5 (25%) patients, respectively.

As to outcomes of pregnancies, there were 2 (10%) therapeutic abortions, 4 (20%) spontaneous abortions, and 12 (70%) deliveries, 8 (66.6%) cesarean sections and 6 (33.4%) vaginal births among them in the 1<sup>st</sup> group. Among complications there were 8 (66.6%) cases of preeclampsia, 3 (15%) premature deliveries and 4 (20%) early amniorrheas; uterine inertia was registered in 3 (15%) women, there were 2 cases (10%) of intrapartum hemorrhage, chronic intrauterine fetal hypotrophy took place in 6 (30%) patients and polyhydramnios in 5 (25%). In this group weight at birth for newborns ranged from 2,880 to 5,000g; there were 6 (30%) newborns with macrosomia, that is, with weight at birth  $\geq 4,500$ g. All babies had a score of 5–7 according to Apgar score. Diabetic fetopathy was found in 2 (16.6%) newborns. On the first day, glycemia was within normal limits in 11 (91.6%); in one (8.3%) newborn it was lower than normal (2.0 mmol/l).

In the 2<sup>nd</sup> group 12 (60%) women perform deliveries at 36–38 weeks of gestation; there were 8 (40%) cesarean sections, two of them (10%) occurred at 34–36 weeks of gestation due to preeclampsia. Among complications there were 3 (15%) cases of preeclampsia, 2 (10%) premature deliveries, 2 (10%) premature

amniorrheas, 3 (15%) cases of uterine inertia; chronic intrauterine fetal hypotrophy and polyhydramnios could be observed in 2 (10%) and 3 (15%) patients. In this group weight at birth for newborns ranged from 2,650 to 4,350g; 6 (15%) newborns at birth weighted  $\geq 4,000$ g. All babies had 5–8 score according to Apgar score. No signs of diabetic fetopathy were registered in newborns by women with the compensated diabetes mellitus.

### Discussion

According to IADPSG recommendations, diabetes should be optimally compensated prior to conception and during pregnancy [7]. But during first trimester prior to appearance of insulin counter-regulatory hormones, nausea and high sensitivity to insulin can increase risk of hypoglycemia. Patients should be informed that their requirement for insulin in the first trimester most likely decrease by 10–20% [2; 6]. It is issue of the night when fasting and continuous glucose utilization by the fetus take place. Women with type 1 diabetes mellitus should snack in the evening and reduce night dose of long-acting insulin before sleep to avoid early morning hypoglycemia [10].

HAPO Study demonstrated that both fasting and postprandial hyperglycemia is risk factors of fetal macrosomia [5]. Strict control of glucose in women with pregestational diabetes (both 1 and 2 type) requires rapid-acting insulin, such as, Lispro insulin prior to meal [12]. Frequent glucose monitoring allows correcting insulin dosage. Keeping blood glucose level normal is a key point in prevention of complications, such as fetal congenital anomalies during the first trimester, macrosomia during the second and third trimesters, as well as neonatal metabolic disorders.

Epidemiological and prospective studies demonstrated that HbA1c levels during 6 months prior to conception and during first trimester correlate with frequency of major fetal anomalies, to name those of nervous system and heart, and with spontaneous abortions [3; 4; 13]. In our study spontaneous miscarriages at early terms of gestation were registered in patients with late compensation of diabetes to be the evidence for inadequate compensation prior to conception and at the beginning of pregnancy.

Pregnant patients with nephropathy are at high risk of complications and rapid progression of kidney disease [9]; that is why these women should know that would better conceive on the early stages of nephropathy with optimal compensation of diabetes mellitus. According to Landon, preeclampsia complicates ~20% of pregnancies in patients with type 1 diabetes mellitus and 95% pregnancies in women with creatinine  $> 1.5$  [8]. Incidence of preeclampsia ranges from 9 to 92%; it is the highest one in patients with severe diabetes course and in those with diabetic nephropathy (proteinuria  $> 300$  mg), renal insufficiency or arterial hypertension. Patients with prolonged type 1 diabetes mellitus, nephropathy or hypertension are at significant risk of preeclampsia complicating pregnancy to result in fetal growth retardation, premature delivery and fetal lung immaturity [2]. In our study high percent of preeclampsia was observed in both groups of patients (40 and 15%, respectively). In addition, premature deliveries and chronic intrauterine fetal hypotrophy took place in the two groups to be the evidence for unfavorable course of diabetes and progression of renal pathology during pregnancy.

Significance of preparation of diabetic patients to conception should be emphasized. In our study there were 8 patients who got pregnant with their diabetes mellitus compensated with regular control of both fasting and postprandial glycemia, and correction of insulin dosage, if necessary. These pregnancies had favorable course; there were no acute variations in blood glucose, progression

of microangiopathies, severe gestoses during second half of pregnancy, threat of miscarriage, signs of intrauterine fetal hypotrophy or macrosomia. Thus, adequate preparation to pregnancy and its favorable course raise the prospect for a diabetic woman to have a full-term pregnancy and deliver a healthy baby. A patient's self-control of carbohydrate metabolism plays a leading role in the process.

#### Conclusions

1. Pregnancy complications could be observed more frequently in patients with late DM compensation: there were 10% of therapeutic abortions, 20% of spontaneous miscarriages, 40% of pre-

eclampsia; premature delivery took place in 20%, 10% of the patients had intrapartum hemorrhage, chronic intrauterine fetal hypotrophy and macrosomia were found in 30% of cases each.

2. Pregnancy outcomes significantly improved with pregnancy planning, and adequate and timely control over glycemia. Thus, there were no abortions or miscarriages in patients with the factors above taken into account; frequency of preeclampsia (15%), premature delivery (10%), chronic intrauterine fetal hypotrophy (20%) and macrosomia (15%) was lower than in the group of patients with the late DM compensation.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-75-77>

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## The basics of local clinical manifestations of superficial bladder cancer

**Abstract:** According to a study The stage of the patients in both groups expressed LIR were observed. Mainly observed mild LIR bladder of 63.7% and 66.7% respectively of the studied groups. In contrast, with T1 stage were pronounced bladder LIR, which in the main group amounted to 73.2% in the control — 81,8%. Therefore, reasonable LIR in the main group was 16.1%, in the control of 36.3%. The results indicate the existence of a relationship between LIR and the tumor stage in the bladder.

**Keywords:** bladder cancer, probiotics, transurethral resection, microflora, relapse.

Treatment of patients with bladder cancer is a difficult and not solved problem. Difficulties due to many factors: late detection of the disease, early emerging complications, frequent recurrence of the tumor and high risk of progression. Despite the fact that chemotherapy drugs and means of immunotherapy are widely used to prevent recurrence after TUR in patients with bladder cancer, many aspects recurrent in programme h plus adjuvant therapy continues to be a matter for discussion and at the present time. Unsolved questions remain about the indications and contraindications to this method, regimes and dosages, as well as methods of preventing unwanted side effects and complications [1; 4; 5].

**Objective:** to Study the severity of local inflammatory reactions in superficial bladder cancer.

**Material and methods:** The object of the study were 167 patients with bladder cancer (BC), the subject of the study — bladder cancer at stage Ta and T1N0M0. Of the total number of surveyed 133 (79,6%) patients had stage BC T1N0M0, and 34 (20.4 per cent) — TaN0M0. The ratio of the frequency of occurrence of BC in men and women was almost 3:1. The age of patients ranged from 27 to 83 years, averaging — 56,3±0.4 years.

In the study of the anamnestic data of 167 patients with BC TA-1N0M0 stage, 52,0% — the duration of the disease was

3 months, from 29.7% to 6 months. and 18.3 per cent — up to 1 year. Being subjective, this figure indicates that there is some effacement of the clinic BC, as evidenced by the presence of a six-month or more history exactly 48% of patients. Depending on the method of tactics of combined treatment BC, patients were divided into 2 study groups. A control group of 80 patients with bladder cancer Ta-1N0M0 stage, treated in the period 2005 to 2013. In this group of patients after traditional preoperative preparation conducted TUR. Then, at 57 (71.2%) of patients in the postoperative period was intravesically installation diluted in 50ml saline drug Doxorubi-

cin in the dose of 50mg. 23 (28,8%) patients after TUR, adjuvant intravesical therapy was conducted.

**Results and discussion:** The study of the severity of local inflammatory reactions (LIR) from the bladder according to the accepted gradations showed that upon admission to the hospital she was typical in all patients and was not specific genders.

Upon further study of the severity of local inflammatory reactions observed that in the majority of cases occurred LIR expressed from the bladder patients BC (table.1).

Table 1. – The distribution of patients according to the severity of BC LIR, n-109

Nº	Graduation LIR	main, n-67	control. n-42	Total
1	Expressed	41 (61,2%)	27 (64,3%)	68 (62,3%)
2	Reasonable	13 (19,4%)	7 (16,7%)	20 (18,3%)
3	Poor	13 (19,4%)	8 (19,0%)	21 (19,2%)

In both groups dominated the number of patients with severe LIR bladder for 61.2 and 64.3%, respectively. In contrast, the proportion of patients with moderate or mild LIR in the studied groups was observed in identical quantities not exceeding 1/3 of the total surveyed population. Overall, the analysis testified to the presence of strong LIR in patients with BC, i. e. 62.3%. This fact indicates the presence of the original parallelism of the inflammatory pro-

cess bladder in the background of a cancer that can be caused by as with concomitant infection, or by reducing local protective immune mechanisms against the background of atypical cells.

To determine the severity of LIR bladder depending on the stage of superficial bladder cancer in the study was subjected to 21 patients with One-stage and 88 patients with T1 stage disease (table. 2).

Table 2. – The distribution of patients according to the severity of BC LUR, n-109

Nº	Graduation LIR	main, n-67		control. n-42	
		Ta-, n=11	T1-n=56	Ta-, n=9	T1-, n=33
1	Expressed	–	41 (73,2%)	–	27 (81,8%)
2	Reasonable	4 (36,3%)	9 (16,1%)	3 (33,3%)	4 (12,1%)
3	Poor	7 (63,7%)	6 (10,7%)	6 (66,7%)	2 (6,1%)

As can be seen from table 2, when The stage of the patients in both groups expressed LIR were observed. Mainly observed mild LIR bladder of 63.7% and 66.7% respectively of the studied groups. In contrast, with T1 stage were pronounced LIR, which in the main group amounted to 73.2% in the control — 81,8%. Therefore, rea-

sonable LIR in the main group was 16.1%, in the control of 36.3%. The results indicate the existence of a relationship between LIR and the tumor stage in the bladder. Consequently, this is the basis for the study of their severity depending on the size of the primary tumor. (table. 3).

Table 3. – Characterization of the severity of LIR depending on the size of the tumor, n=109

Nº	Graduation LIR	<1sm	1,5sm	<2sm	>2sm	Multi.	Total
1	Expressed	–	8	29	21	10	68
2	Reasonable	1	5	6	6	2	20
3	Poor	6	8	7	–	–	21
	Total	7	21	42	27	12	109

According to the obtained results, more expressed LIR is typical of patients with tumor up to 2 cm, 2 cm and more is 38.5 and 24.8%, respectively. So, for tumors up to 1 cm is mainly observed mild LIR is 6.4%, with less than 1.5 cm — 19,2%. Multicentric tumor growth was accompanied by a pronounced LIR, which was observed in 10 of 12 patients.

Thus, the analysis of the severity of local inflammatory reactions of the mucosa of MP shows their dependence on the stage of disease and tumor size. The majority of patients at admission to hospital have a pronounced inflammatory reaction which in turn dictates the need for research on infection, and targeted antimicrobial therapy.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-77-79>

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## A spectrum of the opportunistic and associated diseases in patients with natural course of the HIV-infection

**Abstract:** The research has been aimed at studying of a degree of incidence of the opportunistic and associated diseases in patients with natural course of the HIV-infection. Development of a number of opportunistic diseases is the basic indicator of HIV-infection progression. Up to date, there are a number of scientific papers dedicated to studying of the opportunistic infections [1; 2]. Among the HIV-infected patients, tuberculosis [3] is mainly developed infection out of the opportunistic infections, which is one of the basis reasons for patients' death rate. The risk of tuberculosis reactivation in the HIV-infected patients with positive tuberculin test is 7–10% within a year, and 20–70% of new cases of active tuberculosis in the developing countries. Virus infections (CMV, virus hepatitis C, etc.) [4; 7] also have active influence on the immune system. It is known that the opportunistic diseases under the HIV-infection mutually aggravate the immune system state at the same time facilitating fast transition of the HIV-infection to the end stage of the disease. This is why there is a need to study a spectrum of the opportunistic diseases for the purpose of timely therapy of both the region-specific opportunistic diseases and the HIV-infection [5; 6; 8; 9].

**Keywords:** opportunistic diseases, chronic virus hepatitis B, C and D, cytomegalovirus infection, tuberculosis, lymphoma, chorioretinitis, pneumocystic pneumonia.

**Materials and methods.** The analysis of the opportunistic and associated diseases has been performed in 104 patients with natural course of the HIV-infection.

Among the examined patients 64 ones were male (61.5%), and female — 40 (38.5%). Average age of the patients was 39.9 years. Infection contamination periods in the examined patients varied from 2 to 10 years amounting in average to  $5.20 \pm 0.31$  years.

The opportunistic and associated diseases have been verified based on clinical-laboratory studies. Cytomegalovirus infection, virus hepatitis B, C, D and herpes simplex virus were identified on the basis of polymerase chain reaction (PCR). Pneumonography and head computed tomography were applied. Consultation

with an ophthalmologist together with eye-ground analysis were carried out in order to study eye damage under the cytomegalovirus infection.

**Results and discussion.** In the course of patients allocation by gender and clinical stages the following fact should be taken into account that the number of male-patients at advanced HIV-infection stages (clinical stages 3–4) was practically twice as much as the female patients — 53 (50.9%) against 20 (19.2%) patients under  $P < 0.05$ . At detection of the HIV-infection 10 (9.60%) examined patients had the 1<sup>st</sup> clinical stage of the disease. 21 (20.2%) patients had the 2<sup>nd</sup> clinical stage, and — 30 (28.8%) patients had the 3<sup>rd</sup> clinical stage of the disease. 43 (41.4%) patients were under AIDS stage (4<sup>th</sup> clinical stage) (Table 1).

Table 1. – Allocation of the HIV-infected patients by gender and clinical stages of the disease (n=104)

HIV-infection stage	Male-patients		Female-patients		Total	
1 <sup>st</sup> clinical stage	4	6.30	6	15.0	10	9.60
2 <sup>nd</sup> clinical stage	7	10.9*	14	35.0*	21	20.2
3 <sup>rd</sup> clinical stage	19	29.7	11	27.5	30	28.8
4 <sup>th</sup> clinical stage	34	53.1*	9	22.5*	43	41.4
Total	64	100	40	100	104	100

\*  $P < 0.05$

As you can see in the table, the HIV-infection in male-patients at the time of detection was observed at later stages as compared with women-patients ( $P < 0.01$ ). This was probably due to late seeking medical advice.

Allocation of patients with natural course of the HIV-disease in accordance with the World Health Organization Classification (WHO) for the adolescents and the adults, depending on CD4-lymphocytes count, is shown in Table 2.

Table 2. – Allocation of patients with natural course of the HIV-disease (n=194)

CD4-lymphocytes count	HIV-infection clinical stage				Total
	I	II	III	IV	
1. >500/mm <sup>3</sup>	6 (5.80%)	2 (1.90%)	–	–	8 (7.70%)
2. 200–499/mm <sup>3</sup>	4 (3.80%)	13 (12.5%)	18 (17.3)	19 (18.3%)	54 (51.9%)
3. <200/mm <sup>3</sup>	–	6 (5.80%)	12 (11.5%)	24 (23.1%)	42 (40.4%)
Total	10 (9.60%)	21 (20.2%)	30 (28.8%)	43 (41.4%)	104 (100%)

The spectrum of AIDS-defining conditions in the HIV-infected patients with natural course of the disease at the time of diagnostication is shown in Table 3.

As you can see in the table, tuberculosis is at the first place among the secondary diseases in the HIV-infected patients with natural course of the disease. 33.6% falls to its share, of which pulmonary tuberculosis was detected in 13 (12.5%) patients and the HIV-associated tuberculosis was observed in 22 (21.1%) patients in the generalized form along with hematogenic dissemination of internal organs. Almost all of the patients with severe manifestations of the opportunistic diseases had CD4-count equal to <200 cells/mcl.

Table 3. – The spectrum of the opportunistic diseases and states of the HIV-infected patients with natural course of the disease (n=104)

Disease nosology	abs.	%
Generalized tuberculosis	22	21.1
Oesophageal candidiasis	21	20.2
HIV-cachexia (wasting syndrome)	20	19.2
HIV-encephalopathy	19	18.3
Generalized cytomegalovirus infection	18	17.3
Herpes simplex with frequent recurrence	17	16.3
Pulmonary tuberculosis	13	12.5
Pneumocystic pneumonia	12	11.5
Kaposi's sarcoma	11	10.6
Cerebral toxoplasmosis	6	5.80
Hairy leukoplakia	5	4.80
Cytomegalovirus chorioretinitis	4	3.80
Cerebral lymphoma	3	2.90

Relapsing mucocutaneous candidiasis was diagnosed in all patients, and systemic candidiasis with esophageal affection was detected in 21 patients amounting to 20.2% of all the examined patients.

The generalized form of CMV (17.3%) with eye damage is at the second place by incidence of the secondary diseases; cytomegalovirus chorioretinitis was observed in 4 (3.80%) cases, including one case of detachment of the retina followed by blindness.

HIV-cachexia (wasting syndrome) was diagnosed in 19.1% of patients, and the HIV-associated encephalopathy — in 18.6% of cases (37 patients).

Pneumocystic pneumonia was diagnosed in 12 patients amounting to 11.5% among the detected opportunistic diseases.

Herpes simplex was observed in 17 (16.3%) patients; in 14 (13.5%) patients herpes simplex was manifested as mucous membrane canker; in two cases (1.90%) herpetic bronchitis was diagnosed by laboratory and instrumental procedures.

Specific weight of Kaposi's sarcoma in the HIV-infected patients amounted to 10.6%. At that, dermatitis was observed in 7.70% of cases (8 patients), and oral mucous membranes participating in the pathological process were observed in 3 patients (2.80%).

Cerebral toxoplasmosis was observed in 6 (5.80%) cases. Lymphoblastic cerebral lymphoma was diagnosed in 3 (2.90%) patients using head computed tomography.

Except the above states the following was diagnosed in the patients: hairy leukoplakia of the tongue — 4 (4.80%), repeated or disseminated herpes zoster — 7 (6.70%), peripheral neuropathy — 9 (8.60%). Among other symptoms the following was observed: human papilloma virus-induced dermatitis (condylomata acuminata) in 5.80% of cases (6 patients), surface fungal dermatitis in 9.60% (10 patients), noninfectious dermatitis as seborrheic dermatitis in 12.5% (13 patients), angular cheilitis in 11.5% (12 patients) of cases which are shown in Fig. 1.

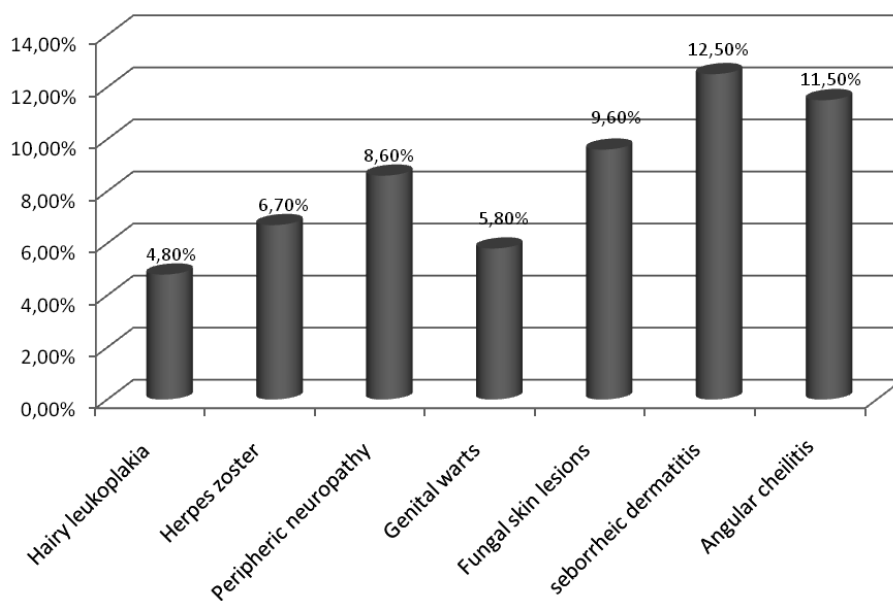


Fig. 1. Incidence of the opportunistic diseases in patients with natural course of the HIV-infection

Among the associated diseases chronic virus hepatitis B was diagnosed in 18 (17.3%), chronic virus hepatitis C — in 35 (33.6%), B+D — in 8 (7.70%) and B+C+D — in 6 (5.80%) patients.

Therefore, the HIV-infection in patients under natural course of the disease is characterized by pathological process progressive course with progress of the generalized forms of tuberculosis and cytomegalovirus infection, systemic candidiasis, pneumocystic pneumonia, herpes simplex with frequent recurrence, which frequently result in severe consequences.

#### Conclusions:

1. The opportunistic diseases under the HIV-infection were often manifested by tuberculosis with process generalization, candidiasis with esophageal affection, cytomegalovirus infection with chorioretinitis complications and the risk of detachment of the retina, and herpes simplex with frequent recurrence;

2. Severe forms of the opportunistic diseases were mainly observed in the HIV-infected patients under the 4<sup>th</sup> clinical stage of the disease and under CD4-lymphocytes count less than 200 cells/ml;

3. Among the associated pathologies, the HIV-infection was frequently accompanied by chronic virus hepatitis C.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-79-81>

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## Efficacy and safety of highly active antiretroviral therapy comprising tenofovir in patients with HIV infection

**Abstract:** The objective of the study was to evaluate the effectiveness and safety of highly active antiretroviral therapy regimens containing tenofovir — TDF in HIV patients. Three classes of antiretroviral agents today are commonly used for the specific treatment of patients with HIV: nucleoside reverse transcriptase inhibitors, non-nucleoside reverse transcriptase inhibitors and protease inhibitors (1, 5, 7). The other drugs of the same class — nucleoside reverse transcriptase inhibitors — were developed in the following years (3, 4). One of the current nucleoside reverse transcriptase inhibitor is Tenofovir (2). Inclusion of Tenofovir drug into antiretroviral therapies leads to suppression of the replicative capacity of human immunodeficiency virus. The nucleoside inhibitors bind stronger to reverse transcriptase than to host cell DNA polymerases. This provides them with a relatively selective effect on the virus. The drug Tenofovir (TDF) in 2001 was approved for use as part of antiretroviral therapy (ART) for the treatment of patients with HIV infection (6).

**Key words:** antiretroviral therapy, tenofovir, viral load, nucleotide and non-nucleoside reverse transcriptase inhibitor.

**Materials and methods.** In accordance with the objectives of this study we totally examined 101 patients with HIV infection admitted to the hospital of the Research Institute of Virology.

Among 101 HIV-infected patients forty-five were men and 56 were women (44,5% and 55,5%), respectively. Patients' age ranged from 21 to 61 years. The average age of the examined patients was 42,5 years. The diagnosis of HIV infection among the patients examined was established based on generally accepted clinical and epidemiological data, and further confirmed in the Republican AIDS Center by laboratory detection of specific antibodies to

the human immunodeficiency virus and its proteins using ELISA and immunoblotting. All patients were on antiretroviral therapy containing tenofovir.

The observation of the patients in the course of treatment included the collection of epidemiological history, medical history, clinical examination, evaluation of the severity of the principal disease and the severity of clinical symptoms, and the presence of opportunistic infections and comorbidities. Patients' clinical, immunological and virological indicators were studied at the 6th months after antiretroviral therapy. Monitoring the effectiveness

of antiretroviral therapy was performed using clinical and laboratory criteria.

**Results and discussion.** The study results showed that patients with the most commonly found diseases such as persistent fever of unknown origin, recurrent aphthous stomatitis, herpes infection, oral candidiasis, Kaposi's sarcoma, Pneumocystis pneumonia, HIV

encephalopathy, oropharyngeal candidiasis, weight loss of more than 10% body weight. Among the surveyed HIV-infected patients 5 (4,95%) had peripheral neuropathy. 25 (24,7%) patients revealed the history of injecting drug use.

Distribution by the route of transmission is represented in Figure № 1 (parenteral, sexual, unknown):

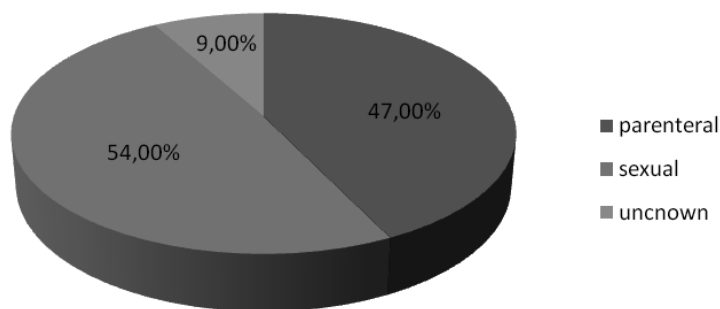


Figure 1. Distribution by route of transmission

The observed patients have been administered the following HAART regimens, containing tenofovir: TDF/FTC+EFV — 26 (25,7%), TDF/FTC+LPV/r — 13 (12,9%), TDF/FTC+NVP — 1 (0,99%), TDF+3TC+EFV — 44 (43,6%), TDF+3TC+LPV/r — 11 (10,9%), TDF+3TC+NVP — 6 (5,94%).

Evaluation of effectiveness of tenofovir containing HAART have shown virologic and immunologic efficacy: in 90,1% of patients at 6 months after the start of treatment, the mean HIV viral

load in the blood was <1000 copies/ml and the average content of T-lymphocytes (CD4 cells) — 345,0 cells/ml.

Virologic failure was detected in 10 (9,90%) patients, who received the following regimens: TDF/FTC+LPV/r — 2 (1,98%) patients, TDF/FTC+EFV — 1 (0,99%) patient, TDF+3TC+EFV — 4 (3,96%) patients, TDF+3TC+NVP — 1 (0,99%) and TDF+3TC + LPV/r — 2 (1,98%) patients (fig. 1).

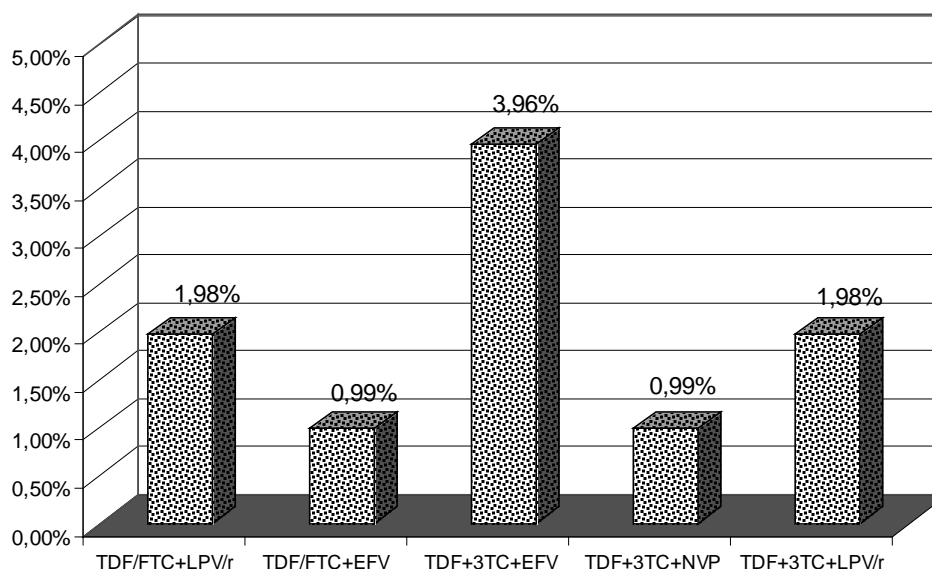


Figure 2. Virological failure of highly active antiretroviral therapy containing tenofovir in patients with HIV infection

4 patients (3,96%) showed impaired liver function as elevated liver enzymes — increased content of alanine aminotransferase (ALT) (from 42,5 mmol/l to 154,3 mmol/l, with an average of 74,7 mmol/l). In 6 (5,94%) patients urine protein — proteinuria was found (from protein traces up to a level of 0,169 g/l), 6 (5,94%) patients had elevated levels of serum creatinine (from 169,9 mmol/l to 191,9 mmol/l, with the average level of 179,7 mmol/l), which indicate a potential kidney disease with damaged filtration function (possibly due to nephrotoxic effect of tenofovir included in the therapy regimens).

The blood test of the patients showed a slight decrease in hemoglobin content (mean 97,9 g/l), RBC (mean  $3.26 \times 10^{12}/l$ ) WBC (mean  $4,45 \times 10^{12}/l$ ) and a slight increase in erythrocyte sedimentation rate (ESR) (mean 19,3 mm/h).

The viral load of human immunodeficiency virus in the blood was determined from 500 copies/ml and 82,625 copies/ml (mean

3620,1 copies/ml). The content of T-lymphocytes (CD4 cells) in the blood was between 4 cells/ml to 1328 cells/ml (average was 257,1 cells/ml).

During clinical observation in the course of the disease among the examined patients the most frequently present clinical symptoms were nausea in 53 (52,5%) patients, vomiting (sometimes recurrent) in 19 (18,8%) patients, dizziness in 67 (66,3%) patients and bloating — flatulence in 58 (57,4%) patients.

Thus, analyzing the data, we can say that highly active antiretroviral therapy containing the drug — tenofovir in HIV-infected patients is effective. Despite the effectiveness of therapy, some patients observed in the course of treatment demonstrated some clinical and laboratory findings pertaining renal and hepatic functional damage, which is important to consider in when administering tenofovir containing ART regimens.



**Conclusions:**

1. Clinical and laboratory efficiency was identified in administration of highly active antiretroviral regimens containing the drug — tenofovir.
2. Adverse effects of highly active antiretroviral therapy regimens containing tenofovir, manifested in nausea, vomiting, bloating and dizziness.

3. Laboratory changes appeared in mild anemia, elevated enzymes (increased levels of alanine aminotransferase) and increased creatinine in the blood, which should be taken into considered when administering the antiretroviral therapy to the HIV patients with kidney and/or liver diseases.

4. Administration of antiretroviral regimens containing tenofovir, considering efficacy and safety allows to enhance the quality of highly active antiretroviral therapy for HIV infection.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-81-83>

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## Indirect influence of hormonal status on the development of ischemic insult and its gender peculiarities

**Abstract:** Hypercortisolemia immediately participated in pathogenetic mechanisms of ischemia deteriorating clinical progress of the disease in patients with ischemic insult. We revealed negative impact of low concentrations of oestradiolum and testosterone on the development and severity of ischemic insult progressing.

**Keywords:** ischemic insult, hormonal status, gender peculiarities.

Ischemic insult (II) is one of the causes of high rate mortality and invalidation of people of workable age; and that conditions the necessity of the study of the factors effecting the progress and outcome of cerebral vascular process.

It is known, that acute stress developing in II causes activation of hypothalamus-petuitary-adrenal system (HPAS) with further increase of glucocorticoids (GC) in blood [1; 4; 5]. In several researches negative effects of hyper cortisolemia, observed in the conditions of excessive or long-lasting stress, were studied, and the interrelation of high concentrations of GC and hyperglycemia (HG) (ГГ) in acute period of insult was underlined [6]. The existing contradictions in the assessment of the parameters of stress reaction in patients with II, and define the importance of the further study of cortisol metabolism in that category of patients [7; 11].

Significant attention in references is paid to the study of the impact of sexual hormones such as oestradiolum and testosterone on the pathogenesis of brain infarction. It is known and doubtless fact

that, men suffer cardiac diseases more often; though scientists offered the explanation of that phenomenon for the first time. According to the results of the study performed in Lester University, Great Britain, it happens due to sexual hormones [2].

Estrogen hormones play a part of protective factors in ischemic insult. Some experimental studies illustrate that status, in details showing molecular mechanisms and conditions of protective function of that group of hormones. It was determined that, in the conditions of increased physiological level of estradiol (proestrus) CA1 neurons of hippocampus were less injured by the common cerebral-vascular ischemia [10].

Clinical study of the amount of thyroxin, triiodothyronine, thyrotropin, ACTH (etc.), in patients with acute ischemic insult revealed “low triiodothyronine syndrome” and increase of thyrotropin, ACTH, and rennin concentration on the 2<sup>nd</sup> day of insult; amount of thyroxin was increased on the 7<sup>th</sup> day of the disease [3; 4].

Physiological role of testosterone in men is well known and it is formation of male phenotype and provision of spermatogenesis. In female organism testosterone supports anabolic processes (first of all in muscular tissue), metabolism and remodeling of bone tissue. High sensitive and specific method of testosterone definition was absolutely necessary for the diagnostics of pathologic states both in men and women [2].

On the basis of the aforesaid, the study of cortisol, oestradiolum, and testosterone amount in blood of the patients with ischemic insult is topical.

**The objective** of this research was to perform gender analysis of cortisol, oestradiolum, and testosterone levels in ischemic insult.

**Materials and methods of the research:** we examined 64 patients (40 men and 24 women) from 60 to 81 years old with II, the average age was  $69.7 \pm 7.8$  years old. Average age of women was  $68.7 \pm 7.7$  years old, and the average age of men was  $67.6 \pm 8.0$  years old.

All patients had complete clinical laboratory and neural-visual check-up. It was complex and included somatic, neurological, and neurophysiological examinations, ECG in dynamics, roentgenography of thoracic cage organs, clinical and biochemical blood analysis, urine analysis; according to the indications ultra sound checking of abdominal cavity and kidneys was performed.

Severity stage of the insult was defined according to the National Institutes of Health Stroke Scale — NIHSS: severe stroke >25 points, moderate — 5–25 points, and slight one <5 points.

Concentration of cortisol, oestradiolum, and testosterone was studied by means of immune enzyme assay with automatic analyzer EL 808 Ultra Microplate Rider (BIO-TEC Instruments, Inc) with the help of standard reactants set «Steroid IEA-cortisol-01» № 061 P and «Non-extraction IGF-1 ELISA DSL-10–2800». Reference values of cortisol normal amount were equal to 50–250 mg/ml, oestradiolum — 15–60 ng/ml, testosterone — 3.5–8.6 pg/ml.

Statistic analysis of the obtained results was performed with the help of standard Excel software. For comparison of the values Student criterion was used. For the study of the link between the studied values Spirman's coefficient of rank correlation was used.

**Results of the research:** on the basis of the obtained data we determined that, there was a dependence of II subtypes revealing on the gender of the patients. In men there was more often development of atherothrombotic and lacunary insults (62.5%), and in women — cardio embolic one (58.3%). In women we observed vast infarctions in carotid lumen more often than in vertebral-

basillary one (62.5% and 37.5%). 70.8% of women came to clinic within initial 3–5 hours from the start of symptoms, while among men that percent was equal to 97.5% ( $P < 0.05$ ).

The study of gender differences in symptoms' complex of II showed that women had symptoms "non-classic" for insult such as change of behavior, disorientation, euphoria or depression, and fatigue reliably more often than in men (87.5% versus 47.5% respectively;  $P < 0.05$ ).

In the study of cortisol amount in II we noted reliable increase, in comparison with the control ( $p < 0.05$ ), and women had more reliably lower values than in men ( $306.5 \pm 15.6$  versus  $269.5 \pm 10.4$ ;  $P < 0.05$ ). The percent amount of patients with reference values among women was 29.2% (7 patients), and among men 22.5% (9 patients). Less expressed increase of cortisol concentration in women can testify development of adaptive stress reaction.

Performance of correlation analysis in patients showed dependence between hormonal reaction HPAS and severity of insult according to NIHSS scale.

In the study of oestradiolum amount in the blood of examined patients we detected decrease of that value in comparison with regular values. In women we registered reliable decrease of oestradiolum 1.1 fold in blood compared with men ( $14.8 \pm 0.5$  versus  $12.9 \pm 0.8$  ng/ml respectively). Registration of reference values in men was equal to 32.5%, while in women — 25.0%.

Correlation analysis of insult severity and oestradiolum amount in blood revealed direct interrelation ( $r = 0.6$ ;  $p < 0.05$ ), i. e. indirect influence of oestradiolum on clinical progress of insult.

Testosterone is metabolized with formation of dehydrotestosterone and oestradiolum, which has genome-mediated neural protective effect both in men and women [11]. According to the obtained data in men there was reliable decrease of testosterone in blood ( $3.6 \pm 0.1$  pg/ml), while in women its level was reliably higher ( $1.5 \pm 0.3$  pg/ml) in comparison with normal value ( $P < 0.05$ ).

Correlation analysis showed that, the amount of testosterone has weak link with the severity of insult ( $r = 0.2$ ;  $p > 0.05$ ).

### Conclusions

1. It was determined that, hyper cortisolemia immediately participated in pathogenetic mechanisms of ischemia deteriorating clinical progress of the disease in patients with II.

2. We revealed negative impact of low concentrations of oestradiolum and testosterone on the development and severity of II progressing.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-83-85>

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## Features of course of idiopathic trigeminal neuralgia between genders

**Abstract:** To learn etiology geneticist fact concerned with sex of neuralgia of trigeminal nerve. As a conclusion, we can say that idiopathic neuralgia is the most spreaded type of trigeminal neuralgia. Men have more cases of catching this illness than women. At men this disease will occur as losing of taste. Disease-producing factors of neuralgia at men: shaving, tooth brushing, draught; at women: tooth brushing, laughter, draught. A neuralgia attack both at men and women often occurs during summer time. Dependence of duration of illness from gender is not defined.

**Keywords:** trigeminal neuralgia, Doppler, transcranial Dopplerography, cerebral hemodynamic.

Recently “idiopathic” origin of diseases is very well studied. The term “idiopathic” has been conditionally used for the first time in 1988 by International Headache Classification.

The first attack of pain occurs without any reasons in 34% cases, during dental treatment in 27% cases, and its connected with senses in 17% cases, in other cases the onset of the illness occurs in combination to different factors (sudden cooling of face, respiratory infections, local wounds and others) [4; 6; 7]. Ethio-pathogenesis of course of acute period of trigeminal neuralgia has been considered as uncertain matter until now. Because of problems on early diagnostics, patients often address and are directed to other specialists. In turn, it demands to study disease on the basis of modern technologies. Course of the illness, its non-treatability still creates some problems.

During the last years pathogenesis of special diseases of brain has been studied against functional systems of organism. It helps to define the pathological phenomena of mechanisms of former and new development [1; 3; 6; 7]. Taking into account progressive development of disease and applied physiotherapeutic reflex-therapeutic of resistance to treatment, patients with trigeminal neuralgia disease have surgical operations. Pathogenesis of diseases can be explained by several theories. In many cases, its reason is intra — and extracranial compressions. This can be occur because of space-occupying lesion (tumour) of cranial fossa (neurinoma of acoustical nerve, meningioma, glioma of pons), disposition and artery expansion of cerebellum, aneurysm of the basic artery, tunnel syndrome (at the expense of compression of 2<sup>nd</sup> and 3<sup>rd</sup> germinal unit, a crack of the channel of a bone and congenital narrowness of bottom jaw and addition of disease of vessels at old men) odontogenic or rhinogenous inflammations. Disease can develop: at removal of teeth, odontogenic neuralgia, as a result of infringement of blood circula-

tion in brain, as a result of herpes infection, it becomes rare the reason demyelination of trigeminal nerve covers at spreaded sclerosis [2; 5; 6].

The term “idiopathic” has been conditionally used for the first time in 1988 by International Headache Classification. There tunnel compression mechanism this form of neuralgia was analyzed.

From the point of view of spread, among diseases of nerves of brain trigeminal neuralgia takes second place after face nerve neuropathy [3; 4]. Trigeminal neuralgia is often observed at middle and old man, but to 40-year-old age the first attacks make 30–35%, at 70 and more year old the first painful attack makes 2–3 percent. Women are ill than men (Shedrenko V. V. 2005) is more often.

**Objective:** To learn etiology geneticist fact concerned with sex of neuralgia of trigeminal nerve

Materials and methods

We have examined 268 patient, age from 30 to 70 (171 of them women (63,8%), 97 men (36,2%)) who were treated on neurology and maxillofacial surgery of medical center of Bukhara region. Results were determined with method of questioning.

**Results and discussion**

According to our examination the reason of illness most of patients is unknown as idiopathic neuralgia is atop, and observed for men much more than for women (53, 6:41, 5). At the same time trigeminal neuralgia arose after wounds, 4, (4,1%) for men and 10 (5,8%) for women. Trigeminal neuralgia observed for women like a consequences of herpes (1,8%), diabetes mellitus (1,8%), acute infection (3,5%) when for men this kind of situation were not discovered.

The main etiological facts of concerning neuralgia of trigeminal nerve with sex are given on table 1.

Table 1. – The main etiological facts of concerning neuralgia of trigeminal nerve with sex

No.	EXCITING CAUSE	Men		Women	
		Number Abc	%	Number Abc	%
1	2	3	4	5	6
1	Idiopathic	52	53,6±5,1	71	41,5±3,8***
2	After Sores	4	4,1±2,0	10	5,8±1,8
3	Acute Infection	–	–	6	3,5±1,4
4	Herpes	–	–	3	1,8±1,0

1	2	3	4	5	6
5	SARS	9	9,3±2,9	18	10,5±2,3
6	After Dental Treatment	6	6,2±2,4	15	8,8±2,2
7	Diabetes Mellitus	1	1±1,0	3	1,8±1,0

Note: \*\*\* Reliabilities of difference between men's and women's groups is  $p < 0.05$

Analysis of facts which rouse attack of neuralgia of trigeminal nerve. Taking bath — men 28,9%, women 22,2%. Brushing teeth — men 39,2%, women 38,0%. Facer — men 18,6%, women 21,6%.

Laughing — men 25,8%, women 38,6%. Shaving — men 46,4%. Make up — women 15,2%. Draught — men 55,7%, women 53,8% Facts which rouse attack of neuralgia of trigeminal nerve given on Table 2

Table 2. – Facts which rouse attack of neuralgia of trigeminal nerve

Facts which rouse attack of neuralgia of trigeminal nerve.	Men		Women	
	Number Abc	%	Number Abc	%
Taking bath	28	28,9±4,6	38	22,2±3,2
Shaving	45	46,4±5,1	–	–
Brushing teeth	38	39,2±5,0	65	38,0±3,7
Facer	18	18,6±3,9	37	21,6±3,1
Make up	-	-	26	15,2±2,7
Laughing	25	25,8±4,4	66	38,6±3,7
Draught	54	55,7±5,0	92	53,8±3,8

Examining changes of sense showed that both for men and for women hyperesthesia observed more than anesthesia. There was no

difference between gender, what is given in table 3.

Table 3. – Changing of sense on neuralgia of trigeminal nerve

Changing of sense	Men		Women	
	Number Abc	%	Number Abc	%
Hyperesthesia	71	73,2±4,5	115	67,3±3,6
Hypaesthesia	21	21,6±4,2	44	25,7±3,3
Anesthesia	4	4,1±2,0	10	5,8±1,8

Examining taste men and women who have neuralgia of trigeminal nerve showed that men's taste districted more than women's

(20,6%: 8,8%), what is given in table 4.

Table 4. – Disturbing taste

Changing of taste	Men		Women	
	Number Abc	%	Number Abc	%
1. No change	77	79,4±4,1	156	91,2±2,2**
2. Change	20	20,6±4,1	15	8,8±2,2**
A. on the Right	10	10,3±3,1	9	5,3±1,7
B. on the Left	10	10,3±3,1	6	3,5±1,4

Note: \*\*\* Reliabilities of difference between men's and women's groups is  $p < 0.01$

Results of analyzing attack of neuralgia of trigeminal nerve according to season: In winter — men 29,9%, women 21,6%. In spring — men 18,6%, women 22,8%. In summer — men 39,2%, women 38,6%. In autumn — men 12,4%, women 17%.

Analyses shows that in summer both men and women have more attack of neuralgia of trigeminal nerve as in summer people use air-conditioner what has a bad influence on neuralgia of trigeminal nerve. Results of analyzing attack of neuralgia of trigeminal nerve according to season given in table 5.

Table 5. – Results of analyzing attack of neuralgia of trigeminal nerve according to season

No.	Gender	All	Season							
			Winter		Spring		Summer		Autumn	
			Number Abc	%	Number Abc	%	Number Abc	%	Number Abc	%
1.	Women	171	37	21,6±3,1	39	22,8±3,2	66	38,6±3,7	29	17,0±2,9
2.	Men	97	29	29,9±4,6	18	18,6±3,9	38	39,2±5,0	12	12,4±3,3

Analyses of idiopathy and chronic illness of patients for men — 14,4%, for women — 14,6%. Illness for a year for men — 16,5%, for women — 17,5%. Results of illness during several years are similar

for men and women (58,8: 55,0). Idiopathy and chronic form of illness similar for both men and women. Continuous of illness given in table 6.

Table 6. – Continuous of illness

No	Antecedent anamnesis	Men		Women	
		Number	Abc %	Number	Abc %
1	1–15 days	14	14,4±3,6	25	14,6±2,7
2	1–3 month	10	10,3±3,1	21	12,3±2,5
3	1 year	16	16,5±3,8	30	17,5±2,9
4	Several years.	57	58,8±5,0	94	55,0±3,8

Analyses of the number of attacks of neuralgia of trigeminal nerve during a day showed that it achieves more than 10 times both for men and women. what given in the table 7.

Table 7. – Number of attacks of neuralgia of trigeminal nerve during a day

No	Times of attack for a day	Men		Women	
		Number	Abc %	Number	Abc %
1	1–2 times	10	10,3±3,1	17	9,9±2,3
2	4–5 times	30	30,9±4,7	56	32,7±3,6
3	10 times	39	40,2±5,0	64	37,4±3,7
4	10 more than times	18	18,6±3,9	35	20,5±3,1

As a conclusion, we can say that idiopathic neuralgia is the most spreaded type of trigeminal neuralgia. Men have more cases of catching this illness than women. At men this disease will occur as losing of taste. Disease-producing factors of neuralgia at men:

shaving, toothbrushing, draught; at women: toothbrushing, laughter, draught. A neuralgia attack both at men and women often occurs during summer time. Dependence of duration of illness from gender is not defined.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-85-87>

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## Clinical and biochemical justification of prevention of basal seat tissues atrophy in the maxilla

**Abstract:** Complete removable dentures have a negative effect on the tissues of basal seat resulting in atrophy of edentulous jaws. It needs correction of the microcirculation of basal seat tissues.

**Keywords:** removable dentures, complete dentures, edentulous ridge/jaw, basal seat, oral mucose membrane, negative effect of removable dentures.

Most of all, a removable denture is inevitable need for replacing both the complete edentulous arch and the partial teeth loss. Despite achievements in manufacturing techniques of the complete removable dentures, a question of improvement of their stability need its decision.

Among all manufactured dentures the removable complete dentures are the most non-physiological. Removable dentures and the materials, which from they have made, can have a negative effect on the oral mucous membrane, which condition is balanced.

Stability of the complete removable dentures depends on a condition of buffer zones of a basal seat, which, in turn, closely depend on microcirculation of the last one.

There is compression syndrome during complete removable dentures is used, resulting in endothelial damage of blood vessels, which disrupts capillary permeability, decreases the tone of blood vessels, slows blood flow, deposits fibrin on the vascular wall, stimulates collagen activity, increases aggregation and adhesion of

platelets (T. M. Milenkaya, E. G. Bessmertnaya). It will undoubtedly lead to restriction of blood flow in the terminal parts of the vascular bed, which is will resulting in a further deterioration of the organ and the systemic circulation. As a result, disturbance of a metabolism will increase atrophy of the edentulous ridge (Tereshina T. P., Labunets V. A., Diyeva T. V., 2006).

**The purpose of the research.** The research objective was the evaluation of the complex treatment effectiveness directed to prevention of basal seat's tissues atrophy in the maxilla in edentulous individuals using of the antiplatelet medicine dipyridamolum and carrying the course of darsonvalisation.

**Material and methods.** There was prosthetic survey of 91 individuals with edentulous maxilla at the age of 50 years and more and 10 individuals with intact dentition (the control group). The 53 individuals received traditional prosthetic treatment. The main group consisted of 38 patients with decreased microcirculation and increased coagulation properties of blood. They had divided into 2 subgroups by the method of random selection. The patients of both subgroups took dipyridamolum in average therapeutic dose of 50 mg 3 times a day for 20 days. Patients of the second subgroup additionally have receiving a darsonvalization on prosthetic bed's tissues, session duration 3 minutes, every other day, for a course of 6 sessions.

There were applied the following methods to evaluate the effectiveness of the suggested therapy:

- clinical stomatoscopy examination;
- quantitative analysis of saliva and determining of pH of saliva;
- LDF examination of the basal seat's oral mucous in the maxilla;
- biochemical analysis of the blood.

The hemodynamic of a basal seat tissues was studied by LDF (laser Doppler flowmetry) method. Examination of each patient was carried out after stabilization of a hemodynamic during 10–15 minute in the reclining position in the room with the soft irradiating lighting, at a temperature of 18–25 °C. The sensor of the device was installed in the area of a palatal distal third, controlling the pressure upon a mucosa was not excessive (to exclude pressure to microvessels) and too weak. Register time is 2 min for each side.

For diagnostics of a basal seat changes in edentulous maxilla we studied an indicator of microcirculation (IM), the index of microcirculation effectiveness (IEM) and vibration amplitudes of the LDF-signal (Kv, LF, HF, CF) reflecting rhythmic processes in system of microcirculation.

#### The obtained results and their discussion.

Biochemical blood results showed that respondents of the main group while using complete removable dentures have a significant increase in the content of Willebrand factor, indicating the in-

creasing of thrombogenic potential of the vascular wall. It was equal to  $151,2 \pm 3,2\%$  in contrast to  $100,6 \pm 6,3\%$  in the control group. Damaging of the vascular wall resulting to the violation of the integrity of the endothelial lining of microvessels, which in turn increased the content of circulating endothelial cells. Their average content in the blood is equal to  $24,2 \pm 2,01 \cdot 10^4/l$  in contrast to  $8,19 \pm 0,24 \cdot 10^4/l$  in the individuals with intact dentures.

One of the acute phase protein is fibrinogen, the contents of which significantly increased 1.5 times and amounts of  $4.97 \pm 0,54$  g/l in the surveyed individuals, but  $3.2 \pm 0,21$  g/l in the control group.

Damaging of the vascular wall and the marked increasing in hemostatic activity of platelets of respondents due to launch the coagulation cascade and increase the number of microaggregates in the bloodstream. Uncontrolled coagulation in the blood and the disbalance of protrombogenic and antithrombogenic factors contribute to the consumption of the natural anticoagulant — antithrombin III and decrease its concentration by 11%.

All patients of the main group had taken dipyridamolum in average therapeutic dose of 50 mg 3 times a day for 20 days.

Clinical stomatoscopy examination of patients of the first group showed improvement in the basal bed's oral mucous color on day 10. A survey of patients felt discomfort while using dentures, revealed that even at 6–8 day of the treatment with dipyridamolum discomfort like a burning sensation and phantom pain significantly decreased or passed at all.

Analysis of saliva in patients of the first group showed that on day 3 of treatment with dipyridamolum the amount of saliva increased to 3.1 ml, on the 7th day — 4.3 ml, on day 10 to 4.5 ml, subsequently the amount of saliva remained relatively stable. Knowing that the dipyridamolum has interferon-inducing properties, we can assume the increase in the level of interferon in the mixed saliva. It increases resistance of the oral cavity to viral infections, which is especially important for our age group of the patients.

Analysis of LDF-grams, executed on the 10th day of treatment showed that the level of tissue blood flow increased by 44%, although the intensity had still reduced by 12%. Vasomotor activity of blood vessels had also reduced by 26% while it was close to the norm. Analysis of amplitude-frequency spectrum of LDF-grams revealed a slight increase in the active modulation of blood flow by 8–10% and reduction of the pulse fluctuations by 8%, indicating that the reduction of stagnation of the tissues under the complete denture basis. On the 20th day of treatment in our patients recorded a slight decrease in MI (10%) of the original level, however, the lower level of the CF-waves at 13% testified to further reduce venous stagnation in the tissues of the basal seat.

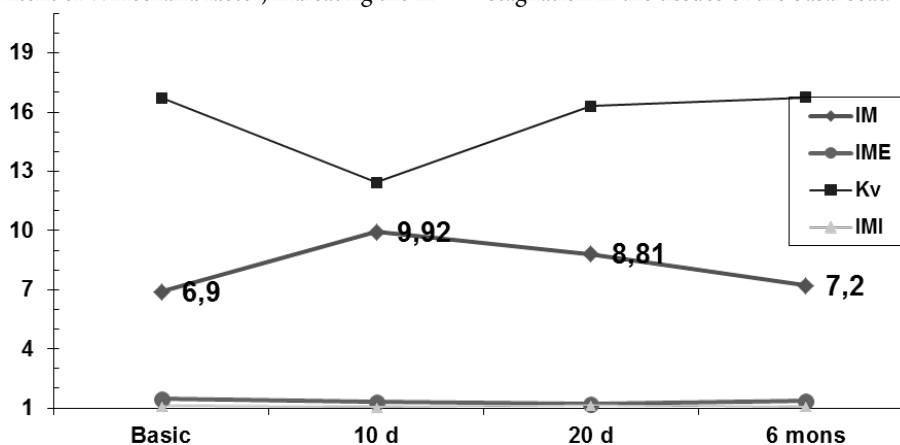


Figure 1. Analysis of LDF-grams

Biochemical analysis of blood showed a tendency to decrease platelet aggregation in 88% of the surveyed persons, with a more pronounced effect had observed on day 20 of the research. The content of fibrinogen amounted to an average of  $2.83 \pm 0,31$  g/l, which is 44% below the baseline. The using of dipyridamolum treatment significantly reduced the number of endothelial cells and content of Willebrand factor in the blood respectively for 41% and 22%.

Performances of the saliva analysis and biochemical blood tests of patients of the second subgroup did not have significant differences from those patients of the first subgroup.

Clinical stomatoscopy examination of the second subgroup of patients showed improvement of the oral mucous color of the prosthetic bed is already on the 6–7-th day of treatment. Subjective complaints of the patients decreased by 5–6-th day of complex treatment.

The results of the LDF-grams on the 10th day of treatment testified the increased blood flow and its intensity respectively for 53% and 4%, while the vasomotor activity of microvessels had reduced by 27%. The analysis of the dynamics of amplitude-frequency characteristics of tissue blood flow held on the 10th day of combined

treatment found an increasing level of high-frequency vasomotions and flaxmotions respectively for 11% and 18%, indicating increased blood flow in the arterial and venular parts of the microvasculature. The decreasing level of the pulse flaxmotions by 9% showed an improvement of the venous outflow in the microvasculature of the basal seat tissues.

Examination of the patients on the 20th day of combined treatment the level of tissue blood flow exceeded initial values by 58% and the intensity of the microcirculation increased by 10%.

**Conclusions.** Our data shows that dipyridamolum reduces the aggregation properties of blood, improves microcirculation, reduces stagnant processes in the basal seat tissues and enhances the protective functions of saliva by stimulating the interferon production. The application of darsonvalization to the tissues of the basal seat had improved outcomes. In this case, it is possible to recommend the using of dipyridamolum in combination with darsonvalization on basal seat tissues to prevent atrophy of edentulous jaw, thrombotic complications, and to improve blood rheology of persons using complete dentures.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-87-88>

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## Interrelation of personal characteristics and affective disorders of patients with breast cancer

**Abstract:** In order to study psychoemotional state of breast cancer carriers at various stages of therapy 70 patients were tested using Hospital Anxiety and Depression Scale (HADS) and Eysenck personality inventory (EPI) subject to undergo various stages of supervision.

**Keywords:** breast cancer, temperament, anxiety, depression, neuroticism.

**Relevance:** Breast cancer (BC) is the most common disease among women in oncology practice. According to WHO data (2014), the incidence rate among women with breast cancer is 43.3 per 100 000 population.

Anxiety and depressive disorders are the major mental disorders in case of Breast Cancer [5; 7]. Depression is one of the most common mental illnesses among patients who have cancer. Diagnosis of depressive disorders in case of patients ill with cancer is still impeded because

of the fact that many symptoms of major depressive disorders (loss of appetite, weight loss, insomnia, loss of interests, cognitive impairment, fatigue and increased fatigability) are similar to signs of cancer. This causes additional challenges upon search for solutions of timely use of psychotherapeutic measures to eliminate depressive symptoms among oncologic patients. Taking into account a great risk of depression among oncologic patients it is suggested to conduct an early and timely psychological intervention to eliminate symptoms of depression [1; 2].

Some therapies of cancer themselves may result in development of psychological disorders. Malaise and nausea is often accompanied by the radiation therapy. Complications caused by chemotherapy are nausea, vomiting, general weakness and emotional distress. Some patients become feel sick even in advance before the repeated course and can be so extremely intense that further treatment is impossible. In such cases the positive effects are often provided using measures aimed to eliminate anxiety as well as other psychotherapeutic methods [3; 4].

Introduction to the integrated treatment of psychological care on the basis of personal characteristics and emotional status is an important task to improve the patients' life quality ill with Breast Cancer.

**Research objective:** Study of interrelation of the level of anxiety and depression with temperament type of breast cancer patients.

**Materials and research methods:** 70 patients with breast cancer I–III stages were studied on the basis of Tashkent Regional Oncology Dispensary. The average age is  $39.5 \pm 12.5$  years. All patients gave their voluntary consent to participate in the research. Patients suspected to have mental pathology and with apparent accentuations of personality traits have not been admitted to be enrolled. All patients have been received a combined treatment: surgery, radiation or drug therapy. The study was conducted during the period of drug therapy. The psychometric methods have been used as follows:

1) Hospital Anxiety and Depression Scale (HADS) developed by A. S. Zigmond and R. P. Snaith in 1983 to identify and evaluate the severity of anxiety and depression in general medical conditions [8];

2) Personal Inventory by D. Eysenck (EPI);

The received data was processed by statistical method.

**Results:** According to clinical and psychological studies the following results have been obtained. Melancholic amounted to 33%, choleric — 25%, phlegmatic — 23%, sanguine — 19%, level of neuroticism was high at 59%, average — 23% and low — 18%. Introverts amounted to 57%, extroverts — 43%. False responses were not found.

According to the Hospital Anxiety and Depression Scale (HADS) anxiodepressive state was detected among 25.7% pa-

tients. Increased anxiety was revealed among all patients, without exception. Clinical manifestation of anxiety was characterized by the prevalence of stress, confusion, emotional instability and irritation.

A quarter of patients were found to have depression (24.9%). A clinical presentation of depressive symptoms and signs was dominated with melancholy, low mood, anxiety, apathy and tearfulness.

Based on the received data it was found that a predominant type of temperament was melancholic, moreover introverts were greater than extroverts in number, and whether it is caused by psycho-emotional condition during disease as some authors suppose that introversion is a risk factor in the development of breast cancer [6], remains not investigated until last.

Comparative data analysis shows that anxious and depressive disorders are more manifested in case of introverts than extroverts.

Also worth noting is that according to the type of temperament and level of anxiety and depression the differences have been revealed. A level of anxiety and depression was higher in case of melancholic and choleric types whereas phlegmatic and sanguine indicators were lower.

Therefore the level of anxiety among women ill with breast cancer is interdependent with depression level and type of temperament. Based on the retrieved data it is possible to suggest that patients with breast cancer are characterized with single anxiety-depressive syndrome manifestation of which depends on the severity of emotional state.

Anxiety is a significant factor in the patients' life quality for which reason an early psychological diagnostics of emotional peculiarities will allow to anticipate possible variations of personal emotionally colored reactions within the system of personality relations in progress of illness and arrange respectively a psycho prophylactic intervention.

**Conclusion:** Research on personality traits and manifestation degree of affective disorders in case of patients ill with breast cancer is an important component to choose treatment modalities and achieve adherence to the therapy. Therefore identified psychological peculiarities during research will be required while definition of the strategy of psychological counseling for patients with breast cancer.

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## Pathogenesis and clinical features of anemia of inflammation in children, during chronic hbv infection

**Abstract:** Examination of 125 children with chronic hepatitis B (CHB) and concomitant anemia has ascertained the frequency of refractory variants of anemia (52.5%). The disease progressed seriously on the background of anemia, that was indicated the prevalence of CHB with severe activity forms (71.4%). The pathognomonic symptoms of anemic processes were revealed. Two pathogenetic variants of the anemia inflammation genesis at children with CHB are being considered: the first is defined by veritable iron deficiency with ferrokinetic markers of iron-deficiency anemia; the second — by re-distributive iron deficit typical for hemosiderosis and refractoriness development.

**Keywords:** chronic hepatitis B, anemia, children, ferrokinetic markers.

The range of anemia prevalence in population, especially among children (up to 46-65% according to WHO, 2005) and high morbidity rate of chronic viral hepatitis preserved for the last decades (the third place after cardiac-vascular and oncologic pathologies, according to WHO, 2008) formed a global problem, which causes a great economical and social damage to the society and the state [5; 17; 20]. It becomes evident, that the contingent of children with chronic hepatitis B (CHB), has the prevalence of anemia of inflammation that reaches up to 94.6% cases, deserves a special attention; and it serves the basis for considering that nosology as one of unfavorable factors of chronic viral hepatic pathology is progressing [6; 8]. In hepatic pathology practice that problem can be often deteriorated by development of anemia forms refractory to ferrum therapy (up to 40%), which require a certain solution. Causative factors consider the close interrelation of pathogenetic aspects of the studied nosologies, particularly pathologic processes in liver, such as decrease of iron absorption in intestine as a result of viral persistence in enterocytes, liver participation in the synthesis of proteins transporting and depositing iron, development of occult hemolysis of erythrocytes, disorder of iron re-utilization and erythropoiesis [12]. On the other hand, anemic processes, such as hem and tissue hypoxia, disorder of lipids peroxide oxidation, antioxidant system and internal cellular metabolism, formation of membrane pathologies, syndrome of regeneration-plastic disfunction, initiator of which is also viral replication [18]. Finally, that promotes suppression of the total resistance of macro organism and reality of all ways of progression of CHB. If we take into account - hepcidin – as one of the main regulators of iron hemostasis synthesized by hepatocytes [9; 14; 15], we can confirm not only significant role of liver in the genesis of anemia, but also get a new point of view on pathogenesis of anemia of inflammation in the conditions of chronic viral persistence. As hepcidin controls the level of extra cellular iron by means of regulation of intestinal absorption, placental transport and release of iron from deposits, and, being a phylogenetic ancient factor, it has

a direct bactericidal effect and ability to increase resistance of the organism [1; 7; 11].

Thus, high possibility of development of anemia of inflammation in children with CHB, especially refractory to ferrotherapy variants, made us consider the problem of combined pathology more attentively. Complexity of that problem was conditioned by few modern scientific researches in that field; absence of the revealed ferrokinetic schemes of anemia in CHB in children; high range of its clinical manifestations, and the motives of making some decision about the therapy of refractory variants of anemia.

**The objective** of the study was the assessment of the characteristics of clinical progress and ferrokinetic of refractory variant of anemia of inflammation in children with CHB.

### **Material and methods of the research**

125 children with CHB in the age from 3 to 18 years old with concomitant anemia were examined, 62.4% of which were boys. Marked activity of CHB diagnosed in 33.6% patients, moderate in 44.8% and minimal in 21.6% cases. The term of the diseases was  $6.2 \pm 0.4$  years. Diagnosis of CHB was set on the basis of anamnesis, clinical data, some serological, biochemical, and instrumental tests in compliance with the diagnostic criteria of the activity degree of the pathological process in liver in children [17]. The fact of anemia was determined according to WHO criteria [20]. 97 patients (I group) out of the total number of the patients had refractory to the iron therapy anemia (**RA**). The rest 28 children with non-refractory anemia (**nRA**) composed the II group. The control group involved 19 healthy children.

Biochemical analysis of blood included definition of: ALAT and ASAT activity, protein content and its fractions, total and direct bilirubin, Gamma Glutamyl Transpeptidase, alkali Phosphatase, tymolic test, C-Reactive protein, fibrinogen, and prothrombin by means of unified methods on biochemical analyzer FP-901 using "HUMEN" set (Germany). Middle molecular peptides (MMP)

were studied with the help of spectral-photometer method (Gabrielyan N.I., 1982). Viral verification (HBV, HCV, HDV) was performed by means of ELISA and PCR methods using the sets of "DNA-technology" and "Vector-Brest" test-systems (Russia).

ELISA method was used for definition of ferrokinetic, markers such as hepcidin, transferrin (Tf), soluble transferrin receptors (sTfR), serum iron, ferritin (Ft), interleukin (IL-1), interleukin (IL-6) with the help of «Biochemmack» set, Moscow (2012) and «Bachem Group», USA (2011). Ratio of soluble transferrin receptors to log. ferritin (sTfR/log Ft index) was calculated [16]. The obtained results had been mathematically processed by means of variation statistics using Student t-criterion with special Excel-2000 software.

## Results and discussion

Examination of children with CHB and concomitant anemia provided definition of the prevalence of refractory variant of anemia in 77.6% cases. Analysis of clinical progress of chronic hepatitis showed that with **RA** the pathology proceeded more severe, with prolongation of the period of exacerbation average to  $3.7 \pm 0.1$  days, and it was also proven by prevailing of more severe forms of the disease (71.4%).

The most complaints of patients with **RA** combined with CHB (table 1) were dizziness and dimness, intensified when change to orthostatic state (92.8% versus 53.5% of the children with **nRA**,  $p < 0.001$ ).

Table 1. – Symptoms, characteristic for anemic process in children with CHB

Symptoms	CVH with RA (I) n=97		CVH with nRA (II) n=28		P
	abs.	%	abs.	%	
Dizziness	89	92.8±2.8	15	53.5±9.4	<0.001
Tinnitus	56	57.7±5.6	9	32.1±8.8	<0.001
Palpitation	67	69.0±4.6	9	32.1±8.8	<0.05
Brittleness of nails	82	85.5±3.6	16	57.1±9.3	<0.01
Acro cyanosis of nails	85	87.6±3.3	10	35.7±9.0	<0.001
Deformation of nails	30	30.9±4.6	2	7.1±4.8	<0.001
Hair fall	60	61.9±4.9	11	39.3±9.2	<0.05
Xerosis in skin	41	42.3±5.0	3	10.7±5.8	<0.001
Angular cheilitis	27	27.8±4.5	6	21.4±7.7	>0.05
Dysgeusia	41	42.3±5.0	6	21.4±7.7	<0.05
Pagophagia	33	34.0±4.8	2	7.1±4.8	<0.001
Osmesis inversion	45	46.9±5.0	7	25.0±8.1	<0.05
Stomatitis	45	46.9±5.0	7	25.0±8.1	<0.05
Glossitis	27	27.8±4.5	7	25.0±8.1	>0.05

P – reliability of the differences between the studied groups.

The study of the symptoms, characteristic for anemic process identified complaints such as tinnitus and palpitation, which were claimed by the children with RA (57.7% and 69% versus 32.1%,  $p < 0.05$ ). During the examination we paid attention to manifestations such as brittleness and acro cyanosis of nails (85.5% and 87.6% versus 57.1% and 35.7%), deformation of nail plates (30.9% versus 7.1%), dryness and excessive hair fall (61.9% versus 39.3%), chaps on finger "pillows" (42.3% versus 10.7% respectively with the groups with **RA** and **nRA**,  $p < 0.001-0.05$ ). In the I group of children there was more often characteristic abnormal taste alteration (pica chlorotica) such as dysgeusia – eating of soil, chalk, raw pastry (2 folds), pagophagia – eating frozen products and ice (4.7 folds), pathoosmia – predilection to unpleasant smells, such lacquer, acetone, and others (1.8 fold) and inclination for development of stomatitis (1.8

fold,  $p < 0.05$ ). At the same time development of glossitis was met almost with the same frequency in both groups.

Among the clinical syndromes of CHB was reliably ( $p < 0.05-0.001$ ) more frequently met symptoms of asthenia complaints of weakness, fatigue, insomnia, and headache (94.8%), hemorrhagic syndrome in the form of nasal bleedings and ecchymoses (90.7%) and marked hepatosplenomegaly (63.9%) with the accent of fast progressing of the disease (fig.1). Besides that, we paid attention to the prevailing (to 32.2%) weight loss among the children with **RA** (69.0% versus 32.1%,  $p < 0.05$ ). Moreover the expression of certain extra hepatic symptoms such as palmar erythema, arteriovenular bridge, spider veins, and venous collateral was manifested in the majority of the patients independently of the character of anemia progressing (92.8% – 100%).

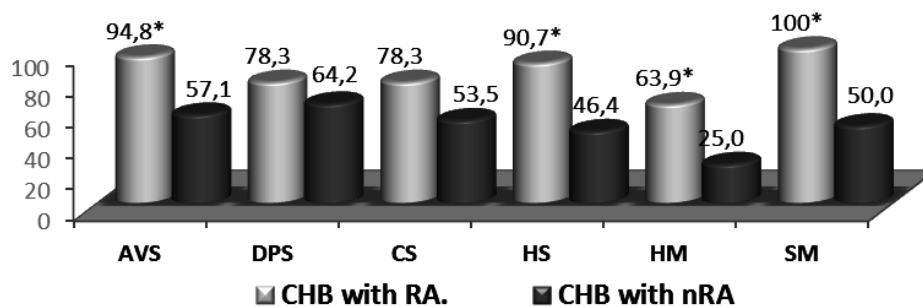


Figure 1. Prevalence of clinical syndromes of CHB in children dependently on the variant of anemia progression, %

AVS — asthenic-vegetative syndrome, DP-dyspeptic, CS — cholestatic,

HS — hemorrhagic, HM- hepatomegaly, SM — splenomegaly;

\* — reliability of differences in the comparison group  $p < 0.05-0.001$ .

The obtained data of the biochemical analysis testified more severe disorders of the functional state of liver in children with CHB with refractory progressing anemia. The leading biochemical manifestations of liver damage were as: cytolysis with development of characteristic long-term hyperenzymemia (77.3%), mesenchymal inflammation (83.5%) and endotoxemia (92.8%). Thus, average values of ALAT reached  $2.87 \pm 0.10$  mkmol/l, and it was 1.4 fold exceeding analogical value of the children with CHB and *nRA* ( $1.99 \pm 0.12$  mkmol/l,  $p < 0.001$ ) and more than 4.2 folds the control values ( $0.68 \pm 0.02$  mkmol/l,  $p < 0.001$ ). Similar situation we observed in relation to the second indicator of cytolysis — ASAT, which was  $2.00 \pm 0.10$  mkmol/l,  $1.00 \pm 0.09$  mkmol/l and  $0.38 \pm 0.02$  mkmol/l respectively in children of the I, II and control groups ( $p < 0.001$ ). It should be noted that, in most cases (76.2%) of refractory progressing anemia there was characteristic revealed hyperenzymemia, preserved for several months and not responsive to basic therapy. The manifestation of mesenchymal inflammation dis-

orders in CHB with superimposed *RA* in children was rise of tymolic test and gamma globulin level in comparison with the control values average 4.0 and 2.0 folds respectively ( $p < 0.001$ ). Level of tymolic test reached  $14.7 \pm 0.62$  units and gamma globulin up to  $32.8 \pm 0.68\%$ . In the group of children with *nRA* these parameters were reliably lower in comparison with the children with *RA*, but still above the control parameters ( $10.2 \pm 0.46$  units and  $26.6 \pm 0.88\%$  versus  $3.6 \pm 0.20$  units and  $15.7 \pm 0.47\%$  respectively,  $p < 0.05$ ). The values of middle molecular peptides were significantly higher than analogical values of the control group (more than 10.3 folds,  $p < 0.001$ ), the amount of which varied from 0.66 to 3.45 mg/ml. And the greatest increase was registered in children with *RA*, and in average it was  $2.88 \pm 0.12$  mg/ml, relatively lower in patients with *nRA* — average  $2.49 \pm 0.10$  mg/ml, while in the control —  $0.24 \pm 0.02$  mg/ml ( $p < 0.01$  between the examined groups).

Comparative analysis of ferrokinetic markers revealed diversity of the parameters, which mostly depended on the variant of anemia progressing in children, with CHB (table 2).

Table 2. – Ferrokinetic markers in children with CHB dependently on the progress of anemia

Value	CVH with <i>RA</i> n=97	CVH with <i>nRA</i> n=28	Control	P <sub>1-2</sub>
Hepcidin, ng/ml	$28.680 \pm 0.63^*$	$56.367 \pm 1.6^*$	$39.4 \pm 6.5$	$< 0.05$
Serum iron, mkmol/l	$8.76 \pm 1.22^*$	$4.67 \pm 0.86^*$	$15.4 \pm 0.86$	$< 0.01$
Ferritin, ng/ml	$124.3 \pm 2.42^*$	$31.8 \pm 1.82^*$	$62.2 \pm 1.21$	$< 0.001$
Transferrin, mg/dl	$166.9 \pm 4.23^*$	$365.5 \pm 7.6^*$	$275.6 \pm 4.4$	$< 0.001$
sTfR, mkg/ml	$1.37 \pm 0.47$	$2.66 \pm 0.40^*$	$1.38 \pm 0.02$	$< 0.05$
sTfR/log Ft index	$0.867 \pm 0.19$	$2.256 \pm 0.16^*$	$0.769 \pm 0.10$	$< 0.001$

P — reliability of the differences between the examined groups; \* — to control ( $p < 0.05-0.001$ ).

With the general deficit of iron, the lowest Serum iron values were noted among the children with *nRA* ( $4.67 \pm 0.86$  mkmol/l). Patients with *RA* had Ft amount more than 3.9 folds higher than the similar value of other examined children ( $p < 0.001$ ). In contrast the amount of Tf in that group of the children was decreased to  $166.9 \pm 4.23$  mg/dl, while in the group of children with *nRA* it was increased to  $365.5 \pm 7.6$  mg/dl (and in the control  $275.6 \pm 4.4$  mg/dl,  $p < 0.001$ ). The similar tendency was noted in the alterations of sTfR and sTfR/log Ft index. While the parameters of the category of children with *RA* were closer to the control values and statistically did not differ, in the group of the children with non-refractory anemia these parameters were significantly increased (sTfR — up to  $2.66 \pm 0.40$  mkg/ml and sTfR/log Ft index — up to  $2.256 \pm 0.16$ ). The assessment of sTfR/log Ft index testified that children with CHB and *nRA* had “true” iron deficit, while the patients with *RA* were sub-divided differently. Generally, if the average level of sTfR/log Ft index was equal to  $0.867 \pm 0.19$ , in the individual analysis in 61.9% cases sTfR/log Ft index was  $< 1$  (absence of the deficit of iron), in 16.7% cases — in the range 1–2 (latent deficit), and in 21.4% cases  $> 2$  (true iron deficit). Taking into account the current situation, we can

conclude the necessity of sTfR/log Ft index determination in children with *RA* for the definition of iron deficit degree and, respectively, prescription of differential approach to the therapy of patients with CHB.

When we considered the parameters of hepcidin, its level was ambiguous, namely it was decreased to  $28,680 \pm 0,63$  in group of children with *RA* and was increased to  $56,367 \pm 1,6$  in group of children with *nRA* (and in the control  $39,401 \pm 6,5$   $p < 0.001$ ). If we take into account that hepcidin is a protein consisting of 25 amino acids, synthesized in hepatocytes under the influence of metriptase enzyme [2; 3; 4], and the majority of the patients with *RA* had expressed activity of CHB, we can explain its low amount in blood.

Among the other laboratory values the most informative for the patients with CHB and *RA* were ones of common blood analysis such as anisocytosis (80.9%), poikilocytosis (73.8%), and decrease of the percentage of erythrocytes Hb saturation below 0.7 (57.1%,  $p < 0.05$ ).

Testing the systemic inflammatory markers in that category of children revealed high values of the parameters in refractory progressing of anemia (fig.2).

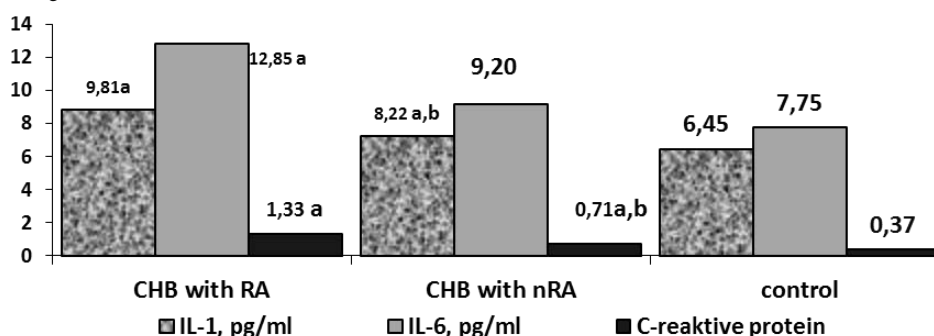


Figure 2. Markers of systemic inflammation in children with CHB and concomitant anemia  
a — reliability of the differences to the control; b — between the checked groups ( $p < 0.05-0.01$ )

The average level of interleukin-1 was raised in both groups with higher levels in children with **RA** ( $9,81 \pm 0,63$  pg/ml, against of the children with **nRA**  $8,22 \pm 0,43$  pg/ml,  $p < 0,05$  and the control  $6,45 \pm 0,34$  pg/ml,  $p < 0,001$ ). The same trend was the level of interleukin-6 corresponded to  $12,85 \pm 0,50$  pg/ml, with the total range of bordering values from 9.2 pg/ml to 16.5 pg/ml, and it was reliably ( $p < 0,05$ ) higher than the values of the children with **nRA** ( $9,20 \pm 0,43$  pg/ml), and the control ( $7,75 \pm 0,75$  pg/ml). Statistic difference between the latter was not determined ( $p > 0,05$ ). Similar tendency was registered in the values of C-reactive protein. Thus, with the general ranging from 0.45 to 1.86 mg/l, in children with **RA** the average amount was in the limits  $1,33 \pm 0,19$  mg/l, and it was significantly higher in comparison with children with **nRA** ( $0,71 \pm 0,14$  mg/l,  $p < 0,001$ ), and the control ( $0,37 \pm 0,10$  mg/l,  $p < 0,001$ ).

### Conclusion

By summerising obtained results, it could be stated that the contingent of the children with CHB, where the prevalence of anemia inflammation could reach 94.6%, deserves a special attention. According to our data, in the half of cases (52.5%) there is development of refractory anemia, and it provides the basis for considering that nosology is progressing in children as one of the main factors of chronic viral liver pathology. So with superimposed **RA** the pathology proceeded more severe, and it was testified by prevailing of more marked forms of the disease (71.4%) with stable prevailing of asthenic-vegetative (95.2%), hemorrhagic (91.6%) syndromes and explicit hepatomegaly (59.5%). Among the symptoms, characteristic for the anemic process the accented ones were dizziness, acro cyanosis, and deformation of nails, chaps on fingers, and pagophagia.

The leading biochemical values of liver damage were the syndromes such as cytolysis with characteristic long-term hyperenzymemia, mesenchymal-inflammatory, and endotoxemia.

In the genesis of anemia development in CHB in children there are two pathogenetic variants of progressing. The first one was characterized by true iron deficit ( $sTfR/log Ft$  index  $> 2$ ) with layout of ferrokinetic markers, peculiar for iron deficiency anemia — rise of transferrin spectrum with decreased values of serum iron and ferritin; the second one — re-distributive of iron deficiency ( $sTfR/log Ft$  index  $< 1$ ), typical for hemosiderosis — rise of ferritin and decrease of transferrin value. The development of the second variant

characteristic for refractory progressing of anemia, evidently, should be considered as prolonged negative-stress-factor, leading to progressing severe CHB in children.

**RA** is characterized by high inflammatory index. Taking into account the toxic effect of the majority of pro-inflammatory cytokines on the synthesis of erythropoietin with further inadequate production of erythrocytes by bone marrow (increased destruction, shortening of life term, etc.), and in the conditions of hepatic pathology insufficient inducing its effect on the synthesis of hepcidin in hepatocytes, we can partially explain compatibility of severe forms of hepatitis with refractory progressing anemia. In our opinion, together with the increase of the pathologic activity as a result of a whole cascade of metabolic shifts with viral genesis, such as replication of viruses in cells of reticuloendothelial system, suppression of bone marrow blood production, hypersplenism, bleedings from various veins, hemolysis of erythrocytes, etc. [4; 10], finally there is exhaustion of compensatory-adaptation capabilities of an organism with transformation at the certain stage of the first mentioned mechanism of iron metabolism disorder in the second, and development of refractory progressing of anemia. For the detection of “true” iron deficiency, or redistributing genesis, additional ferrokinetic monitoring is required with application of diagnostic markers such as ferritin, transferrin,  $sTfR$ , and calculation of  $sTfR/log Ft$  index.

Thus, in pathogenetical field these alterations reflected virus-induced pathological stress-reactions, in the progress of which, as a result of various metabolic shifts, there was formation of damaging mechanisms; and, in the conditions of associate progressing, it promoted development of two parallel mutually deteriorating processes, which conditioned progressing of CHB. Taking into account the aforesaid, therapy of refractory forms of anemia in CHB in children is a complex problem demanding its solution. Unjustified prescription of the agents of iron in the **RA** therapy in children with CHB is not only ineffective, but also can cause harm to the patient such as decrease of antioxidant protection, immune suppression, generalization of bacterial processes, etc. [13; 19]. For the definition of optimal therapeutic routines of **RA** therapy during CHB in children we need prospective controllable studies with the account of the revealed pathogenetic schemes of anemia of inflammation development.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-93-98>

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## **Correlation of thyroidectomy difficulty scale with the time of an operation and its complications**

**Abstract:** The aim of the research was to evaluate the use of thyroidectomy difficulty scale (TDS) for its concordance, correspondence with operative time and correlation with complications. TDS can serve as a tool of forecast of operation difficulty.

**Keywords:** thyroid gland, thyroidectomy, difficulty of an operation.

### **Introduction**

Last century, thyroidectomy was associated with high mortality and frequent development of post-operative complications. Many medical specialists of that time started considering thyroid gland surgery as murderous, which led to the ban on its conduct because of high mortality.

With the improvement of notions of physiology and anatomy of thyroid gland, thyroid surgery has become much safer. Theodor Kocher

reduced mortality below 1% and received a Noble prize in 1909 for the promotion of thyroid surgery. Today, thyroidectomy is associated with almost zero mortality and extremely low incidence of disease, when it is performed by experienced surgeons [1]. Nevertheless, the complications of thyroidectomy can affect the quality of life. They include the damages of recurrent laryngeal nerve causing hoarseness and dysphagia, damages of parathyroid glands as a result of which, hypocalcemia and

post-operative bleedings develop. The incidence of damages of recurrent laryngeal nerve and hypoparathyrosis in the performance of qualified surgeons is less than 2% [2; 3]. The frequency of time complications is much higher and they differ depending on the volume of thyroidectomy, pathology and conduct of lymph node dissection. According to the data of publications, the frequency of transient hypocalcemia fluctuates from 7 to 38% [4; 5]. Surgeons operating on thyroid relate certain thyroid diseases to the more complex resection and high frequency of complications. They include thyroidectomy in Grave's disease, Hashimoto's thyroiditis, large goiters (struma magna) and widely invasive thyroid carcinomas [6; 7; 8; 9; 24]. For instance, the cases of temporary complications fluctuate from 12 to 38% in patients with AIT [7; 10] and from 11 to 28% [6; 11] in patients with Grave's disease. The frequency of complications, blood loss and duration of operation serve as surrogate of difficulty of the operation. Difficulty scales were also designed for other procedures, often as educational means [12; 13; 14]. The notion of difficulty of thyroid surgery in reference literature remains subjective and is limited with separate cases, opinions and operation technique [15; 16]. Traditionally, factors affecting the difficulty of thyroid surgery include: increase of vascularization, inflammation, porousness, fibrosis and big size of the gland [7].

Currently, unlike other kinds of operations, there are no scales measuring thyroidectomy difficulty. This requires more objective evaluation of difficulty and definition of factors of disease related to difficulty based on evidential data. The aim of the research was to evaluate the use of thyroidectomy difficulty scale (TDS) for its concordance, correspondence with operative time and correlation with complications.

## Methods

This prospective study was conducted at the Department of endocrine surgery of the Republic specialized scientific research center of endocrinology (Tashkent, Uzbekistan) in 2014–2015. A scale with six elements (points) (vascularization, porousness, mobility/fibrosis, gland size, displacement of trachea, retrosternal position) was used according to earlier designed scheme. 30-point TDS was used for the evaluation of each element on the scale from one to five (Fig. 1). After an operation, which involved two specialized surgeons, each of them filled in TDS privately. Participating surgeons had working experience from 15 to 30 years. Paired gaining of TDS points was compared with the help of Spearman's rank correlation coefficient and concordance was evaluated by Kappa parameter. Co-existing diseases of the patient, disease data and pre-operative laboratory results were obtained from the medical history. The data of operative time was obtained from the operative journal and was calculated as time from the cut to closing of the wound.

Compression symptoms included discomfort in the neck, dysphagia or respiratory symptoms. Complications included hoarseness, hypoparathyrosis and bleedings. Correlation between the operative time and TDS points were analyzed by linear regression. Binary comparisons were made with the use of Student's test,  $\chi^2$  test or Mann-Whitney test, where it was necessary. Multiple regression was used to evaluate the association of TDS points and other clinical data with the duration of the operation. All analyses were conducted with the use of STATA version 12.1.

Figure 1. – Thyroidectomy difficulty scale (TDS)

Thyroidectomy difficulty scale					
Patient's name					
Surgeon					
Date of operation					
Type of operation					
Vascularization	1	2	3	4	5
	Normal		Medium		Expressed
Porousness	1	2	3	4	5
	Easy to retract		Breaks easily, but retraction is possible		Impossible to hold with a clamp
Mobility/ fibrosis	1	2	3	4	5
	Easily lifted		Retraction by force is possible		Fixed, retraction is not possible
Gland size	1	2	3	4	5
	Normal		Higher than average		Big size
Displacement and narrowing of the trachea	1	2	3	4	5
	Not displaced	Displaced insignificantly up to 1cm without narrowing	Displaced with narrowing up to 1,5 cm		Displaced significantly, over 4 cm or narrowed, less than 1 cm
Retrosternal position	1	2	3	4	5
	Not retrosternal	Partially in retrosternal position	1/2 of the part of thyroid in retrosternal position	2/3 of the part of thyroid in retrosternal position	Entire thyroid in retrosternal position
Total points					
Difficulty of operation	Easy; Medium; Difficult; Very difficult				

## Results

### Pre-operative data

This study included 146 patients. Mean age of the patients was 39,5±11,8 years; 118 (80,8%) of which were women (Table 1). 11 (7,5%) were the smokers. As for thyroid pathology, nodal forms

were the majority: nodular goiter — 52 (35,6%), multi-nodular goiter — 22 (15%). Toxic forms, including several nosologies (Grave's disease, multi-nodular toxic goiter and mixed toxic goiter) accounted for 45 (30,8%), Hashimoto thyroiditis — 8 (5,4%) and thyroid cancer — 11 (7,5%); although, these groups couldn't not

be mutually exclusive (Table 1). Total 45 patients (37,8%) reported strangulated (compression) symptoms (Table 1).

**TDS points**

Mean average TDS point was 14,4 (range 6–30) (Table 2). Considering the point profiles of the patients with different thyroid pathologies, patients with hyperthyroidism, as a rule, gained higher points in vascularization (3,0±1,1). The highest total points (16±1,9) were gained by patients with multi-nodular goiters at the expense of high points of retrosternal position and displacement of trachea (2,6±1,3) (Table 2). In Hashimoto thyroiditis, as a rule, patients gained higher points in the category of fibrosis (2,6±1,1) (Table 2). Patients with hyperthyroidism had a higher median of points than patients with euthyroidism (14,1 against 10,1 p = 0,04).

Table 1. – Patients' data (n-119)

Age (years)	39,5±11,8
Sex (females)	118 (80,8%)
BMI	31,5±6,6
Smoking	11 (7,5%)
Co-existing pathology	42 (28,7%)
Cancer	11 (7,5%)
Recession	8 (5,4%)
Hashimoto thyroiditis	8 (5,4%)
Multi-nodular goiter	22 (15%)
Nodular goiter	52 (35,6%)
Grave's disease	17 (11,6%)
Multi-nodular toxic goiter	13 (8,9%)
Mixed toxic goiter	15 (10,2%)
Strangulated syndrome	45 (37,8%)

Table 2. – TDS points table

TDS indicator	Mean	SD
Hashimoto thyroiditis		
Vascularization	2,3	1,1
Porousness	1,7	0,8
Mobility/fibrosis	2,6	1,1
Thyroid size	2,1	0,9
Displacement, narrowing of trachea	1,2	0,6
Retrosternal position	1,8	0,9
Total	11,5	
Grave's disease		
Vascularization	3,0	1,1
Porousness	2,5	1,0
Mobility/fibrosis	2,2	1,0
Thyroid size	2,5	0,9
Displacement, narrowing of trachea	1,9	0,9
Retrosternal position	2,1	1,0
Total	14,1	
Multi-nodular goiter (including thyrotaxi-cosis)		
Vascularization	2,8	1,4
Porousness	2,4	1,2
Mobility/fibrosis	1,8	1,0
Thyroid size	3,0	1,4
Displacement, narrowing of trachea	2,6	1,2
Retrosternal position	2,6	1,3
Total	15,0	

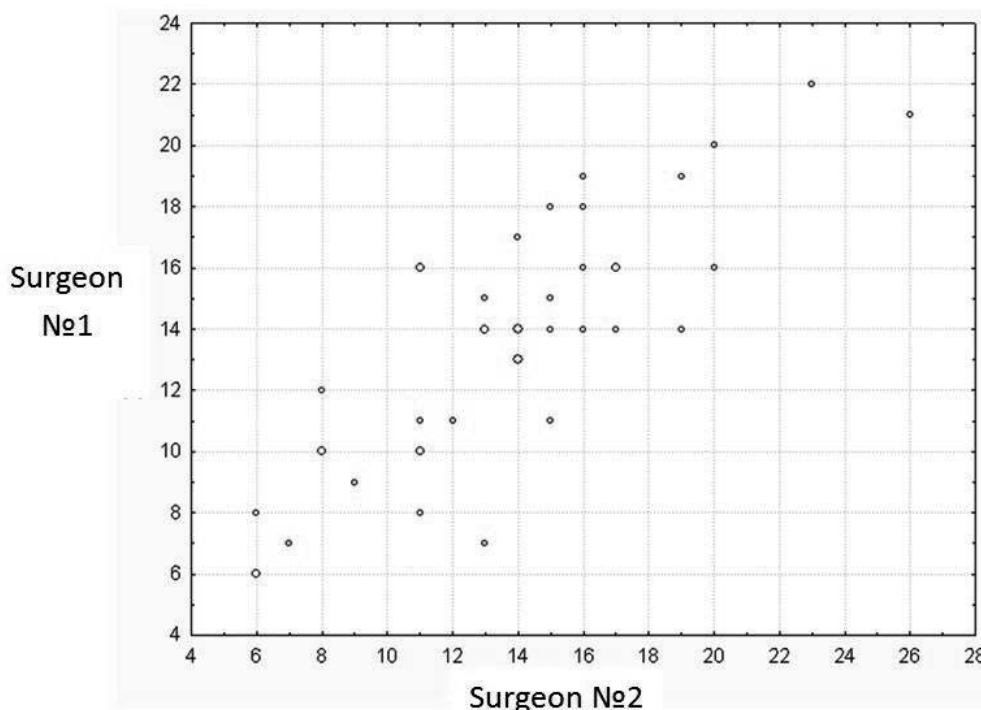


Figure 2. – Correlation between two surgeons according to total points

**Concordance**

For separate elements of TDS, exact concurrence between surgeons fluctuated from 62,2 to 73%. Concordance according to the Cohen's kappa (k) fluctuated from 0:44 to 0:59, and showed moderate and good concurrence between the surgeons (Table 3).

It is important to note that a concurrence is significantly better for every separate element of TDS (Table 3).

The points of two surgeons correlated well, even if they were not identical. Total points of both surgeons showed high degree of correlation (Spearman's rho= 0,82. P<0,001) (Fig. 2).

**Correlation with operative time**

TDS points demonstrated linear dependence with operative time ( $R^2 = 0.79$ ,  $p < 0.01$ ) (Fig. 3). Cases with the point  $> 13$  are 46,0% more compared with cases with the point  $< 13$  ( $p < 0.01$ ).

In case of a multiple regression analysis, TDS points are independently related to operative time considering other clinical and laboratory factors of the patients ( $p < 0.01$ ).

**Complications**

19 cases of complication were observed (19.3%). 6 (31,5%) patients showed transient hoarseness; 12 (63,1%) had transient hypocalcemia and 1 patient (5,2%) showed post-operative bleeding. Neither of these patients had constant complication. Patients, who experienced complications, had higher TDS points than the patients without complications (15 against 4,  $p < 0.01$ ). Step-by-step increase of the percentage of complications was observed at the increase of TDS points (Fig. 4). 88% of patients with complications had the level of points over  $> 15$ .

Table 3. – Concordance

TDS indicators	Concurrence (%)	Possible concurrence (%)	Concordance (k)	P
Vascularization	62.2	26.7	0.48	$< 0.01$
Porousness	62.2	32.5	0.44	$< 0.01$
Mobility	63.1	30.2	0.46	$< 0.01$
Thyroid size	68.9	24.1	0.59	$< 0.01$
Retrosternal position	73.1	23.2	0.64	$< 0.01$
Displacement of trachea	68.9	24.1	0.59	$< 0.01$

**Discussion**

TDS showed good concordance in different thyroid diseases. It should be noted that TDS points correlate with operative time and number of complications. Consequently, TDS can serve as a useful instrument for the identification of a patient and peculiarities of a disease related to the difficulty of thyroidectomy. This will allow further study of the factors contributing to the difficulty of operations. TDS is unique. There are several scales of difficulty of operations: laparoscopy, cataract removal operations, or aneurysms [12; 13; 17]. Reference literature has quite poor data on the difficulty of thyroid operations. Nevertheless, it includes multiple examples of every separate point that forms TDS with a single conducted research, where several components were studied together [20]. Thus, the use of potassium iodide (Lugol's solution) to reduce blood supply and porousness of thyroid in patients with Grave's disease is still discussed [18; 19]. Fibrosis, another TDS component observed in Hashimoto thyroiditis, contributes to the increase of frequency of complications, particularly, vocal cord paresis [7]. At last, a big size of thyroid contributes to the increase of frequency of complications, particularly, vocal cord paresis and transient hypocalcemia [10; 16]. Schneider et. al. included four components in his research: vascularization, porousness, thyroid size and fibrosis. In our research, we included two additional components (retrosternal position, displacement of trachea), which play important role in the difficulty of operation. The evaluation of difficulty is important. The difficulty may be evaluated intra-operationally or during post-operative period; a surgeon cannot use TDS as pre-operative tool of forecast as indicated by Schneider et. al earlier [20]. Pre-operative analysis of all these factors contributing to the difficulty of thyroidectomy will allow performing a more careful pre-operative preparation of patients with the analysis of risk of development of complications during intra-operative and post-operative period. To do this, we first need to perform an objective evaluation of difficulty during pre-operative period with all available means (physical method, instrumental method). This study supports the use of TDS as proved difficulty scale. The next step in this research will be to define pre-operative laboratory indicators, drugs, co-existing diseases and/or demography of patients to forecast difficult operations (high TDS points), consequently, with high risk of complications. Further study of the factors contributing to the difficulty of operations with the use of TDS may allow performing a more personalized evaluation of post-operative risks.

TDS factors in this research also correlated with operative time. If TDS can improve the understanding of certain factors contributing to the difficulty of operation, it can be used to forecast operative time. Further use of TDS can help reveal the cases, where more operative time and provision of this time is required. Since the degrees of difficulty of TDS and its points correlate with operative time and complications, further studies may use TDS points to identify patients and factors of the disease related to high difficulty (and, consequently, high risk).

Although, most reference literature on thyroid surgery uses operative time, blood loss and complications as difficulty substitutes [8; 18; 21; 22], these items alone cannot cover the entire notion of difficulty. For instance, Consorti et. al [23] considered the factors affecting operative time in total thyroidectomy. They discovered that such factors as thyroid volume or neck circumference tell about a very small difference in operative time. The increase of the size of thyroid is traditionally considered as factor contributing to the difficulty of operation. Although our TDS correlated with operative time, we tested TDS on different thyroid pathologies and correlation is better in more homogeneous group.

This study was conducted at a large specialized center. We acknowledge that certain levels in every category remain slightly subjective despite recommendations and examples for every level of points (Fig. 1). Since this cohort included cases where only two surgeons had at least 15 years of experience, this fact may provide preconceived evaluation in respect of more severe cases. TDS will be accepted in other institutions, if it is used for wide number of cases. The range of pathological processes and points presupposes that this group included a whole range of diseases and different levels of difficulty.

This questionnaire can be used in the forecast of difficulty and risk of development of complications during pre-operative period. For this case, all factors of the questionnaire should be studied more thoroughly with the use of additional laboratory-instrumental methods of diagnostics (for instance: MRT examination of the neck in the presence of such factors as retrosternal position of the thyroid or narrowing or displacement of trachea). During physical examination of thyroid, work experience of a person conducting the evaluation (endocrinologist, surgeon) plays important role in objective evaluation of such factors as porousness, mobility/fibrosis, gland size, displacement of trachea.



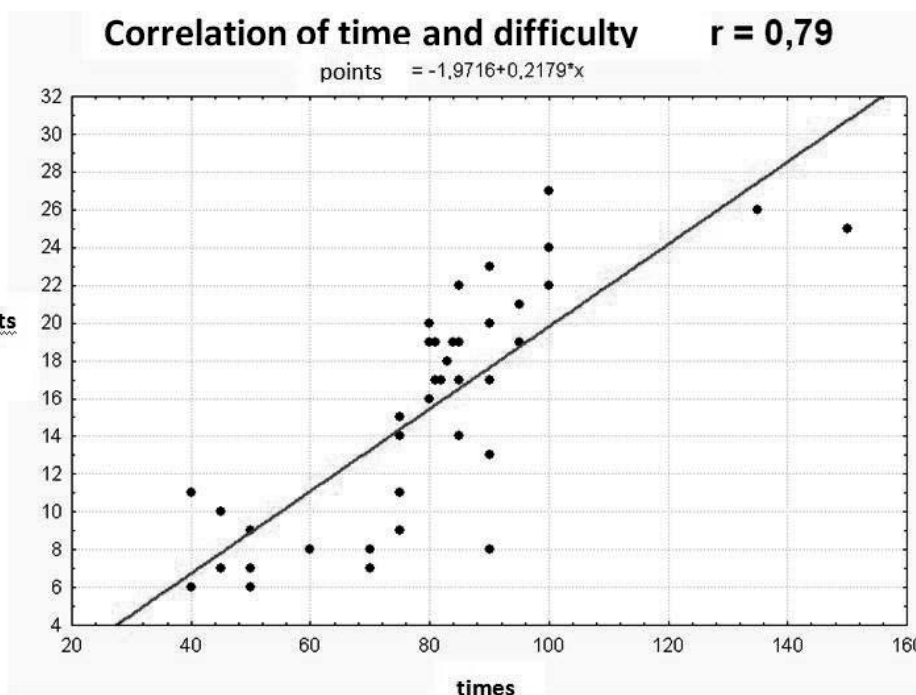


Figure 3. Correlation of TDS points with operative time. The dark line shows linear regression between TDS points and operative time

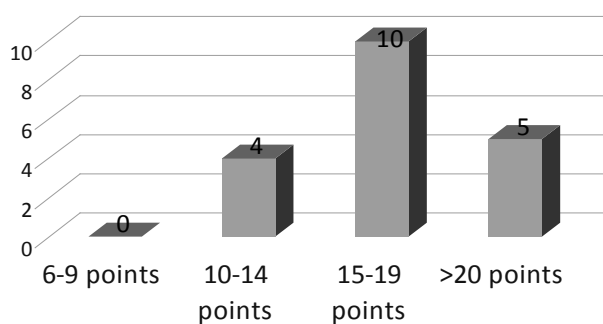


Figure 4. Correlation of separate groups of levels of TDS points with the number of complications

### Conclusions

TDS is a new tool with high degree of concordance for the evaluation of difficulty of thyroid operations. Correlation between the duration of an operation and point of difficulty of thyroidectomy was  $r=0,79$  ( $p<0,002$ ). Thus, TDS points correlated with operative time and complications ( $r=0,83$ ). 88% of patients with

complications showed the level of points over  $>15$ . Concordance between two surgeons was 68% ( $k=0,59$ ). TDS can be used during pre-operative period to forecast the difficulty of operation, which requires further wider study of TDS factors with the use of laboratory-instrumental methods of diagnostics.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-98-100>

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## Clinical aspects of zoonthropous microsporia in present — day conditions

**Abstract:** clinical features of microsporia in children were studied in up- to- date conditions. Typical clinical picture of microsporia of hairy part of the head and smooth skin was revealed in 185 (84%) patients. Atypical forms of microsporia made up 35 (16%) patients. Atypical forms of microsporia are divided into trichophytoid, infiltrative-suppurative, psoriasis form and seborrheic forms.

**Keywords:** microsporia, atypical forms, children.

Microsporia or ringworm are the most common diseases with mycotic etiology in pediatric practice [2; 8]. Microsporia- a fungus disease from the group of dermatophyte, which is common in man and in animals. It affects the skin and hair, eyebrows, eyelash and lanugo of smooth skin [2; 3]. Analysis of registration of morbidity by the Republic for the last 5 years showed, that the growth of intensive index from 1,3 (in 2009) to 2,6 (in 2013) to 100 thousand population [1] was noted. Alarm condition is still among children contingent by the morbidity with microsporia. So from general number of patients with microsporia children under 18 made up in 2009 – 61,5%, in 2010 – 63,7%, in 2011 – 61,5%, in 2012 – 59,8%, in 2013 – 58,9% [1; 5]. 20-fold growth of microsporia in newborns was marked by the data of literature for the last 20 years. Mycosis has a high contagiousity and in children it may proceed as epidemic outbreak [4; 8]. The main source of infection is cats, mainly stray ones.

Infection occurs in the contact with sick animals or through subjects infected by their hair [3]. One of the reasons of the growth of morbidity with mycosis is impertinence of diagnostics of microsporia as a result of changes of epidemiology and clinics of infection in recent years [8]. In current conditions the clinical course of mycosis is different by significant polymorphism, increase the number of obliterated, subclinical and recurrent forms. Usual clinical forms of difficulties in diagnostics do not cause, but atypical manifestations of the disease may serve as a reason of diagnostic pitfall, irrational treatment, irregular conducting of antiepidemic measures [6; 7].

**The purpose of the work-** to study the clinical features of microsporia in children in current conditions.

### **Materials and methods**

220 children at the age from 2 months to 14 with microsporia hospitalized to the department of mycology of the RSSPMC of der-

matology and venereology of the Health Ministry of the Republic of Uzbekistan were under the observation. Of them 138 (62,7%) — male, 82 (37,3%) — female. The occurrence of morbidity was predominantly in patients at the age of 4–11, making up 65,3% from general number of patients. The duration of disease in 154 (75%) patients was from 2 weeks till 1 month, in 44 (20%) — made up 1,5–3 months, in 11 (5%) — 4–6 months, in 7 (3%) — from 7 months till 1 year and in 4 (2%) more than 1 year. Chronic duration of microsporia (from 4 months to 1 year), conditioned untimely diagnostics and irrational treatment was marked in 22 (10%) patients.

### Results and discussion

Microsporia of hairy part of the head was diagnosed in 100 (45,3%), microsporia of smooth skin — in 60 (27,3%), mixed form (hairy part of the head and smooth skin) — in 60 (27,3%) children. In 6 (9,7%) along with affection of hairy part of the head, the disease proceeded with involving in mycotic process of setaceous hair of eyebrow and eyelash. Typical clinical picture of microsporia of hairy part of the head and smooth skin was revealed in 185 (84%) patients.

For the typical clinical picture of microsporia of smooth skin caused by *Microspore* was typically appeared with sharply boundary spots, straitening oval or oval forms by size from 1,0 to 3,0–4,0 cm in diameter with clear boundary, slightly raised edges with presented, separate bladders, serous scabs, scales. Central part of pale — pink color with scaly peeling. On the hairy part of the head the single, big foci with straightening — rounded or oval shape in size from 2,0–4,0 to 6,0–8,0 cm in diameter, coating with grey asbestos shaped scales with obliterated inflammatory appearance of the skin were observed. In the nidus of affection of hair were broken to the level 5–8 mm. For the clinical pictures of microsporia caused by rusty *Microspore* the presence of more excessive eruptions which is localized on the edge zone of hairy part of the head with simultaneous affection of adjacent fields of smooth skin (forehead, temple and neck) was typical. By our data in recent years atypical forms of microsporia made up 48 (16%) patients. Atypical forms of microsporia are one of the causes of diagnostic pitfalls. Considering of microsporia the mycosis of childhood, specialist in skin and venereal diseases do not always carry out mycological examinations in adults.

It is possible to reveal these forms of disease by only complex mycological investigations (microscopy of pathological material, fluorescent and cultural diagnostics).

At present one of the typical epidemiological features of microsporia is acceleration of morbidity cases with mycosis among young children and in adults elder than 18.

Microsporia of children at an early age, including newborns (0–3 years old) was detected in 39 (13%) cases. If early classic clinical pictures of microsporia in children at an early age on hairy part of the head were the presence of single, big with wide peripheral surface, insignificant inflammatory effect, without broken of hair, torpid course, in our observations microsporia had the features of mycosis in children at elder age group.

At the same time on the hairy part of the head as a rule multiple erythematous- squamous foci with broken hair and typical whitish clutches are appeared. The nidus on the smooth skin usually has erythematous- squamous character, without specific platen, reminding seborrheic dermatitis or allergic eruptions. Microsporia of adults (18 years old and over than 18) — was observed in 22 (7,3%) cases. The foci of microsporia are localized on the trunk as erythematous- squamous eruptions reminding parapsoriasis, seborrheic dermatitis and not often the nidus of mycosis had the form “iris” or a symptom “ring in the ring” similar with rubromycosis of smooth skin. As a result of combing may be joined pyoderma, which intensifies

atypicalness of mycosis. In one case the nidus of microsporia was located in pubic zone and it remembered us the clinical picture of zooanthroposis trichophyte of this localization. All atypical forms of microsporia were divided into trichophytosis 19 (39,6%), infiltrative -suppurated — 21 (43,8%), psoriasis formed — 4 (8,3%), seborrheic forms — 4 (8,3%) patients.

Trichophytoid form of microsporia was diagnosed in 14 (39,6%), mainly this form was occurred in school children at an elder age with complicated allergic anamnesis (atopic dermatitis, allergic rhinitis, asthma). Loose, chronic course was specific for it with duration from 4–6 months to 1 year. At the same time the nidus of mycosis is localized on the hairy part of the head or boundary zones of forehead, temporal area and on the skin of the trunk. On smooth skin the nidus were presented by less peeling, unsharp inflammatory or hypopigmentation spots. The edges of the nidus of affection are fuzzy, outlines are indefinable. These forms of microsporia can be taken to seborrhea group, seborrheic — dermatitis, streptococcal impetigo, and pityriasis versicolor, chronic trichophytosis are necessary to differentiate.

On the hairy skin of the head such form appeared with diffuse or focal peeling, falling out and thinness of the hair, usually dull, broken in different levels. Later on may be developed deluted hair as rounded or bigger nidus with polycyclic contours.

Deep (infiltrative -suppurated) forms of microsporia were diagnosed in 15 (43,8%) patients.

Infiltrative -suppurative nidus of mycosis were big, confluent, rising over the skin with foci on the hairy part of the head. This is usually conglomerations from fused and suppurated painful follicles; perifolliculitis. Their surface was covered by rude purulent scabs with agglutinated hair. In removal of scabs and hair from openings of hair follicles the matter was discharged. In the nidus of affection of the hair were broken into different levels from healthy skin (4–5 mm) and they resembled the clinics of zooanthroposis trichophytosis.

Regional lymph — nodes were painful and extended. In patients expressed symptoms of intoxication were observed. On smooth skin the nidus were rounded form in size from 2,0x 3,0 cm in diameter to children palm with clear borders and distinctive peripheral wall containing from small micro vesicles and pustule. The affected skin in the nidus was swollen, infiltrated and hyperemic. The diagnosis of microsporia in this group of patients was determined after getting of fungus in culture.

Papula-squamous or psoriasis formed forms of microsporia was registered in 3 (8,3%) patients. Eruption as usual was located on the smooth skin, on the chest and lateral surface of the trunk. The nidus consisted of papule which were merged in the plague with polycyclic contours that in the surface were noted expressed peeling and a slight infiltration. On the hairy part of the head were single, big foci of straightly-rounded or oval contours in size from 2,0–4,0 to 6,0–8,0 cm in diameter, covered by grey asbestos form flakes with insignificant inflammatory process of the skin.

Erythematous — swollen or seborrheic form of microsporia was diagnosed in 3 (8,3%) children at an early age. Observations showed that the main cause of the development of this form was using of corticosteroid creams and as a result of untimely diagnostics of mycosis or self-treatment of patients. In these cases the foci of mycosis were localized principally on seborrheic zones of facial skin, shoulder, interscapular area and in the chest. The foci of affection on smooth skin in these patients were disseminated, multiple, small, bright — red color, round- oval sometimes irregular forms with sizes from 1,0–2,0 cm to 3,0–5,0 cm in diameter. In some foci the borders are fuzzy, peripheral walls are absent. Peeling with scale — scabs was observed on the surface of foci.

Such clinical forms of microspore can be accepted mistakenly for multiform exudative erythema, toxicodermia, pityriasis rosea of Jiber, allergic dermatitis, which it delays the term of establishment of diagnosis.

#### Conclusion

1. In the least suspicion to microsporia it is necessary to go to the specialist -dermatologist, which it allows to diagnose this

disease in a short time and to administer rational treatment in time.

2. Belated diagnostics and because of irrational therapy increases atypicalness of clinical manifestations leading to chronic course of mycosis and its dissemination. Such patients are the foci of unidentified infection and they increase unfavorable epidemiological condition.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-100-103>

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## The significance of inflammatory mediators in the clinical interpretation of patients with stable angina of II-III fc

**Abstract:** This article presents the results of a study on inflammatory mediators in patients with ischemic heart disease stable angina of II–III FC with postinfarction cardiosclerosis in anamnesis and without it. It had been found significant higher levels of CRP and pro-inflammatory cytokines IL-6 and TNF- $\alpha$  in patients with stable angina with postinfarction cardiosclerosis in anamnesis. The relationship between these indicators revealed according to the correlation analysis.

**Keywords:** ischemic heart disease, stable angina, postinfarction cardiosclerosis, inflammatory markers, cytokines.

**Topicality.** The cardiovascular disease for the past 50 years, firmly holds the primacy among the causes of death in the developed world [7]. The most common form of chronic ischemic heart disease (IHD) is stable angina (SA) [14]. The atherosclerosis of the coronary arteries is the pathological basis of coronary heart disease. The local and systemic signs of nonspecific inflammatory process in atherosclerosis observed at an early stage lesion of blood vessel walls. It is known that arteriosclerosis — is a chronic inflammatory process, and even at the early stages of atherogenesis — intra- and

extracellular lipid sediments and the formation of lipid spots inflammatory cells already present (macrophages and T lymphocytes) [2]. These cells, activating, secrete large amounts of cytokines, chemokines, and matrix metalloproteinases that cause the progression of atherosclerotic foci [2; 6].

Among the basic mechanisms of pathogenesis of atherosclerosis of arterial vessels the importance given to the inflammatory process, which, according to P. Libby theory, accompanies all its stages [10]. It is known that cytokines have regulatory multidirectional im-

act on the atherosclerotic process. Thus, pro-inflammatory cytokines (TNF- $\alpha$ , IL-1 $\beta$ , IL-6, IL-8) are considered as atherogenic and anti-inflammatory cytokines (IL-4 and IL-10)-like antiatherogenic mediators [9]. The major pro-inflammatory cytokines are TNF- $\alpha$ , IL-1 and IL-6, IL-8. The tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) — is a proinflammatory cytokine with expressed proinflammatory properties. It is playing a crucial role in the development of inflammation. It is an active participant in the immune response, is involved in regulation of cell apoptosis [12].

The IL-6 as a pro-inflammatory cytokine plays an important role in systemic inflammation, it is a major activator of protein synthesis of liver acute phase. According to the authors of [8], the content of IL-6 in the blood serum increases in obesity and atherosclerosis, and also shows the value of IL-6 as a predictor of the development of clinical manifestations of atherosclerotic vascular lesions in healthy individuals without any signs of the disease [13].

Also, the reality of atherosclerosis inflammatory theory is confirmed by the discovery in the blood of patients with cardiovascular disease elevated levels of systemic inflammatory response markers such as high sensitive C-reactive protein (hs-CRP) [5]. We detected a moderate positive association between CRP levels early and long-term risk of adverse outcomes in patients with ACS. Given that CRP studied as a marker of inflammation in IHD better than the other markers such as IL-6, TNF- $\alpha$ , fibrinogen, et al., Some may have a greater prognostic value [3; 4]. In connection with this, now is the urgent question of studying and comparing the predictive value of not only CRP, but also other markers of inflammation in patients with IHD.

**Purpose.** The study of inflammatory mediators in patients with IHD with SA of II–III functional class (FC), with postinfarction cardio sclerosis (PICS) and without it.

#### Materials and methods.

The study included 34 IHD patients with SA of II–III FC at the age of 23 to 70 years (mean age  $57,5 \pm 1,57$  years). Of these, 12 (35%) men (average age of  $56,8 \pm 2,1$  years) and 22 (65%) women (mean age  $58,9 \pm 2,1$  years). The duration of the disease IHD at the time of inclusion of patients in the study was an average of  $10,9 \pm 1,42$  years. Hypertensive heart disease was observed in history in 27 (79%) patients. Based on the clinical data, all patients were divided into 2 groups: the I group — consisted of 24 IHD patients with SA of II–III FC; The II group — was presented by 10 IHD patients with SA of II–III FC with PICS (the prescription of myocardial infarction  $\geq 6$  months or more). The diagnosis of SA

of II–III FC was verified according veloergometry, as recommended by the GFCF/WHO (2004), the classification of the Canadian Society of Cardiovascular Diseases (1989). The patients' gathering was carried out on the basis of the paid cardiology department of City Clinical Hospital № 7 in 2013. The diagnosis of myocardial infarction was established on the GFCF and ICD-10 recommendations, taking into account medical history, ECG, EhoCG. The control group consisted of 25 healthy individuals (men and women), mean age of  $56,2 \pm 1,53$  years.

The criteria for inclusion in the study were men and women up to 70 years; the presence of ischemic heart disease: stable angina of II–III FC confirmed clinically (the characteristic pain) and treadmill test data (segment depression  $ST > 1$  mm length  $> 0,08c$ ); the presence of myocardial infarction (patients of group II) — prescription of myocardial infarction  $> 6$  months, confirmed with the data of ECG and echocardiography (hypokinesia zones); informed consent. The study excluded patients with complex disorders of rhythm and conduction of the heart; chronic heart failure of III–IV FC (NYHA); acute myocardial infarction; Resting heart rate before treatment  $< 60$  beats per minute; renal and hepatic failure; thyroid dysfunction, diabetes mellitus type 2 in the stage of severe decompensation requiring insulin treatment; oncological and immunological diseases.

Immunological studies were performed in the laboratory of immunopathology and immunopharmacology of the Institute Immunology of the Academy of Sciences of Uzbekistan. The cytokines IL-6 and TNF- $\alpha$  were determined in serum by ELISA method using sets produced by "Vector-Best" LTD (Novosibirsk, Russia) on the enzyme immunoassay analyzer «StatFax — 2100» (USA). The statistic processing of the results was performed using Applied software for statistical data processing Statistica® version 6.0. The significance of differences between treatment groups was evaluated by Student's t test. Differences compared values recognized statistically significant at  $p < 0,05$ . The correlation analysis was held with the help of Spearman's coefficient calculation.

#### Results and discussion

Essential to the development of atherosclerosis and occurring on its basis of IHD is attached immunological reactions [12]. To evaluate the clinical significance of immune responses in the development of coronary artery disease were studied indicators hs-CRP, fibrinogen, leukocytes and ESR in IHD patients with PICS history and without it (figure 1).

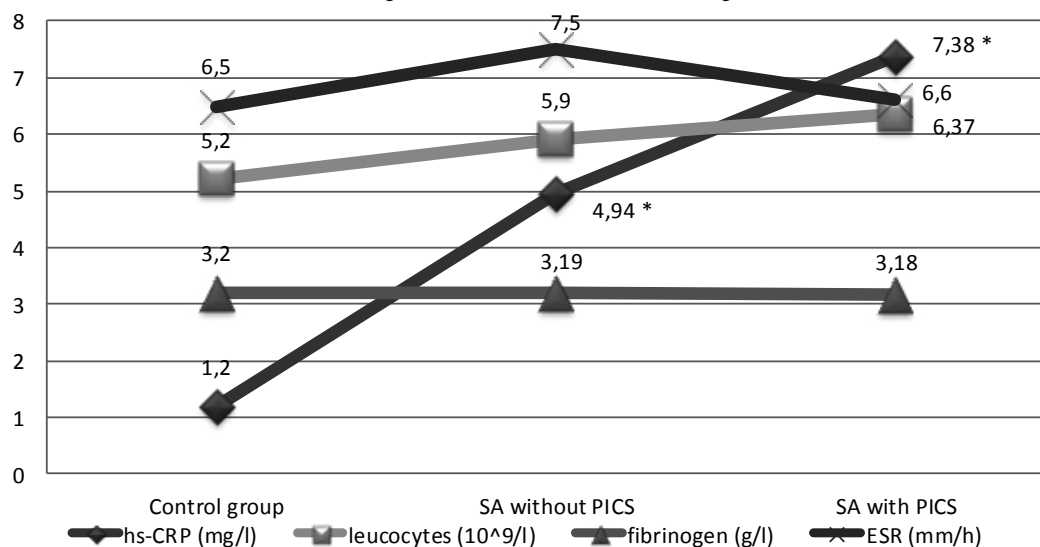


Figure 1. The level of inflammatory markers in patients with stable angina with the presence of PICS and without  $P < 0,05$  compared with the control group

The study of clinical and laboratory parameters in patients with SA showed that the level of hs-CRP in the control group was significantly lower than in the main group. Since the average value of hs-CRP in the control group was  $1,2 \pm 0,70$  mg/l, despite the fact that, in groups of patients with cardiovascular continuum on the background of PICS  $7,38 \pm 2,08$  mg/l, and in patients with cardiovascular continuum without PICS  $4,94 \pm 0,37$  mg/l. As can be seen, the largest index of hs-CRP was observed in the group of patients with SA with PICS, which significantly exceeded the level of hs-CRP in the control group to 6.15 times ( $p < 0.05$ ). It was also on the differences between hs-CRP groups: in the group of patients with PICS hs-CRP was increased in 1.5-times, compared with patients without it. According to a meta-analysis conducted by Li-ping H in 2010., Early CRP is a predictor of poor outcome in patients with ACS. We detected a moderate positive association between CRP levels early and long-term risk of adverse outcomes in patients with ACS. [11]. According to the results of our research important

clinical and diagnostic marker for coronary artery disease is the hs-CRP. Its level in patients with previous myocardial infarction was significantly higher compared to other groups, which confirms the relationship of CRP concentration to severity of angina.

According to received data level of white blood cells had no significant difference between the groups, but in the group of patients with SA with PICS noted most increased value of leukocytes. The Indicators of fibrinogen and ESR in patients with angina is not particularly differ from the control group data.

By the next step, we carried out the immunological characteristics of patients with SA with the presence PICS in anamnesis and without it. In the literature a lot of data on changes in IL-6 and TNF-alpha in patients with coronary artery disease, but so far there is no final opinion on the role of these cytokines and lacking the practical aspects of their interpretation. So we had the interest to study the IL-6 and TNF-alpha in patients with SA with the presence PICS anamnesis and without it (Table 1).

Table 1. – The level of pro-inflammatory cytokines in patients with stable stenocardia in combination with PICS and without it, M  $\pm$  m

	IL-6 (pg/ml)	TFN- $\alpha$ (pg/ml)
control (n=25)	3,42 $\pm$ 0,28	4,58 $\pm$ 0,81
Patients with IHD (n=24)	12,9 $\pm$ 1,19*	9,73 $\pm$ 0,63*
Patient with IHD on the PICS background (n=10)	15,42 $\pm$ 2,22*	11,43 $\pm$ 1,69*

*P < 0,001 compared with the control group.*

The Table 1 shows the mean value of IL-6 in control group was  $3.42 \pm 0.28$  pg/ml, while in patients without PICS it was  $12,9 \pm 1,19$  pg/ml. while in patients with a history of PICS presence it was  $15.42 \pm 2.22$  pg/ml. A significantly high level of IL-6 determined in angina patients compared with controls ( $p < 0,001$ ). Increasing the content of this cytokine in 4.5 times compared with the control group occurred in the serum of patients with SA of II–III FC amid myocardial infarction. In patients without a history of myocardial infarction IL-6 level was raised to 3.7 times compared with the control group. Comparing the two groups of patients with angina pectoris is observed between 1.2 times increase in patients with a history of presence PICS. By diversity cell sources and the target product of the biological action of IL-6 is one of the most active cytokines involved in the immune response and inflammatory reactions. According to the authors of [8], the content of IL-6 in the blood serum increases in obesity and atherosclerosis, and found an association of high concentrations of IL-6 with impaired contractile function of the heart in patients with chronic heart failure [15]. Our results are consistent with the literature, which was carried out the correlation between the performance of CRP, IL-6, TNF-alpha and the severity of coronary atherosclerosis as a result of coronary angiography.

The results of the study of pro-inflammatory cytokine TNF-alpha showed  $4,58 \pm 0,81$  pg/ml in the control group, in the group of patients with SA without PICS in anamnesis noted  $9.73 \pm 0,63$  pg/ml and higher the level observed in patients with the presence of a history of PICS, which amounted to  $11,43 \pm 1,69$  pg/ml. Determining the concentration of TNF-a in the serum of patients with coronary artery disease showed its significant increase in comparison with the control group ( $p < 0,001$ ). For example in patients with SA without PICS level of TNF-a has been increased by 2.1 times, and in patients with previous myocardial infarction greater than 2.4 times compared to the control group. A comparison group of SA between them there was an increase of 1.17 times in patients with a history of PICS. TNF- $\alpha$  is synthesized primarily in monocytes and mac-

rophages, as well as in mast cells, fibroblasts, endothelial cells. It stimulates the expression of interleukin-1 $\beta$  production, IL-6, IL-8, also affects the functional properties of the endothelium to affect coagulation gives lipid metabolism by stimulating the processes of atherogenesis [12]. We found that IHD patients with SA of II–III FC significant largest increase in TNF- $\alpha$  observed in patients with PICS.

Therefore, the immunological characteristics of patients, showed that the presence of IHD with preserved PICS high importance not only of clinical laboratory parameters of inflammation, and immunological inflammatory mediators. Comparison of IL-6 and TNF-a in the groups of patients with coronary artery disease showed a significant higher their content in patients with SA and myocardial infarction.

In the correlation analysis, which was conducted in patients with SA postinfarction cardiosclerosis, was revealed a direct significant relationship between indicators of IL-6 and TNF-a ( $r=0,6$ ;  $p < 0,05$ ), IL-6, and erythrocyte sedimentation rate ( $r=0,6$ ;  $p < 0,05$ ) and inverse relationship between indicators of fibrinogen and TNF- $\alpha$ ; and hs-CRP and fibrinogen ( $r = -0,57$ ;  $p < 0,05$ ,  $r = -0,8$ ;  $p < 0,01$ , respectively). In the group of patients with stable stenocardia A significant positive correlation relationship between indicators of IL-6 and fibrinogen ( $r=0,47$ ;  $p < 0,05$ ). Also were found on the average power of the inverse correlation between IL-6 and hs-CRP ( $r = -0.5$ ), but it was not accurate  $p > 0.05$ .

### Conclusion

1. Studies showed activation of proinflammatory cytokines in the group of patients with stable angina of II–III FC with PICS and the group without a history of PICS, but reliable high value identified cytokine status in patients with PICS.

2. Also, a high degree of inflammation in patients with stable angina PICS history (the level of hs-CRP, IL-6 and TNF-alpha, and others.) Than in patients without PICS characterizes the level of CRP, which was significantly higher in the group of patients with stable stenocardia of II–III FC with previous myocardial infarction.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-103-105>

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## Use of essential Forte n in complex treatment of Antiphospholipid syndrome in women

**Abstract:** Research of autoimmune response impacts (formation of antibodies to certain proper phospholipids) on implantation, growth, fetal and fetus development processes, gestation course and outcome of labor is taking on special significance in studying function of immune-associated processes and in pathogenesis habitual noncarrying of pregnancy.

**Keywords:** Antiphospholipid syndrome; Reproductive losses; Autoimmune response; Essential's phospholipid.

**Introduction:** Obstetric complications developing at antiphospholipid syndrome are serious medical-social problem. Seeking of the treatment methods sets conditions for urgency of the article reviewed. Essential forte N is widely applied for treatment of women with reproductive losses and coagulation system changes. However mechanism of action of preparations containing proteolytic enzymes is unclear, there are no well-grounded indications for their application and objective monitoring of treatment efficiency [1; 2; 3].

Antiphospholipid antibodies have multifarious influence on haemostasis system by damaging its entire protective links: endo-

thelial barrier, function of natural anticoagulants, and endogenous fibrinolysis by activating platelet link of haemostasis and procoagulant factors.

At present specialists of all medical sectors are involved in studying of APS. It's time to apply this knowledge in interpretation of diversified clinical picture of APS, studying critical conditions, recurrent thromboses which contribute to progress of obstetric and perinatal complications [2; 4; 5].

As far as pregnancy progression with diseases proceeding with haemostasis system disturbance the risk of blood clot development in vessels of placenta, fetus, maternal body increases.

Research objective was in clinico-laboratorial evaluation of Essentiale forte N drug impact in APS in women with reproductive losses of Ferghana Valley (Andijan, Ferghana and Namangan regions of Uzbekistan).

### Materials and methods

Data of 43 women in the non-pregnancy state with reproductive losses (RL) in past history with revealed APS (main group) had been studied by us. Main group was divided into two groups depending on treatment. The study included only women with the Fergana Valley: Andijan, Namangan and Fergana regions the Republic of Uzbekistan. In group I (n = 20) the patients had received conventional anticoagulant, antiaggregant and antioxidant therapy. The patients of group II (n = 23) in addition to conventional therapy had received preconceptively Essentiale forte N (manufactured by sanofi aventis, Germany) at course dose in 1 tablet 10 t.i.d. within 1 month prior to estimated pregnancy with further maintaining dose depending on haemostasis indices over a period of pregnancy and enzymatic preparation Serrata. Essentiale forte H does not have teratogenic effect; it has fibrinolytic, anti-inflammatory and anti-edematous activity as well as regenerates microcirculation and oxygenation of tissues.

It is known that a surfactant substance vital to lung by more than 80% of the EFL; however the drug promotes the formation of normal lung tissue and preventing distress syndrome in newborns. Timely application of EFL in complicated gestation removes lipid metabolism — one of the factors in the development of malnutrition and fetal hypoxia. Choosing Essentiale forte N is based on its ability to influence hemocoagulation, blood rheology due to the effect on the endothelium of blood vessels, preventing the development of obstetric complications. Distinctive qualities of the mechanism of drug action are the ability to have an impact on blood flow in the mother-placenta-fetus, then when a number of drugs affect only the mother-placenta or placenta-fetus. It is possible to ensure optimal conditions for placentation, development of the ovum and embryo prevent placental abnormalities.

Control group (III) was comprised of 10 women (n = 10) with physiologically proceeding pregnancy and without APS at the same terms of gestation. Groups were comparable by age, number of ges-

tation and childbirth in past history. Determination of lupus anticoagulant (LA) in plasma had been carried out with 6–8 weeks interval according to Scientific and Standardization Committee of International Society on Thrombosis and Haemostasis since LA determination according to literary data in 75 per cent of cases is reliable while the concentration of anticardiolipin antibodies is reliable only in 65 per cent of cases. Basis of test on LA (lupus-test) was taken its property to inhibit phospholipids by extending the coagulation time in APTT tests, the dilute Russell's viper venom time, PT and the activated recalcification time.

Diagnosis of thrombophilic state of the blood was included determination of platelet aggregation: detection of fibrin monomers soluble complex concentration (FMSC), D-dimer (fibrin polymerization). Determination of the main links of haemostasis system before and after treatment that included the following parameters: prothrombin time (PT, s), International Normalized Ratio (INR, units), Prothrombin Index (PI,%), Activated Partial Thromboplastin Time (APTT, s), Fibrin Monomers Soluble Complex (FMSC, mg/100 ml), Fibrinogen (g/l).

All observations had been carried out on the basis of central research laboratory (CRL) of the Andijan State Medical Institute.

Findings had been exposed to statistical data processing on personal computer Pentium-IV by means of Microsoft Office Excel-2003 software package including use of embedded functions for statistical manipulation.

### Results and their review

Activation of plasmatic links of haemostasis system had been observed when compared indices of haemostasiogram before treatment of women with RL caused by APS as compared with control group (table 1).

Study of haemostasis system shows general trend to hypercoagulation of procoagulant link. Trend to extension of APTT is observed in patients from group I for 1.4 times as compared with control group while in group II for 1.2 times when plasma procoagulant activity was evaluated. Parameters of D-Dimmer indices in both groups were higher for 5 times. However, other indices were also higher in patients of the main group as compared with control group.

Table 1. – Parameters of haemostasis system indices in women with APS before treatment

Index	n=23	n=20	n=10
PT. s	19.96±1.09****	19.9±0.25***	17.5±0.42
INR. unit	1.15±0.09*	1.23±0.01****	1±0.02
PI.%	102.65±3.38****	107.25±0.63**	94.1±1.30
APTT. s	37.52±1.42***	44.6±0.50***	31.9±0.56
FMSC. mg/100 ml	4.93±0.30***	5.85±0.14****	3.93±0.08
Fibrinogen. g/l	3.07±0.19	3.43±0.13*	3.0±0.13
D-Dimmer. mg/ml	1164.35±104.52***	1342.5±35.98****	233.3±22.57

\* – reliable  $P<0.1$ ; \*\* –  $P<0.01$ ; \*\*\* –  $P<0.001$ ; \*\*\*\* –  $P<0.02$ ; \*\*\*\*\* –  $P<0.002$ ; \*\*\*\*\* –  $P<0.05$  as compared with control group.

Laboratory test values of groups I and II had been compared with control group (table 2) after completion of therapy course.

Table 2. – Parameters of haemostasis system indices in women with APS after treatment

Index	n=23	n=20	n=10
PT. s	16.04±0.53	19.65±0.43****	18.5±0.42
INR. unit	0.92±0.03	1.18±0.01***	1±0.02
PI.%	77.26±1.63**	105±0.81***	94.1±1.30
APTT. s	32.48±1.37	43±0.63**	31.9±0.56
FMSC. mg/100 ml	3.47±0.13*	5.5±0.16**	3.93±0.08
Fibrinogen. g/l	2.98±0.2	3.13±0.14	3.0±0.13
D-Dimer. mg/ml	240.13±21.63	1305±38.79**	233.3±22.57

\* – reliable  $P<0.01$ ; \*\* –  $P<0.001$ ; \*\*\* –  $P<0.002$ ; \*\*\*\* –  $P<0.05$  as compared with control group.



Number of distinction had been detected in surveyed patients during evaluation of haemostasiogram indices first of all in platelet link. Indices were acquired values to be typical for physiological gestation. It should be noted that normalization of these values occurred faster in surveyed group II as compared with surveyed group I. Markers of thrombophilia became normal values faster in women from group II in relation to control group than in women from group I respectively.

Thus, conducted therapy with Essentiale forte N was conducive to haemostasis. Conducted researches confirm the safety of application. Elevation of D-Dimmer and FMSC levels is the reflection of haemostasis system since such factors in APS and thrombophilia are elevating long before estimated pregnancy and markers of such processes.

If to take into account that increase in coagulation potential is an adaptive response for haemostasis system during physiologically proceeding pregnancy then thrombophilic type disturbance of gestational adaptation to be observed in APS often points to advisability to study of coagulation system and devise of preconceptive therapy long before the estimated pregnancy.

Enabling the use of Essentiale forte N in the complex therapy of women with APS promotes bringing the pregnancy to term. The most effective application of the methodology in the pregravid period, it reduces the incidence of miscarriage, intrauterine growth retardation, perinatal morbidity and mortality.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-105-108>

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## Assessment of functional status cardio-vascular system in pregnant women with obesity

**Abstract:** 124 pregnant women at the age from 23 to 28 years old in gestation periods of 37–39 weeks have been examined with the aim of investigation of hemodynamic status of pregnant women with obesity. All examined patients have presented in 6 groups. In all observed patients pregnancy, according to the consultations of obstetric-gynecologists, was accepted as uncom-

plicated. Groups were identical due to age and gestation periods, differences consisted only in body mass and body mass index (BMI). The degree of obesity has assessed according to body mass index. The carried out investigation showed that overweight as far as its progression has a very unfavorable influence for hemodynamic and functional status of cardio-vascular system in general. The most significant disorders of the functional status of cardio-vascular system have been taken place for the obesity of II and III degrees.

**Keywords:** pregnancy, obesity, hemodynamic.

**Introduction.** It is generally known that overweight in pregnancy as far as its progression leads to the disorders of the basic system of life support, and in the first place cardio-vascular system [1–6]. Also it is needed to note that pregnant women with obesity have been presented the group of high risk for the development of preeclampsia, so far as disorders of macro- and microcirculation have a leading role in the development of such pathology [7–11]. In this connection the study of hemodynamic status in pregnant women with obesity is gained special importance for preparation to delivery, determination of orientation of drug treatment and selection of rational method of manual of anesthesia.

**The aim of investigation** was to study of the status of cardio-vascular system in pregnant women with obesity of the different degrees of significance in the gestation periods of 37–39 weeks.

**Material and methods of investigation.** 124 pregnant women at the age from 23 to 28 years old in gestation periods of 37–39 weeks with obesity of different degrees of significance have been examined in order to study the status of cardio-vascular system. All examined patients have presented in 6 groups. 19 somatically healthy not pregnant women with body mass index (BMI) of 19–24,9 kg/m<sup>2</sup> have been consisted in the first group and relatively healthy pregnant women with normal weight (BMI — 19–24,9 kg/m<sup>2</sup>) have been consisted in the second group. Patients with overweight and obesity have been consisted in the third, fourth, fifth and sixth groups; their BMI were respectively 25–29,9 kg/m<sup>2</sup>, 30–34,9 kg/m<sup>2</sup>, 35–39,9 kg/m<sup>2</sup> and  $\geq 40$  kg/m<sup>2</sup>. Groups were identical due to age and gestation periods; differences consisted only in body mass and BMI which allowed us to make its objective and comparable assessment.

In all observed patients pregnancy, according to the consultations of obstetric-gynecologists, was accepted as uncomplicated.

The degree of obesity has determined according to body mass index (BMI) [3, 11]. According to BMI in somatically healthy not pregnant women (n=19) it was from 19 to 24,9 kg/m<sup>2</sup> (normal body mass, the 1<sup>st</sup> group); in relatively healthy pregnant women (n=21) it was from 19 to 24,9 kg/m<sup>2</sup> (normal body mass, the 2<sup>d</sup> group); in the 3<sup>d</sup> group of patients BMI was from 25 to 29,9 kg/m<sup>2</sup> (n=21), (overweight); in the 4<sup>th</sup> group of patients BMI was from 30 to 34,9 kg/m<sup>2</sup> (n=21), (I degree of obesity); in the 5<sup>th</sup> group of patients BMI was from 35 to 39,9 kg/m<sup>2</sup> (n=21), (II degree of obesity) and in the 6<sup>th</sup> group of patients BMI was  $\geq 40$  kg/m<sup>2</sup> (n=21) (III degree of obesity).

Central hemodynamic was studied the method of echocardiography with the use of ACCUVIXQX, Medison (Japan) apparatus and TRITON (Russian Federation) monitor.

Impact (II) and cardiac indexes (CI), general peripheral vascular resistance (GPVR) and the index of left ventricular capacity (ILVC) have been calculated [15].

Central hemodynamic has differentiated due to the following types: hyperkinetic, eukinetic and hypokinetic. Blood pressure (BP), heart rate (HR), respiratory rate (RR) and blood saturation by oxygen (SpO<sub>2</sub>) were controlled with the use of Schiller-argus (Sweden) monitor. The mean dynamic pressure (MDP) was calculated, 6 minutes step test [10] and Shtange test [9] have been used in order to assess initial functional status of cardio-vascular system,

peripheral blood circulation was assessed by diuresis during hours or minutes and gradient of temperature ( $\Delta t$ ), presenting the difference between temperature of index finger of the hand and temperature of the eardrum area of acoustic meatus with using electro thermometer (Temp — 4) for it.

All numeral indexes received during investigation have been processed by the method of variation statistic with the use of Student criterion (with the use of Microsoft Office Excel program) and presented as  $M \pm m$ , where M was mean arithmetic value, and m was standard error. Differences in  $P < 0,05$  was considered as statistically reliable. The received results have been presented in the table.

**Results and discussion.** As you can see from the table in the gestation periods of 37–39 weeks hemodynamic indexes in pregnant women with normal body mass — 2<sup>d</sup> group (BMI — 19–24,9 kg/m<sup>2</sup>) corresponded to the standards which were characterized for healthy pregnant women of such gestation period [14]. All women of this group have eukinetic type of blood circulation, ILVC was  $0,58 \pm 0,005$  W $\times$ m<sup>2</sup>, CI was  $3,32 \pm 0,14$  l/m<sup>2</sup>/min, RR was  $19,2 \pm 1,2$  per minute, SpO<sub>2</sub> was  $98,4 \pm 0,6\%$ , diuresis during an hour was 0,82 ml/kg/h, gradient of temperature ( $\Delta t$ ) was  $1,29 \pm 0,08$  °C which were indirectly testified about quite satisfactory functional status of cardio-vascular system and its reserve possibilities, about effective oxygenation. During comparing the received results with such ones in somatically healthy not pregnant women with normal body mass (1<sup>st</sup> group) we have registered certain differences testifying about moderate changes in the system of blood circulation in pregnant women which it should be considered as process of adaptation of the human organism to the new conditions.

The differences between 1<sup>st</sup> and 2<sup>nd</sup> groups of patients were consisted in tendency in pregnant women of 2<sup>nd</sup> group to the frequent HR, increasing MDP and GPVR, reduction of the once and minute productivity of the heart. Some worsening of the results of functional tests with exertion in patients of the 2<sup>nd</sup> group has been taken into consideration (see table 1). At the same time all these changes did not have reliable character, because they did not overrun their physiological variations.

Increasing BMI until 25–29,9 kg/m<sup>2</sup> (overweight, 3<sup>rd</sup> group) at the same gestation periods concerning group of pregnant women with normal body mass has provoked moderately significant hemodynamic disorders — significant reduction of once and minute productivity of the heart and ILVC respectively in 16,5%, 13,9% and 6,9%. At the same time eukinetic type of blood circulation, adequate diuresis and blood saturation by the oxygen have been preserved. Indexes which are indirectly characterized functional status of peripheral blood circulation have been worsened —  $\Delta t$  was increased in 15,1%, diuresis per hour was decreased in 12,2%. Absolute mean arithmetic indexes of 6 minutes step test and tests with breath-holding were decreased in comparison with such indexes in healthy pregnant women (2<sup>nd</sup> group) respectively in 6,0% and 5,6%. However these changes did not have reliable character, normokinetic type of blood circulation was still preserved.

During comparing the received results with the appropriate indexes in patients with normal body mass we have made a conclusion that overweighs provokes a series of pathologic processes leading

to the moderately significant disorders of the functional status of cardio-vascular system and reduction of its productivity.

Increasing of BMI till 30–34,9 kg/m<sup>2</sup> (I degree of obesity, 4<sup>th</sup> group) was accompanied by reliably frequent HR in 8,0%, increasing MDP in 9,2% and also decreasing of CI, II, ILVC in 20,2%, 25,7% and 10,3% respectively concerning with group of pregnant women with normal body mass. It has been decreased the once and minute productivity of the heart,  $\Delta t$  has been decreased until 1,68±0,08 C° which testified about the worsening of the peripheral blood circulation. Diuresis during an hour is remained in the stable numbers and it is not reliably changed. Against this background RR is reliably more frequent until 23,9±0,4 per minute with simultaneously reduction of SpO<sub>2</sub> until 96,3±0,5%.

During comparison of the received results of the 4<sup>th</sup> group (I degree of obesity) with the 3<sup>rd</sup> group of patients (overweigh) it has been also noted progressive and reliable reduction of II, CI with simultaneously increasing of GPVR and  $\Delta t$ , also reliable worsening the results of 6 minutes step test and test Shtange in pregnant women with obesity (see table). We should note that in spite of have worsen functional status of cardio-vascular system as far as augment-

ing BMI in patients of 4<sup>th</sup> group normokinetic regimen of blood circulation has been preserved.

Increasing of BMI until 35–39,9 kg/m<sup>2</sup> (obesity of the II degree, 5 group) is accompanied by reliable reduction of II, CI, ILVC in 34,5%, 28,6% and 17,2% respectively concerning the pregnant women with normal body mass which testifies about forming of heart failure. At the same time MDP and GPVR were increased, HR was more frequent in 15,0%, 38,5% and 9,2% respectively. RR was more frequent in 26%. SpO<sub>2</sub> is corresponded to 95,6±0,4%. The above listed hemodynamic changes are accompanied by worsening signs of peripheral blood circulation — reduction of diuresis during an hour until 0,63±0,07 ml/kg/h and increasing of  $\Delta t$  until 1,84±0,06 C°. Indexes of the functional stress tests were progressively worsened, so, mean arithmetic absolute index of 6 minutes step test was reduced concerning the group of pregnant women with normal body mass in 30,3% and the result of Shtange test was 32,4%. It was planned a clear tendency of transformation of the eu-kinetic regimen of blood circulation in the hypokinetic type. It is needed to note that practically all our investigated parameters characterizing functional status of cardio-vascular system were reliably differed from 4<sup>th</sup> group of pregnant women with obesity of the I degree (BMI — 30,0–34,9 kg/m<sup>2</sup>) with clear tendency for worsening (see table).

Table. 1. – Functional status of system of blood circulation in pregnant women with normal body mass, overweigh and obesity in the gestation periods of 37–39 weeks

The studied parameters	Investigated groups of women					
	1 (n=19)	2 (n=21)	3 (n=21)	4 (n=21)	5 (n=21)	6 (n=21)
HR, per minutes	76,3±2,4	78,9±2,6	82,2±2,1	85,8±1,6 $\Delta$	86,9±1,8 $\Delta$	90,4±2,1 $\Delta$
MDP, mm. Hg	79,1±1,2	82,1±1,2	86,6±1,3 $\Delta$	90,4±2,6 $\Delta$	96,6±2,1* $\Delta$	101,6±2,8 $\Delta$
II, ml/m <sup>2</sup>	44,8±1,6	41,7±2,1	34,8±0,5 $\Delta$	31,0±0,4* $\Delta$	27,3±0,3* $\Delta$	23,4±0,4* $\Delta$
CI, l/m <sup>2</sup> /min	3,48±0,18	3,32±0,14	2,86±0,09 $\Delta$	2,65±0,06* $\Delta$	2,37±0,04* $\Delta$	2,18±0,04* $\Delta$
ILVC, W x m <sup>2</sup>	0,59±0,006	0,58±0,005	0,54±0,007 $\Delta$	0,52±0,005* $\Delta$	0,48±0,007* $\Delta$	0,47±0,008 $\Delta$
GPVR, dinxs/sm <sup>5</sup>	1127,5±54,2	1095,6±40,3	1293,9±55,8 $\Delta$	1476,2±64,3* $\Delta$	1781,9±70,4* $\Delta$	2159,3±70,3* $\Delta$
Diuresis during an hour, ml/kg/h	0,84±0,05	0,82±0,09	0,72±0,11	0,71±0,09	0,63±0,07 $\Delta$	0,61±0,08 $\Delta$
$\Delta t$ , B C°	1,12±0,09	1,29±0,08	1,52±0,07 $\Delta$	1,68±0,08 $\Delta$	1,84±0,06 $\Delta$	2,04±0,07* $\Delta$
Step test in m.	564,1±32,8	432,3±40,8	406,4±30,8	345,2±23,4 $\Delta$	301,4±12,4 $\Delta$	269,4±18,3 $\Delta$
Shtange test, per second	33,4±2,3	28,4±2,5	26,8±1,4	21,8±1,6* $\Delta$	19,2±0,9 $\Delta$	18,8±0,6 $\Delta$

**Note:**  $\Delta$  – reliability of differences ( $p < 0,05$ ) concerning group of pregnant women with normal body mass. \* – reliability of differences ( $p < 0,05$ ) concerning previous group of pregnant women with low BMI.

Increasing of BMI until 40 and more kg/m<sup>2</sup> (morbid obesity of the III degree, 6<sup>th</sup> group) was promoted to the progression of the signs of heart failure which have presented in reliable concerning patients of the 2<sup>nd</sup> group reducing of II, CI, ILVC in 43,9%, 34,3% and 19,0% respectively. Against this background MDP was increased in 101,6±2,8 mm.Hg., GPVR was 2159,3±70,3 dinxs/sm<sup>5</sup>, also significant tachycardia (HR — 90,4±2,1 per minutes) and tachypnea (RR — 24,9±0,2 per minutes) were observed. Reduction of blood saturation by oxygen (SpO<sub>2</sub> – 94,3±0,6%) and decreasing of diuresis during an hour are testified about the worsening of peripheral blood circulation. Hypokinetic regimen of blood circulation has taken place. The results of the received during performing functional tests have testified about dramatic reduction of adaptive possibilities of cardio-vascular system (see table).

The above listed allow us to conclude that overweigh as far as its progression renders extremely unfavorable influence for the functional status of cardio-vascular system and hemodynamic in general.

The most significant disorders of the functional status of cardio-vascular system have been taken place in obesity of the II

and III degrees. In such contingent of women, even in uncomplicated pregnancy to the gestation periods of 37–39 weeks it has been formed heart failure, hypokinetic regimen of blood circulation requiring individual approach to the prenatal drug preparation, periods and methods of delivery and methods of anesthetic manual.

#### Conclusions.

1. Overweigh as far as its progression renders extremely unfavorable influence for the functional status of cardio-vascular system and hemodynamic in general.

2. Increasing body mass index in pregnant women until 39,9 kg/m<sup>2</sup> concerning to pregnant women with normal body mass is accompanied by reliably significant reduction of impact index, cardiac index and the index of left ventricular capacity which testifies about decreasing once and minute heart productivity, forming of prerequisites to the development of heart failure.

3. Increasing of body mass index until 40 and more kg/m<sup>2</sup> is prerequisite to the development of heart failure which requires individual approach to the prenatal drug preparation, periods and methods of delivery and methods of anesthetic manual.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-108-110>

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## Evaluation of the results of surgical treatment of tuberculous spondylitis

**Abstract:** Using titanium autografts has high strength and plastic properties, wear resistance, quickly assimilated through ingrowth into the pores of the bone at the radical reconstruction operations in patients with spinal tuberculosis significantly improve the results of surgical interventions.

**Keywords:** tuberculosis spondylitis, anterior spinal fusion, extra pulmonary tuberculosis.

Currently, spinal tuberculosis is detected in the fuzzy and complicated stages of the disease and at the same time, the use of high-tech operations in the surgical treatment of complicated forms of tuberculosis spondylitis improve the results of therapy, will reduce the period of hospitalization [1; 3; 5].

The effectiveness of the treatment of tuberculosis of the spine is not high: healing observed in 36,5–69,5%; remission process — in 29,0–52,8%; disability — in 67–88,8% of cases [2]. In complicated forms of tuberculosis spondylitis celebrated the destruction of a large number of vertebral bodies with the emergence of large defects of the spine, filled sequester, cheesy masses, and spinal disorders with severe disorders of the spine stability and development of kyphotic deformation [2; 6].

At present various options anterior fusion with autograft and non-biological implant in complicated forms of tuberculosis spon-

dylitis can not completely solve the problem of the effective stabilization of the affected spine, which began to attach the recent important [4].

**Objective:** To study the effectiveness of the stability of the affected spine in the surgical treatment of patients with complicated forms of tuberculosis of the spine.

**Methods and scope of the study:** Spend analysis of data from 162 patients were treated Republican Specialized Scientific Practical Medical Center Phthisiology and Pulmonology complicated forms of tuberculosis of the spine. The disease — from 1 month to 1.5 years. The specific process is localized in the cervical region in 23 (14.1%) patients, the thoracic region in 44 (27.1%), lumbar spine in 60 (37.0%), the lumbosacral region in 31 (19.1%) patients. The diagnosis of complex clinical laboratory, bacteriological, histological and rentgenotomo-raficmethods. Methods of radiation survey in-

cluded: plain film all 100% of patients, 5 (14.2%) cases, the thoracic spine is made defeat contrast myelography, MRI performed in all patients with a magnetic field strength of 0.3 to 1.5 Tesla. Tuberculosis of the spine was diagnosed at later stages, which leads to serious complications. Destructive changes were extensive vertebral bodies until fracture of the vertebral bodies to form kyphosis (35.5%).

Preoperative preparation of 1 to 1.5 months, had a set of conservative, antibacterial, pathogenetic therapy in orthopedic operation. Depending on the timing of surgical interventions the patients were divided into 2 groups: group 1, 86 (53.1%) patients who underwent surgery performed within the first 3 months after the detection of the disease, 2-group 76 (46.9%) who underwent surgery performed in the later stages, for up to 1.5 years after the detection of the disease. The specific process of the spine in all cases was in the active stage. Men were 80 (49.3%), 76 women (46.9%). The isolated spinal lesion was observed. Defeat 2 or more vertebrae found 1 group — in 9 (62.9%), more than 3 vertebrae — in 4 (37.3%) and 2 patients — group — in 6 (60.0%) and 4 (40.0%), respectively. Kyphotic deformity of the spine is set in 7 (53.8%) patients in the 1 — group and 6 (60.0%) of 2-group paravertebral abscesses and sinter-sided — in 7 (53.8%) patients in the 1 — group and 6 (60.0%) of 2-group, double-sided —  $\gamma$ . When lesions of the cervical spine preoperative preparation of 1 to 1.5 months, had a range of antibacterial, pathogenetic therapy in orthopedic operation.

In patients with lesions of the cervical spine 2 or more vertebrae found 1 group — in 9 (62.9%), more than 3 vertebrae — in 4 (37.3%) and 2 patients — group — 6 (60.0%) and 4 (40.0%), respectively. Kyphotic deformity of the spine is set in 7 (53.8%) patients in the 1 — group and 6 (60.0%) of 2-group.

Upon successful resolution of the problems of radical remedial treatment of complicated forms of tuberculosis spondylitis may contribute to the development and Applications, wide surgical approaches to the spine, allowing to expose the vertebral body to a considerable extent and under visual control to make all optionally-sary surgical manipulation. When lesions of the cervical vertebrae was performed front-side access to the cervical spine. The main 1 group 13 (56.5%) patients with the aim of the affected spine plastics used titanium cage. 2-group, 10 (43.4%) autobone (ribs have — 25, from the wing of the ilium — 5 patients), taken during surgery.

In patients with lesions of the thoracic spine neurological disorders of radicular syndrome to profound paresis and plegia in violation of the pelvic organs were observed — in 30 (85.7%) patients. MRI examinations characteristic feature was an increased signal in the affected areas with the presence of pre, paravertebral and epidural abscess.

In 35 patients in whom the defeat thoracic department — in 15 (42.8%), mid-thoracic in 13 (37.1%), lower thoracic spine — in 7 (20.0%) patients. The specific process of the spine in all cases was in active stage. Related pulmonary tuberculosis in 4 (11.4%), pleural — in 3 (8.5%), and the ribs were 3 (8.5%) patients. surgical access transtorokal. At the same time, transtorokal access has created an opportunity to carry out under the supervision of visual manipulation throughout the thoracic spine, removal of purulent necrotic masses, resection of the affected spinal decompression of the spinal cord at the level of injury to the spinal fixation.

When lesions of the lumbar and sacral spine lumbar surgery departments carried out the conventional method. Front side, taking into account the localization of the abscess: the main group: surgical access for the purpose of abstessotomy (from m.psoas), necrectomy affected vertebrae with spinal cord decompression and revision of the dura mater, the elimination of kyphosis with fixation of the vertebrae. To gain access to the upper lumbar vertebrae perform

resection XII and, in some cases, XI rib. Preoperative preparation of 1 to 1.5 months, had a range of antibacterial, pathogenetic therapy in orthopedic operation. 1 groups 13 (56.5%) patients with the aim of the affected spine plasticity is-to use a titanium cage, the control group, 10 (43.4%) using autobone (wing of the ilium), taken during surgery. Defeat 2 or more vertebrae found 1 group — in 9 (62.9%), more than 3 vertebrae — in 4 (37.3%) and 2 patients — group — in 6 (60.0%) and 4 (40.0%), respectively. Unstable kyphotic deformity of the spine is set in 7 (53.8%) patients in the 1 — group and 6 (60.0%) of 2-group, sinter abscesses (m.psoas) unilateral — in 7 (53.8%) patients of 1 — and the group of 6 (60.0%) of 2-group. All patients were operational data are compared with the results of MRI.

Postoperative material studied Reference Laboratory of Republican Specialized Scientific Practical Medical Center Phthisiology and Pulmonology (caseation, pus) in 23 (100%) patients. Pure cultures were obtained using a solid medium Lowenstein-Jensen, followed by the study of drug sensitivity to a liquid medium-MGIT-960. In all patients, 35 (100%) histological diagnosis was verified, which is confirmed by a specific process in the spine.

**Results:** The analysis of the literature led to the conclusion about the presence of unresolved problems in the treatment of complicated forms of tuberculosis of the spine, such as: the absence of clear indications for surgical treatment techniques specific spondylitis with retaining structures and tactics developed their application in different phases of tuberculous spondylitis. The postoperative orthopedic operation on the background of anti-TB therapy was carried out immobilization of the affected card cervical collar soft (Schantz type) for 2–4 weeks. The range of treatments include massage and physiotherapy up to 3 weeks. After the operation, the formation of X-ray of the bone block in the affected vertebral level at 6 months in 11 patients (84.6%) of group 1, and 6 (60.0%) of the 2 groups. After 2 months at 10 (15.3%) of 1-group and (40.0%) of the 2 groups. Fixation of the cervical spine x-ray was carried out before the detection of bone block. All patients had relief of neurological symptoms.

Increasing variability of Mycobacterium tuberculosis has led to an increase in atypical forms and pathomorphosis clinical symptoms and rentgenotomografic thoracic spine tuberculosis, which is associated with the widespread use of antibacterial drugs. However, not always the X-ray and MRI picture of tuberculosis and tuberculosis of the spine is so pathognomonic to her in conjunction with clinical findings could build a proper diagnosis.

MRI in these cases allowed to find in different parts of the spine different in nature and degree of destructive changes, ranging from barely visible under X-ray foci research centers and to large bone cavities.

The postoperative orthopedic operation on the background of anti-TB therapy, taking into account the DST conducted immobilization of the affected department of the lumbar spine for 1.5 months. in group 1, two months in two patients. In both groups of patients assigned to pathogenetic therapy in the treatment of the complex include massage and physiotherapy up to 3 weeks. After surgery rentgenotomografic noted eliminate instability and the formation of the bone block in the affected vertebral level at 6 months in 11 patients (84.6%) of 1-group and 6 (60.0%) of the 2 groups. After 2 months at 10 (15.3%) of 1 — group, and (40.0%) of the 2 groups. Fixing a orthopedic splint of the lumbar spine was performed before the X-ray detection of bone block. All patients had relief of neurological symptoms.

Thus, currently the plastic compensation for defects, resulting in bone tissue after removal of the pathological focus, still remains a major problem and continue the study of the transplant,

the aim of the use of plastic material for specific lesions of the spinal column in the surgical treatment. Different versions of anterior fusion with allograft and autologous or non-biological implant in complicated forms of tuberculosis spondylitis can not completely solve the problem of stabilization of the spinal column.

**Conclusions:** 1. The bone graft is a biological material widely used plastic material purpose, but the drawback is that often by the

sword, with all their nonunion bed, festering, under axial load are more susceptible to deformation and reduces its stability.

2. The non-biological material, (Titanium mesh) have high strength and plastic characteristics, wear resistance has rapidly assimilated due to ingrowths into the pores of the bone tissue in radical — recovery operations in patients with spinal tuberculosis.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-110-112>

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## Upgraded approach and methods of use of modern theory comprehensive prevention programs dental caries in children

**Abstract:** Dental caries in children is a significant problem in all countries of the world, due to the trend towards an increase in the severity and frequency of disease. It should be noted that the widely used prevention programs have the potential to achieve positive changes in matters of dental caries prevention It is necessary to note that the implementation of the prevention program involves reduction of both dental caries and periodontal disease, reduce the incidence of tooth loss at a young age, which in turn implies an increase in the number of children and adolescents with intact teeth.

**Keywords:** dental caries, early childhood, prevention program.

Dental caries is currently the most common disease of mankind. As is well known problem of tooth decay and diseases it has a long history, which is due to the trend towards an increase in the severity and frequency of disease.

Widespread dental caries in children necessitates further improvement of effective and accessible public means of prevention of this disease, which is one of the urgent problems of modern dentistry.

Despite some progress caries prevention, recorded a high prevalence and intensity of dental caries, especially among children. Currently, there are many works on the prevention of dental caries in children. Despite the fact that gained a lot of positive experience in implementing advanced caries preventive measures, the level of dental disease according to WHO, is not reduced. The relevance of the development of prevention methods is also associated with a decrease in the volume of medical activities and as a consequence of material costs, as the cost of preventive methods is 20 times lower than the cost of treatment of diseases already developed.

Dental caries in children is a significant problem in all countries of the world, such an interest and the constant attention of the experts associated with the high prevalence of these diseases among the population. At the same time, the global dental practice

convincingly shows that preserve intact teeth and periodontal tissues is only possible through the introduction into the daily practice of the methods of prevention of dental diseases. However, many scientific works point to the low level of informativeness in prevention of dental diseases.

It is known that dental caries — a multifactorial disease characterized by pockets of enamel demineralization. The leading factor in the development of dental caries is the cariogenic microflora of the oral cavity, although the broader consideration of dental caries is a chronic infectious disease resulting from an imbalance of multiple risk and protective factors.

Another important factor in the pathogenesis of dental caries is a frequent use of carbohydrate. Rapid break down of these products to the final oral metabolites — lactic acid, acetic acid, propionic acid and others, is an important part in the occurrence of caries. Since they initiate demineralization of enamel.

In the etiology of dental caries Saliva plays an important role, which has a mineralizing, washing, cleansing and protective functions. Important for the mineralization of the enamel has a speed of salivation, saliva remineralization capacity and features of the mineral composition of dental hard tissues. It is known that dental caries is a result of imbalance in the system “tooth enamel — sa-

liva Violations of the structural properties of saliva begin already at its lightweight acidification (pH 6.2) as in those with minor carious teeth, and at high CPU and Composition. properties of saliva are also dependent on the level of non-specific resistance of the organism. Thus, people with low natural resistance to the body's formation of soft plaque is accelerated and it is dominated by cariogenic strains of streptococcus.

Among the oral flora, leading role to assign streptococci. Most dentists proved that *Str.mutans* *Lactobacillus* level and in the mouth, facilitate the spread of caries. The main factors that play a role in the development of dental caries in children is the structure of the teeth both in time and in a constant bite. The next link in the chain of development of dental caries is the formation of plaque, which is taking place in several stages. In step plaques mature plaque pH is lowered to 3.0–5.0 and with exposure *sosokunii* above described organic acid promotes the dissolution of the shell and causes *nemiikulornoy* enamel demineralization. These many references suggest that plaque is an important etiologic and pathogenetic links in the development of periodontal disease and tooth.

A large number of dental plaque is difficult to shoot with a yellowish hue is the first diagnostic sign of tooth decay in children. The purpose and objectives of preventive dentistry formulated WHO: elimination of the causes and development of diseases, as well as creating conditions for increasing the body's resistance to adverse environmental factors; reducing dental disease, reducing the prevalence and intensity of dental caries; increase in population with intact teeth; decrease in the percentage of persons who showed signs of periodontal tissue damage (reducing the number of sextants with bleeding, tartar and pathological pockets in the core age group in accordance with the index of needs in the treatment of periodontal disease); reducing the number of teeth at the age of 18, and the warning of this process in the population aged 35–44 years.

All measures aimed at improving the dental health of the population, are divided into primary, secondary and tertiary prevention: primary aimed at preventing the occurrence of dental diseases; secondary is the use of traditional treatments (dental health); tertiary focused on replenishing the lost function by using tools that replace the missing tissue and conducting rehabilitation patients as possible bringing their condition to the norm.

The leading component of prevention of dental diseases is oral hygiene. Massive population surveys conducted in recent years in all countries of the world, convincingly demonstrated the importance of this manipulation. It was found that dental caries and periodontal disease in humans, regularly cleaning the teeth, are much rarer.

Personal hygiene — regular and thorough removal of the patient dental plaque from the surfaces of teeth and gums by various means. Good cleaning of the teeth promotes the physiological process of "maturation" and the mineralization of the enamel, it improves its resistance to decay, resulting in the disappearance of "fresh" stains and chalk to 100% stabilization of the "old", causes an increase in calcium in the saliva. However, regular use of the known methods of oral care with the use of various means, even with good skills does not solve such a complex problem as the prevention of dental diseases. Professional oral hygiene conducted by specialists (dentist or dental hygienist), ensures complete removal of plaque, thus preventing the appearance of enamel demineralization.

Professional hygiene — a set of measures that eliminate and prevent the development of dental caries and inflammatory periodontal diseases by mechanical removal from the surface of the tooth above and subgingival dental plaque. Professional oral hygiene involves several steps: the patient's motivation to prevent dental diseases and

training of his personal oral hygiene; removal of supra- and subgingival dental plaque; polishing the tooth surface (including the root); addressing the factors contributing to the accumulation of plaque. It is known that the most promising and effective is a primary prevention, since it is designed to protect not impaired health, and prevent the occurrence of lesions in the oral cavity. For primary prevention methods include:

- balanced diet;
- Individual oral hygiene;
- Professional oral hygiene;
- The use of endogenous fluorine products;
- Use of means of the local prevention;
- Dental education of the population.

In conditions of high anthropogenic impact and sustained socio-economic changes in the formation and preservation of public health importance acquires the power factor, which the most sensitive to the child's body, which is in the stage of growth and development. Children should have their food at the same hours, at the same time you must also ensure the proper distribution of the daily caloric intake: breakfast — 25%; Lunch — 35–40%; lunch — 10–15%; Dinner — 25%. High-quality high-grade metabolism increases the body's resistance to adverse environmental factors.

It is known that fluorine compounds possess a pronounced caries preventive effect, the use of which can be divided into two main ways:

- I. System (endogenous) — delivery of fluoride in the body of water, salt, milk, as well as tablets or drops;
- II. Local (exogenous) — the use of solutions, gels, toothpastes and varnishes.

Widespread dental caries prevention methods based on the introduction of fluoride directly to the hard tissue of teeth. When using a local need to comply with the following conditions: the concentration of fluoride in water solutions must differ low concentration of fluoride in solution, which is particularly important. Apply 0.05, 0.1 and 0.02% freshly prepared solution of sodium fluoride. use plan: daily, 1 time per week, 2 times a month. Remineralizing solutions do not have a prolonged action, therefore developed specific mineral bearing compounds in the form of varnishes that can be retained on the tooth surface for a relatively long time. The optimum concentration of fluorine in the lacquer is 2.9–3.0%.

Dental education of the population is one of the main components of prevention programs should both precede and accompany the teaching of oral hygiene. An important role in maintaining dental health plays a personal responsibility of the patient as well as his own efforts can be very effectively implemented and 80% allow to keep your mouth healthy.

All methods used to educate the public, can be divided into the following: active — providing the interested public participation (lectures, information and propaganda speeches, collective and individual interviews, counseling, health lessons, games, quizzes, etc.) and passive — not requires the active participation of the population (popular scientific literature, leaflets, memos, sanitary papers, newsletters, posters, exhibitions, film shows and commercials).

Dental prevention programs are diverse in structure, and their implementation in practice depends on the economic possibilities of each individual region, the ethnic characteristics of the country and its epidemiological data. It is also known that the introduction prevention leads to a sharp decrease in the intensity of dental caries and periodontal disease, a significant reduction in the loss of teeth cases young age and increasing number of children and adolescents with intact teeth.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-112-114>

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## Impact of photodynamic therapy and CO<sub>2</sub> laser treatment on the planimetric figures of festering wounds in the experiment

**Abstract:**

**Objective:** assess the complex action of photodynamic therapy and CO<sub>2</sub> laser on planimetric figures purulent wounds in the experiment.

**Materials and methods.** purulent wound model reproduced in 80 male rats by MP Thick (2002) with some modification. Animals from the third day were divided into 4 groups: 1) 20 rats with physiological regeneration, 2) 20 rats with standard therapy, and 3) 20 rats PDT 4) rats 20 inclusion complex treatment with conventional methods, the CO<sub>2</sub> laser 3–4 times daily until the wound cleansing from necrotic raids and PDT. Studied plane geometry, healing time, peripheral blood counts and morphology of biopsies from the wound bed and the wall on the 1st, 3rd, 7th and 10th day of the experiment.

**Results.** Photodynamic therapy in a CO<sub>2</sub> laser complex was not sufficiently effective invasive treatment of purulent wounds and allows to recommend its use in clinical practice for the treatment of local purulent-destructive diseases of soft tissues. Complex application of PDT and CO<sub>2</sub> laser leads to an earlier cleansing from the pus, the active formation of granulation tissue and shortening deadlines complete epithelialization of the wound surface.

**Conclusions:** Complex treatment with CO<sub>2</sub> laser and photodynamic therapy is the most effective, as compared to other methods studied separately.

**Keywords:** purulent wounds, planimetry, laser, photodynamic therapy.

Despite the fact that the history of the issue of treatment of these pathologies has more than one decade, and to date has offered a large number of different methods, the problem of the effectiveness and speed of the results is still not resolved until the end. Bacterial contamination of the wound supports inflammation and slows down the course of reparative processes [1,4]. An unsolved problem is the resistance of pathogens to antimicrobial therapy and the problem of hospital infections. In this regard, continued development of alternative technologies and practices in the local treatment of infectious diseases of the skin and soft tissues of different etiology [3; 5].

To resolve this problem in recent years successfully used laser photodynamic therapy [5; 6; 9; 12]. Photodynamic therapy is a relatively new method of treatment of purulent diseases, and is currently PDT has a high potential for its application in many clinical areas. In sensitized cells and tissues its develops a photochemical reaction with the release of singlet oxygen free radicals and highly active biological objects existing detrimental, in particular on tumor cells, microorganisms, and etc. [2; 3; 8; 10; 11].

**Objective:** To evaluate the effect of a complex of photodynamic therapy and CO<sub>2</sub> laser on the dynamics of planimetric figures festering wounds in the experiment.

**Materials and methods.** For experimental researches were used 80 white mongrel male rats. Purulent wound model reproduces all rats as recommended by M. P. Tolstyh (2002), with the introduction of some modifications. In pre-depilated and twice treated with antiseptics skin site of femoralgluteal region with a diameter of 2.5 cm, was excised skin and subcutaneous tissue to the superficial fascia, crush injuries and underlying muscles region, injected the 24-hour suspension of the mixture of microbes (museum strains of Staphylococcus aureus and Escherichia coli), containing in 1 ml 10<sup>9</sup> microbial cells in a volume of 2 ml. In order to create an impermeability, to prevent injury and contamination of the surrounding organisms to the edges of the wound stitched plastic ring with a side height of 1.2 cm and 2.5 cm in diameter, fixed ring with two sides, inserted into a dry sterile gauze ball and imposed suggestive nodal joints. Wherewith 2 rats died of generalized infection.



Festering wounds in rats were formed after 48 hours and had all the classic signs of inflammation. Animals from the third day were divided into 4 groups depending on the treatment (Table 1). Photodynamic therapy (3rd group) were carried out after removal of the gauze ball and processing solution of hydrogen peroxide with the application of sterile gauze ball soaked 0.005% aqueous solution of methylene blue (MB) to the wound surface layer of 1–2 mm, with full closure of the wound surface. Then superimposed opaque bandage, after 30 minutes application irradiated

with installation FDI-1 with a power density of 200 mW/cm<sup>2</sup>, with a duration of 10 minutes on the field every day, a total of 6 sessions [10]. The animals of group 4 underwent complex treatment including conventional methods of CO<sub>2</sub> laser (JZ-3A) 3 times daily until the wound cleansing from necrotic raids, and photodynamic therapy in the same conditions. For morphological evaluation process of wound tissue samples taken, obtained from the bottom of the wound and the wall on the 1st, 3rd, 7th and 10th days after its application.

Table 1. – Groupings of animal

N <sup>o</sup>	Monitoring groups	Number of rats
1	Observing the natural course of wound healing	18
2	The traditional method of treatment (debridement, ceftriaxone, levomekol)	20
3	Study of the effect of photodynamic influence on the course of wound healing	20
4	The influence of the traditional method of treatment in combination with CO <sub>2</sub> laser and photodynamic therapy on the course of wound healing	20

To assess the effectiveness of the treatment was carried out a thorough dynamic monitoring of the general state of the animals, the local course of the wound process, the progress of wound healing. It has been observed and assessed the rate of contraction of the skin, the presence and disappearance of redness around the wound, the rate of primary and secondary scab, the nature of discharge from the wound — its color, smell, and amount. Watch for changes in the peripheral blood, a qualitative and quantitative change in the dynamics of microbial inoculation of the wound. The complex evaluation of the effectiveness of the treatment the following parameters were included: laboratory, thermometry, the nature and amount of wound, planimetric (change in wound area), the timing of wound cleansing, the time of appearance of granulation, as well as morphological and bacteriological parameters.

Digital material is treated by variational statistics.

### Results and its discussion

Planimetry of lesions in experimental animals of all groups on the first day before the start of the treatment points to the expansion

of the focus of infection, accounting for 745±23.2 mm (Table 2). On examination, there was a moderate redness and swelling of the wound edges, the bottom was covered with a dirty grayish bloom. The surrounding tissues were lots diapedetic hemorrhage. In the dynamics of physiological regeneration we observed a gradual decrease in the size of the purulent center, while during the standard therapy showed a significant decrease in their in 1.17; 1.27 and 1.45 times the value of the 1st group of animals, respectively maturity at 3, 7 and 10 days of starting treatment. Carrying only photodynamic therapy (group 3) also noted a decrease in wound area of 1.24; 1.33 and 1.52 times, respectively, with respect to the parameters of group 1, and was not significantly different from that of the group of rats treated with conventional treatment. Earlier healing purulent focus observed in the 4th group with a combination of CO<sub>2</sub> laser and photodynamic therapy: focus area decreased to 1.9; 2.41 and 4.78 times the performance of group 1; 1.62; 2.41 and 3.3 times as compared with the 2nd group; 1.52; 1.81 and 3.14 times — compared with the values of the third group of rats, respectively terms.

Table 2. – Indicators planimetry (mm<sup>2</sup>) of purulent lesions in the dynamics of treatment, M±m

Groups	Dates of researches			
	Until treatment	On the 3 <sup>rd</sup> day	On the 7 <sup>th</sup> day	On the 10 <sup>th</sup> day
1	745±23.2	723.0±19.0	661.5±15.9 <sup>a</sup>	581.4±11.3 <sup>a</sup>
2	745±23.2	619.0±16.1 <sup>a, b</sup>	518.8±17.1 <sup>a, b</sup>	401.3±10.3 <sup>a, b</sup>
3	745±23.2	581.6±10.2 <sup>a, b</sup>	495.8±6.8 <sup>a, b</sup>	381.8±8.3 <sup>a, b</sup>
4	745±23.2	381.6±8.3 <sup>a, b, c, d</sup>	274.6±9.1 <sup>a, b, c, d</sup>	121.6±3.6 <sup>a, b, c, d</sup>

In the animals of the 1st group who did not receive treatment, cleansing the wound surface from necrotic masses observed for 17 days (16,5 ± 0.7 days) in group 2 — to 10-th day (9.4 ± 0.8 days), group 3 — to day 7 (6.3 ± 0.8 days), whereas animals of group 4 — to 6th day from the start of treatment (5.2 ± 0.9 days). According to the results of our research, filling the wound with granulation tissue was observed in the animals of group 1 to the beginning of the 4th week (23.6 ± 1.1 day), the 2nd group — to the beginning of the third week (15.1 ± 0.9 days) in group 3 — on the 9th day (8.8 ± 0.9 days), and in the rats of group 4 — to 7th day (7.1 ± 0.3 days) from the start of treatment.

As can be seen from the above data, the animals of group 4 of the wound surface area decreased more rapidly contracting and granulation wounds observed faster than in the other groups. This proves that the combined application of traditional methods of treatment sessions with CO<sub>2</sub> laser and photodynamic therapy is the most effective, as compared to other methods studied separately.

The results suggest greater effectiveness of this method of exposure to destructive purulent wounds as compared to other treatments studied. When exposed to light of a specific wavelength and photo sensitizers energy begin to produce singlet oxygen and other reactive oxygen species that cause oxidative damage to various molecules (proteins, unsaturated fatty acids, nucleic acids), and cell structures (membranes, enzyme systems, genetic apparatus, and etc.), that entails inactivation of pathogens [9; 10; 11]. Experimental and clinical studies have shown that primary target of PDT in vivo is the vascular system, namely the endothelial cells of the capillary network [7; 8; 11]. It can be assumed that the violation of perfusion with hypoxemic subsequent necrosis is an important goal of cell death in addition to the direct damage to cellular structures [13; 14].

### Conclusions

1. Photodynamic therapy in a complex with CO<sub>2</sub> laser was not sufficiently effective invasive treatment of purulent wounds and al-

lows recommending its use in clinical practice for the treatment of local purulent-destructive diseases of soft tissues.

2. The results showed that the planimetric study with the use of laser photodynamic therapy photo sensitizer methylene blue and

CO<sub>2</sub> laser contributes to shortening of clearance of the wounds from necrotic deposits, the appearance of granulation, epithelialization beginning.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-114-116>

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## Application of photodynamic therapy and CO<sub>2</sub> laser in the treatment of infected and purulent wounds

### Abstract:

**Objective:** to evaluate the complex action of photodynamic therapy and CO<sub>2</sub> laser in the treatment of infected and purulent wounds.

**Materials and methods.** Depending on the treatment, the patients were divided into 3 groups: group 1 (control group) included 26 patients who were held traditional conventional methods; in the 2nd group (main group) of 30 patients, which in combination with traditional methods applied PDT treatment with 0.05% methylene blue buffered saline and CO<sub>2</sub> laser (if necessary).

**Results.** Photodynamic therapy in a CO<sub>2</sub> laser complex was not sufficiently effective invasive treatment of purulent wounds and allows to recommend its use in clinical practice for the treatment of local purulent-destructive diseases of soft tissues. Complex application of PDT and CO<sub>2</sub> laser leads to an earlier cleansing from the pus, the active formation of granulation tissue and shortening deadlines complete epithelialization of the wound surface.

**Conclusions:** Complex treatment with CO<sub>2</sub> laser and photodynamic therapy is the most effective, as compared to other methods studied separately.

**Keywords:** purulent wounds, infected wounds, laser, photodynamic therapy.

Treatment of purulent — inflammatory processes of soft tissues is one of the long-studied topic in Medicine, however, still remains an urgent problem surgery [4]. According to the literature, the number of patients with acute purulent soft tissue diseases is among the surgical patients 30–60% [1].

The primary structure of the total consulting in general surgery frequency surgical skin and soft tissue infections reaches 20 to 70% [5; 8].

Despite the fact that the history of the issue of treatment of these pathologies has more than one decade, and to date has

prompted a large number of different methods, the problem of the effectiveness and speed of the results is still not resolved until the end [2]. One of the promising areas of modern medicine to address this problem is the use of laser treatments. To date, the most efficient use antibacterial photodynamic therapy and CO<sub>2</sub> laser in the treatment of purulent wounds. Photodynamic therapy (PDT) is a relatively new treatment method based on the use of drugs — photosensitizers (substances that are sensitive to light) and laser light with a specific wavelength corresponding to an absorption peak of a photosensitizer [3; 6; 7; 9; 10; 11].

Photocoagulating CO<sub>2</sub> laser has sterilizing properties and effect on the fabric. As a result, tissue dissection is carried out without bloodshed, and the cut surface remains absolutely sterile.

**Objective** — Improving the results of treatment of patients with infected and purulent wounds, through integrated use of PDT and CO<sub>2</sub> laser.

#### Materials and methods

We have examined and treated 56 patients with purulent and infected wounds of different etiology and localization in age from 19 to 74 years who were in the department of purulent surgery of 1 City Clinical Hospital at the Department of Surgery GP TMA from 2011–2015.

Depending on the treatment, the patients were divided into 3 groups: group 1 (control group) included 26 patients who were held traditional conventional methods; in the 2nd group (main group) of 30 patients, which in combination with traditional methods applied PDT treatment with 0.05% methylene blue buffered saline and CO<sub>2</sub> laser (if necessary).

Both groups were representative by gender, age, area and location of the wound surfaces.

**Characteristics of the device.** CO<sub>2</sub> laser. Laser wavelength: 10.6. Output Power: 1 ~ 15w. Output Mode: Focus or defocus.

For photodynamic therapy using a light emitter with a wavelength of 600–640 nm with a power density of 200 mW/cm<sup>2</sup>.

In the complex treatment of the traditional complement of photodynamic therapy and CO<sub>2</sub> laser (with the presence of purulent necrotic masses and films). The use of CO<sub>2</sub> laser has allowed the possibility of early and bloodless necroectomy and increased the effectiveness of PDT (as in the presence of purulent necrotic masses

and films PDT effect is sharply reduced). A session on the severity of the condition of patients ranged from 3 to 7 sessions. After 2–3 sessions a purulent focus area, we observed a significant reduction in necrotic detritus and characteristic odor.

After surgical treatment of purulent focus complement traditional treatment of PDT. The wound after standard surgical treatment and drying the photosensitizer was applied. As the photosensitizer used buffered solution of 0.05% (or ointment) of methylene blue from 30 minutes exposure. Then, irradiation was carried out of wound surface of the light emitter for photodynamic therapy. The wavelength of 630–650 nm, with a power density of 200 mW/cm<sup>2</sup>. The distance from the source to the wound surface was 10 cm in the absence of heat discomfort in the patient. Duration of treatment was 15–30 minutes, depending on the area of the wound surface. After radiation photosensitizer wound surface discolored since gone photodynamic reaction. After PDT superimposed ointment bandage corresponding phase of wound healing process. The multiplicity of procedures is 3–6 sessions, depending on the clinical diagnosis.

Selecting of photosensitizer and the radiation source based on the results series of in vitro experiments that allows us to select the most effective combination of photosensitizer and radiation parameters.

**Results discussion** Comparative results of treatment were evaluated in both groups in a complex on the general and local criteria, as well as laboratory parameters periphery blood. The general evaluation criteria include the timing of normalization of body temperature and heart rate control, allowing to judge the severity of intoxication and general inflammatory response. Local criteria are periods of cleansing the wound, the appearance of granulation, epithelialization of the wound beginning, on the basis of these data, judged the local stage of the process. In laboratory parameters monitored leukocytosis and severity index was calculated leukocyte intoxication index (LII).

Patients of the control group to normal body temperature (below 37.0°C) by an average of 3.5 ± 1.03 days, and the use of a CO<sub>2</sub> laser, PDT resulted in a more rapid normalization of body temperature — in average 2.0 ± 0.44 hours. Control of normalization heart rate (less than 90 ppm) in the control group was 3,3 ± 0,55 days in the main 1,9 ± 0,26 days.

Table 1. – Dynamics of the number of heart rate and body temperature

Parameter	Before treatment		After treatment	
	Main group	Control group	Main group	Main group
Heart rate, beats per minute.	88,1±1,9	87,9±2,3	74,0±1,0	79,5±1,8
Body temperature, °C	38,2±0,06	38,6±0,05	36,7±0,05	37,8±0,09

Analyzing the overall clinical manifestations of wound healing is important to note that after PDT decreased clearance of the wounds from purulent detritus and a fibrinous masses, as well as the time of appearance of granulation and epithelialization start especially for the core group — Table 2. On average, cleaning of wounds

from purulent and fibrinous detritus mass occurred at 3,5 ± 0,5 day, and the appearance of granulation found at 3,9 ± 0,4 hours. At 4,1 ± 0,4 day marked the beginning of the edge epithelialization, which was significantly better than with conventional treatment.

Table 2. – Dynamics of number of wound healing, depending on the treatment

Method of treatment	Amount of patients	Средние сроки (сутки)		
		Healing wound	Appearance of granulation	Getting the epithelialization
Main group	30	3,5±0,5	3,9±0,4	4,1±0,4
Control group	26	7,1±0,5	6,5±0,6	7,8±0,5

During hospitalization, all patients had signs of intoxication varying degrees of severity, as evidenced by changes in leukocyte blood: leukocytosis, increased number of immature forms of neutrophils, the appearance of plasma cells, reducing the number of monocytes and lymphocytes, as well as the increase in the LII (up to

6–8 conventional units). Increase in the number of immature forms of neutrophils indicated the voltage of compensatory mechanisms for the inactivation of toxins. Reducing the number of monocytes and lymphocytes, indicative of immunological suppression of the body's defense system. After 3 days, after the surgical treatment

of patients with purulent focus and a comprehensive traditional therapy marked decrease LII values — to 3,2usl. Units, with an additional impact on the injury occurred PDT greater reduction index LII — to 2,71usl. u Revealed changes suggest increasing non-specific resistance and decreasing toxicity. Within 7 days after the

start of treatment for complex treatment of purulent wounds using a CO<sub>2</sub> laser and photodynamic therapy corresponded to the value of FRI normal numbers  $-1,56 \pm 0,5$  conv, while the control group remained elevated in patients —  $2,14 \pm 0.6$  standard units

Table 3. – Dynamics of FRI patients of the main and control group

Leukocyte index of intoxication (LII)	Days of treatment			
	1	3	5	7
Main group	3,42±0,8777	2,71±0,81	1,71±0,59	1,56±0,5
Control group	3,34±1,19	3,2±1,10	2,32±0,54	2,14±0,6

Indicators of postoperative bed-days in the groups differed significantly. If the traditional treatment of patients with purulent wounds of the average hospital stay was 9 days, the patients of the main group of hospital stay was 7 days.

All 17 patients of the study group was well tolerated method of photodynamic therapy, side effects were observed. This allowed all 17 patients (100%) planned to undertake a full course of treatment, PDT. The use of PDT is not required additional analgesia.

Thus, the data prove conclusively on the basis of common assessment, local criteria and laboratory parameters ascertained a marked improvement in the results of treatment of patients with infected and purulent wounds when applied PDT. Clinical data correlate well with the results of bacteriological tests in vitro.

### Conclusions

1. Antibacterial photodynamic therapy in complex treatment of patients with purulent destructive diseases of soft tissues allows an earlier date to achieve cleansing of purulent wounds and their healing.

2. Photodynamic therapy is a very effective non-invasive and gentle treatment of purulent wounds and serve as justification for the use of the method of photodynamic therapy in clinical practice for the treatment of acute inflammatory processes in combination with conventional treatments.

3. Experimental and clinical studies of the results of applying PDT showed its efficacy as an in vitro as in vivo.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-116-119>

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## The effectiveness of immunotherapy in children with cystic fibrosis

**Abstract:** We observed 48 children with CF aged from 4 to 8 years, as well as the indicators of 20 healthy children of the same age were studied. Based on the dynamics of immunological parameters the effectiveness of the drug polioxidonium was

shown. After the course of treatment the T cell-mediated and humoral immunity were activated, and increased the activity of nonspecific protection factors, leading to the normalization of the IL-1  $\beta$  and IL-8.

**Keywords:** children, cystic fibrosis, cellular and humoral, immunity, immunotherapy.

Cystic fibrosis (CF — is one of the most common mono-gene diseases with polihedral manifestation. CF is characterized by lesions of exocrine glands, organs and body systems, different heavy, flow and a poor prognosis [4; 9; 10; 11]. The disease is inherited in an autosomal recessive manner. The cause of CF — is the mutations of chloride channel gene (cystic fibrosis transmembrane conductance regulator) [8; 9]. Violation of transport of chloride ions leads to the breakdown of transport of water and dehydration secret. Secrets of the exocrine glands thicken, leading to the development of multisystem disease with a lesion of bronchopulmonary system, digestive system, reproductive system, etc., and, ultimately, to the patient's death [6; 7; 8].

In CF, in the pathological process involves the entire body, but the most — the respiratory and digestive (liver, pancreas, bile ducts), as well as sweat glands and sexual organs (especially in males) [9; 10]. The clinical picture is dominated by symptoms of bronchopulmonary and digestive systems, especially dysfunction of these systems in the greatest degree determine the tactics of treatment and outcome of this disease [2; 3; 5; 8].

**The purpose of the research** — is to study the performance of innate and adaptive immunity in children with cystic fibrosis to justify carrying out immunotherapy.

**Material and methods.** On the base of The Department of Pulmonology, the Republican Specialized Scientific and Practical Medical Center of Pediatrics (RSSPMCP) were examined 48 children with a mixed form of cystic fibrosis (intestinal and pulmonary) from 4 to 8 years. The survey was conducted in the acute phase in 29 (60.4%) patients, and in remission — in 19 (39.6%) patients. The control group consisted of 20 healthy children of the appropriate age.

Immunological studies carried out with the studying of the level of lymphocytes on the identification on the surface of the cluster differentiation CD3, CD4, CD8, CD16, CD20, CD95 and of CD25 with monoclonal antibodies of LT Series ("Sorbert"LLP, Moscow, Russia). The concentration of immunoglobulin A, M, G has been determined by Mancini's method. Neutrophil phagocytic activity has been determined using latex particles (1.5 md) by Kudryavtseva V.P. method. The concentration of cytokines: interleukin — 1  $\beta$  (IL-1  $\beta$  and interleukin-8 (IL-8) was determined by ELISA (reagents set of «Cytokine»LTD, Russia).

For statistical calculations used in standard programs (MS Excel 2002, Statistica 6,0). The reliability of differences between groups was assessed by the criterion of a Fischer — Student. Differences were considered statistically significant at  $P < 0.05$ ;  $P < 0.01$ ;  $P < 0.001$ .

**Results and their discussion.** The analysis of comorbidities showed that 90% of children were observed ENT diseases. In 28.6% of the children there was a delay of physical development.

In the analysis of somatic diseases in history have 31.4% of the patients children rickets was diagnosed.

Analysis of the presence of bacterial and viral infections revealed the following pathogens: St.aureus, P.aeruginosa, E.coli, Klebsiella pneumonia, Herpes and Chlamydia and mycoplasma infection.

The data of the immunological examinations of children with cystic fibrosis show suppression of cell-mediated immunity. There has been a fairly low level of CD3 + -cells ( $44,2 \pm 1,9\%$  against  $55,4 \pm 1,2\%$  in the control,  $p < 0.01$ ) and CD4 + -cells ( $25,4 \pm 1,5\%$  as opposed to  $32,1 \pm 0,9\%$ ) (Table-1). By reducing the helper activity

was significantly depressed immunoregulatory index ( $1,2 \pm 0,01$  vs.  $1,5 \pm 0,02$   $p < 0.05$ ).

Also marked inhibition of the secretion of natural killer cells ( $8,2 \pm 0,4\%$  in comparison with control group values of  $14,7 \pm 0,5$ ,  $p < 0.05$ ).

On the background of elevated level of CD20 + -cells in these children revealed disimmunoglobulinemia, i. e. a significant decrease of Ig G and Ig A, virtually unchanged values of IgM. Specific antibodies — the most powerful mechanism for binding and limiting the spread of pathogens of respiratory infections in children. When the primary immune response immunoglobulins M begin to form from the 4th day after exposure to antigens of the immune system. They capture free virions cover their surface, facilitate their recognition by phagocytic cells and "killer cells". The term life of Ig M on average is 7 days. If within the first 2 weeks of respiratory infections recorded the permanence and growth of concentrations of specific IgM, it can be assumed that it is this or that primary infection.

On the 14th day of antibody formation class G. This type of antibodies more effectively restrains and inhibits infection [7]. The life of any specific IgG in the average is 21 days. If, starting from the 4th week of the onset of infection seen a steady increase in IgG concentrations, it can be assumed that the development of primary infection continues. When re-exposed to the same antigens of pathogens of respiratory infections almost immediately formed of IgG antibodies [7].

One of the most important functional characteristics of a neutrophils is their phagocytic activity. The number of phagocytic neutrophil significantly reduced in children with cystic fibrosis ( $44,5 \pm 1,9$  vs.  $54,8 \pm 1,6\%$ ,  $p < 0.01$ ). Phagocytes being the first line of defense against infectious agents, in the most cases, protect the body against bacteria.

In children with CF is common a functional failure of phagocytes.

Table 1. – The status of innate and adaptive immunity of the surveyed children, ( $M \pm m$ )

Indicators	Control group, n=20	Children with CF, n=48
CD3+,%	$54,8 \pm 1,6$	$44,2 \pm 1,3^*$
CD4+,%	$32,3 \pm 1,0$	$25,4 \pm 0,9$
CD8+,%	$21,5 \pm 0,8$	$20,7 \pm 0,7$
CD4/CD8	$1,5 \pm 0,02$	$1,22 \pm 0,01^*$
CD16+,%	$14,7 \pm 0,5$	$8,2 \pm 0,4^*$
CD20+,%	$18,3 \pm 0,9$	$25,8 \pm 1,0^*$
IgG, mg/%	$970 \pm 37$	$695 \pm 11,8^*$
IgA, mg/%	$123,0 \pm 7,2$	$86,5 \pm 6,4^*$
IgM, mg/%	$85,5 \pm 4,9$	$87,8 \pm 5,2$
Phagocytosis, %	$54,8 \pm 1,6$	$44,5 \pm 1,9^*$
IL-1 $\beta$ , pg/ml	$22,7 \pm 3,7$	$85,3 \pm 5,6^*$
IL-8, pg/ml	$14,8 \pm 1,4$	$47,2 \pm 2,2^*$

Note: \* values are valid when comparing with the control group ( $p < 0.05-0.001$ ).

Current long-term immunosuppressive effect of the inflammatory process in lung tissue is manifested primarily in relation

to humoral immunity, increased production of proinflammatory cytokines ( $85,3 \pm 1,3$  pg / ml - IL-1 $\beta$ ;  $47,2 \pm 2,2$  pg / ml IL-8 - in the study group compared with the control group -  $22,7 \pm 3,7$  pg / ml and  $14,8 \pm 1,4$  pg / ml, respectively,  $p < 0,05-0,001$ ) violation detection of microbial antigens inhibition of the cytotoxic effector function of NK-cells. A characteristic feature of chronic inflammation in the lungs of CF patients - persistent infiltration of the lung tissue with massive neutrophils in the airways.

Involvement of neutrophils into the lung tissue due to high levels of IL-8- primary chemo attractant for neutrophils [1]. With increasing severity of inflammation was a significant ( $p < 0,01$ ) increase in the levels of pro-inflammatory cytokines: IL-1 $\beta$  and IL-8 [1]. Derivatives dying neutrophils - elastase, cathepsin G, proteinase, collagenase, gelatinase, factor plasminogen activation, free radicals, myeloperoxidase, oxidases, cytokines, endotoxin contribute to the development of "respiratory burst" and can directly destroy lung structure (elastin, fibronectin and other structural proteins) [1]. In addition, neutrophil elastase, - is potential stimulator of IL-8 production and bronchial secretions. Clinical manifestation of the vicious cycle of infection - inflammation - lung tissue damage is the progressive decline of lung function.

In this state of the immune system it becomes impossible elimination of intracellular pathological agent, in the body conditions for the spread of chronic pathological focus in the lung tissue are formed.

The above led to the conclusion that in this cohort of patients have a place in violation of multivalent basic systems regulating the homeostasis of the immune system, which leads to a decrease in general resistance to infectious agents and the products of their metabolism.

Due to the fact that children with cystic fibrosis recorded marked deficiency in T-cells, their major subpopulations imbalance humoral defense reactions, decreased functional activity of leukocytes and phagocytic activity of neutrophils, due to which there was expression of proinflammatory cytokines using different Patient Therapy group of drugs that implement various ways pharmacokinetic effect.

To enhance the effectiveness of the base immunotropic treatment of cystic fibrosis, and in view of the typical changes in the immune status further recommended the appointment of drugs targeting T-B-dependent reactions. We proposed immunomodulatory drug Polioxidonium, which is an immunomodulator systemic action.

The data obtained after 3 months a course of treatment are presented in Table-2. Immunomodulating action Polioxidonium implemented through macrophage secretory activity affected the T-cell, a more pronounced against CD3 + lymphocytes ( $48,9 \pm 1,4\%$  in comparison with the group to treatment -  $44,2 \pm 1,9\%$ ,  $p < 0,05$ ). Positive shift CD4 + -cells resulting in increased immunoregulatory index. This effect is apparently due to the increased level of phagocytosis ( $49,8 \pm 2,5\%$  as compared to baseline -  $44,5 \pm 1,9\%$ ,  $p < 0,05$ ), which acts on and enhances production of interferon activity T-cell and killer activity ( $11,0 \pm 0,9\%$  in comparison with the values before the treatment -  $8,2 \pm 0,4\%$ ).

We would also like to note the positive impact Polyoxidonium the maintenance of serum immunoglobulins. There was a significant increase in their level ( $p < 0,05$ ).

Table 2. – Dynamics of immune parameters during treatment Polyoxidonium, (M  $\pm$  m)

Indicators	Control group, n=20	Children with CF before treatment, n=48	After 3 months after treatment, n=42
CD3+,%	$54,8 \pm 1,6$	$44,2 \pm 1,3^*$	$48,9 \pm 1,4^{**}$
CD4+,%	$32,3 \pm 1,0$	$25,4 \pm 0,9^*$	$29,5 \pm 1,1^{**}$
CD8+,%	$22,5 \pm 0,8$	$20,7 \pm 0,7$	$21,3 \pm 0,9$
CD4/CD8	$1,4 \pm 0,02$	$1,22 \pm 0,01^*$	$1,38 \pm 0,02^{**}$
CD16+,%	$14,7 \pm 0,5$	$8,2 \pm 0,4^*$	$11,0 \pm 0,9$
CD20+,%	$18,3 \pm 0,9$	$25,8 \pm 1,0^*$	$22,3 \pm 1,0$
IgG, mg/%	$970 \pm 37$	$695 \pm 11,8^*$	$798 \pm 12,5^{**}$
IgA, mg/%	$123,0 \pm 7,2$	$86,5 \pm 6,4^*$	$95,6 \pm 7,2^{**}$
IgM, mg/%	$85,5 \pm 4,9$	$87,8 \pm 5,2$	$88,2 \pm 5,3$
Phagocytosis,%	$54,8 \pm 1,6$	$44,5 \pm 1,9^*$	$49,8 \pm 2,5^{**}$
IL-1 $\beta$ , pg/ml	$22,7 \pm 3,7$	$85,3 \pm 5,6^*$	$55,8 \pm 2,1^{**}$
IL-8, pg/ml	$14,8 \pm 1,4$	$37,2 \pm 2,2$	$20,1 \pm 1,2^{**}$

Note: \* values are valid when compared with the control group ( $p < 0,05-0,001$ )

\*\* Values are valid when compared with the group to treatment ( $p < 0,05-0,001$ ).

Prediction of pulmonary disease in a child with immunodeficiency always serious, especially in children with combined immune deficiency.

When using immunomodulators is very important to the formation of a sustainable immunological memory, which has significant practical importance.

In conclusion, it should be emphasized the need to continue the search of individual immunotherapeutic approaches to this vast group of patients. When a prospective look at is a problem becomes even more obvious need for the modern understanding of the rules of academic therapeutic: «Treat not a disease, and the patient.»

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-119-120>

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## Depressive disorders in patients after myocardial infarction

**Abstract:** In article the depressions arising at patients after a myocardial infarction (MI) are shined, necessity of overcoming stigma concerning weight of the transferred MI, rational understanding of illness especially in early period of the post infarction is defined.

**Keywords:** depressive disorders, myocardial infarction (MI), work capacity of patients, post infarct depression, risk factors.

High prevalence of a mental pathology is noted both among a contingent of polyclinic establishments, and in versatile hospitals where basically mental frustration are presented by out-patient “neurotic” forms among which prevail somatic disturbing-depressive frustration. Depression, irrespective of its origin, developed against available heavy somatic disease, considerably burdens its current and rehabilitation of the patient. In a number of researches it is established that depression symptoms are authentic prognostic indicators of death rate from cardiovascular diseases after the transferred MI [1; 4].

Nervous and mental disorders at a acute myocardium infarction (AMI) are connected substantially with infringement of brain blood circulation, more often functional character, and sometimes owing to a thrombosis or thromboembolism small vessels of a brain. In the acute period of a MI there can be the fear of death accompanied by anxiety, alarm, melancholy. Some patients are silent, motionless, others, on the contrary, are extremely irritable [2; 3].

In clinic of psychopathological infringements at a AMI the big place is occupied with emotional disorders. In the first days of a MI the disturbing-depressive syndrome more often is found out. The fear of death, melancholy, alarm, disturbing depression can be replaced by psychomotor excitation. Patients in such condition try to get up, go, speak much. The disturbing depression accompanied by steady and long melancholy, can be at the bottom of suicide actions [5].

*The aim of the research* — the analysis of influence of depressive disorders (DD) on clinical and social characteristics at patients with AMI.

**Materials and methods.** During the period of 2010–2013 years, It is surveyed 121 patients in cardiological department of Bukhara branch of Republican centre of science of urgent medical aid. Patients have been divided into two groups: the first group have made 88 pa-

tients who have transferred a AMI at whom in the subsequent the DD have developed, the second group — 33 patients who also have transferred a AMI, but without depression symptoms. Re-search methods were: clinical and psychopathological, clinical catamnesis, reliability of results was estimated with use of criterion of Student.

**Results and discussion.** At the characteristic of clinical features of DD at patients in the period of post infarction it is necessary to note the allocated variants of depressions: disturbing (77.3%), melancholic (11.2%), dysphoretic (4.8%), masked (6.7%). Irrespective of a depression variant in conversation patients first of all showed complaints to pressing, compressing pains behind a breast, eccentric in characteristic zones, and aching, pricking in the left half of thorax. Patients passed an opinion experiences of the physical condition, painful sensations, prospects on the future. From shown complaints the sleeplessness was following. From the subjective complaints specifying in DD, depression, a breakdown, sensation of hopelessness are noted. In experiences with identical frequency the fear of repetition of a AMI, pessimistic views on the future and a low self-estimation were reflected.

A well educated person often occurs in 2 groups of survey is more often (72.7%), average vocational education is more characteristic for patients of 1 group (45.4%). Obviously, that fact matters that the person who is engaged in brainwork, does not think of possible loss of work whereas the person who is engaged more in a physical activity, is compelled to limit loadings after the transferred MI and to replace activity that conducts to decrease or change of qualification and can change not only a habitual rhythm of life of the patient, but also indirectly affect a material prosperity.

Convinces of it and that the reason of depressions at patients with a AMI in most parts of cases (81.8%) is the present somatic disease (table № 1).

Table 1. – The reasons of development of depressions

The reasons of development of depressions	Group 1	
	Abs	%
Absent	0	–
Psychotrauma	14	15.9 ± 3.9
The present somatic disease	72	81.8 ± 4.11
Physical pressure	0	–
Intellectual overstrain	2	2.3 ± 1.6
Mental disease	0	–
In total	88	100

The depression beginning in the first days after a AMI (40.9% — in a current 1–7 days, 37.5% — in a current 8–30 days) confirms thought that for the patient the diagnosis of a MI and connected with it change of the relation to, the habitual active life, is the most serious psychologic traumatic factor. Obviously, work of the internship doctor, the cardiologist in early post infarct the period should be directed on overcoming stigma concerning weight of the transferred MI, on development of rational understanding of illness, possibility of logic reconsideration of life after a AMI.

At a part surveyed (19 patients — 21.6%) the AMI was observed repeatedly and in all cases at this group of patients development of DD was observed. It is interesting that in an origin of the majority of depressions (17.1%) at patients with repeated cases of a MI the reason also is the fact of the transferred AMI.

MI and the depression arising as consequence of the transferred AMI it is reflected in work capacity of patients (table № 2). So, at 27.3% of patients of group 1 and 69.7% of patients of group 2

( $p < 0,001$ ) work capacity is lowered, whereas disability authentically is more often observed at patients of group 1 ( $p < 0,001$ ). It can serve as the obvious proof of negative influence of the joined depression on sociolabor adaptation of patients.

Table 2. – Work capacity of patients

Work capacity	Group 1		Group 2	
	abs	%	abs	%
It is kept	18	20.4 ± 4,30	7	21,2 ± 7.15
It is lowered	24	27.3 ± 4,75	23	69.7 ± 7.80
It is lost	46	52.3 ± 5,57	3	9.1 ± 5.01
It is raised	0	–	0	–
In total	88	100	33	100

Thus, for the majority of patients with a AMI the fact of presence of heavy somatic disease is at the bottom of development of DD among which to a thicket there are disturbing depressions. A MI and depressions leads to decrease in work capacity and activity of patients.

#### Conclusion:

1. It is necessary to optimize rendering of the specialized (psychiatric) help by the patient with a AMI.

2. In early period of post infarct work with the patient should be directed on overcoming stigma concerning weight of the transferred MI, on development of rational understanding of illness.

3. Great significance gets the organization of the advisory psychiatric help corresponding to modern requirements in cardiological hospitals, and also working out of educational programs on clinical psychiatry and psychopharmacotherapy for cardiologists, cardiologist and other experts.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-120-123>

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## Modern possibilities of combined and complex cervical cancer treatment in fertile age patients

**Abstract:** The main treatments for patients with cervical cancer are radiation, surgical and medical, which are used in combination with each other or separately. The study included 204 patients with cervical cancer younger who underwent traditional combined radiotherapy, chemoradiotherapy and chemotherapy and radiation treatment. The results of treatment showed that the effectiveness of the therapy and quality of life is higher in the group where the received chemotherapy and radiation therapy using radiomodifier.

**Keywords:** fertile age, systemic chemotherapy, endoarterial regional chemotherapy, cervical cancer, fertility-sparing surgery, ovarian transposition, quality of life, effectiveness of treatment, dynamic monitoring.

The world marked increase in the incidence of cervical cancer in young women, especially from 29 to 45 years old. Analysis showed

that in patients with preserved ovarian function, not only the effectiveness of the treatment, but also the quality of life. It is associated



with the acceleration, earlier puberty and the onset of sexual activity. In recent years more and more widely used radical surgery with preservation of the ovaries and the abduction of the radiation castration and preservation of reproductive function. The world reports have estimated that women under 50 years of age comprise 3% per year, with a particularly significant incidence increase in women up to 29 years, in Russia it is 2.1% per year. In the structure of oncological morbidity of female reproductive system of the Republic of Uzbekistan CC takes second place after breast cancer and the fourth place in the incidence of all cancers in the country (3). The highest cervical cancer incidence has been reported in women of 45–55 yrs. The similar trend to CC increase in women of fertile age has been followed in other countries. Currently, there are following methods of CC treatment: surgery, combined radiotherapy, chemotherapy. Currently, there are following methods of CC treatment: surgery, combined radiotherapy, chemotherapy. However, the principal therapeutic methods for cervical cancer are surgery and radiation which are used both separately and in various combinations. In severe cases it is necessary to perform advanced surgery, the volume of which is directly depended on the advance of tumor process. Most CC patients who underwent radical treatment tended to keep the former style of life, social status, and work activities. The quality of life as an integral characteristic of physical, psychological, emotional and social functioning of a woman is based on her subjective perception. When performing radical surgery on young women with CC it is advisable to carry out the transposition of both ovaries in the lateral channels of the abdominal cavity, removing them from subsequent exposure to radiation in order to preserve hormone function considering the serious consequences of post-castration syndrome. A distinctive characteristics of extended hysterectomy with ovarian transposition is the preservation of uterus — ovary and fallopian tube and their neurovascular connections located in the funnel — pelvic ligament [4; 6; 7].

**Material and methods:** We have analyzed the survey data and the phases of treatment 204 patients with CC. All patients examined in the treatment guidelines were divided into 2 groups:

Table 2. – Distribution of the followed patients by groups and stages (n=204)

Stage	Main group (n=112)		Control group (n=92)		Total	
	abs	%	abs	%	abs	%
T1bNoMo	5	2.5	2	0.9	7	3.4
T2 aNoMo	18	8.8	19	9.1	37	17.9
T2 бNoMo	57	27.9	32	15.9	89	43.8
T2 бN1Mo	11	5.5	17	8.3	28	13.8
T3 aNoMo	21	10.2	22	10.9	43	21.1
Altogether	112	54.9	92	45.1	204	100.0

Depending on the type of combined (surgery + CRT) and complex (NAPCT + surgery + CRT) treatment, the patients were

Table 3. – Distribution of the patients with CC by groups depending on the type of therapy

Subgroups	Therapy type	Stage by TNM	I group (surgery with ovarian transposition) n=112		II (control) group (surgery without ovarian transposition) n=92	
			abs.	%	abs.	%
1	surgery + CRT	T <sub>1b-2a</sub> N <sub>0</sub> M <sub>0</sub>	23	11.3	21	10.2
2	complex (NAPCT + surgery + CRT)	T <sub>2b-3a</sub> N <sub>0-1</sub> M <sub>0</sub>	47	23.2	37	18.1
3	EARCCT + surgery + CRT	T <sub>2b-3a</sub> N <sub>0-1</sub> M <sub>0</sub>	42	20.6	34	16.6

The main clinical criteria of the effect of antitumor treatment are the immediate objective effect, the development of side effects, recurrence and period of their development, the survival rate of patients within 3 years of observations.

Group I — 112 (55.1%) patients, who underwent surgical treatment with ovarian transposition as a part of combined and complex therapy. Group II — 92 (44.9%) patients, who were performed surgery without ovarian transposition as a part of combined and complex therapy. Each group was divided into 3 subgroups: *Subgroup 1* comprised the patients with stage T<sub>1b-2a</sub>N<sub>0</sub>M<sub>0</sub>, who underwent surgery + combined radiotherapy (CRT). *Subgroup 2* comprised the patients with stage T<sub>2b</sub>N<sub>0-1</sub>M<sub>0</sub> who underwent systemic PCT + surgery + CRT. *Subgroup 3* comprised the patients with stage T<sub>2b</sub>N<sub>0-1</sub>M<sub>0</sub> who underwent endoarterial regional continued chemotherapy (EARCCT) + surgery + combined radiotherapy CRT.

Analysis of the obtained data showed that the initial complaints of all 204 patients were general weakness, fatigue, watery or sanious discharges from the genital tract, pain in the abdomen and lower back. The symptom-complexes, specific to cervical cancer lesions, depending on the duration of the first signs in a varying degree were identified. Patients noticed the pains of different nature: dull, aching, cramping, or moderate, varying duration — constant, periodic or unannounced, various sites — low abdomen, in the back, in the crotch area, when urinating or during defecation. The condition of initial focus and tumor grading was evaluated as follows: tumor location (anterior lip, posterior lip ectocervix or endocervix, with/without transition on neighboring organs and tissues, tumor size, growth form, parametrical tissue infiltration, invading to regional lymph nodes. During our examination we mainly met the patients with exophytic 82 (40.2%) and endophytic growth — in 68 (33.3%) cervical tumors (Table 1).

Table 1. – Distribution of the patients with CC by tumor growth form (n=204)

	Growth form	abs	%
1	Exophytic tumor growth	82	40.2
2	Endophytic tumor growth	68	33.3
3	Combined tumor growth	54	26.5

All patients were distributed by TNM system as follows (tabl.2).

distributed as follows (Tabl. 3).

*Chemotherapy was conducted by scheme:* Methotrexate total dose of 50 mg/m<sup>2</sup> within the first 12 hours; 5 Fluorouracil 1000 mg/m<sup>2</sup> for the next 12 hours; Cisplatin 100 mg/m<sup>2</sup> during the following 48 hours. The total duration of chemotherapy introduction was

72 hours continuously. The patients had kept bed for 3 days, herewith to stand up or take up the position, bending endovascular catheter was not allowed. To prevent catheter thrombosis during the day the patients were injected Heparin 5000 ED 1 ml. through the catheter under the control of coagulation time. When the clotting time was higher than 5 minutes heparin injection was not introduced. After the introduction of total dose of chemotherapy in order to prevent bleeding from post-puncture holes and the development of hematoma, catheter removal was carried out by compression of the puncture area. After removal of the catheter it was made mechanical compression for 10–15 minutes. After hemostasis compressed aseptically bandage was applied. The patients had been in a supine position for 12 hours.

The distinctive feature of extended hysterectomy with ovarian transposition is the preservation of the uterus (ovaries and fallopian tubes) and their neurovascular connections located in funnel-pelvic ligament. There are several wing, posterior wall of pelvic, on both sides of spinal column, the upper abdomen, and others options for ovarian transposition: to iliac. The best optimal version is the transposition of ovary in the upper abdomen. As a result of transposition the ovaries are displaced on supplied "pedicle" into the upper abdomen and, herewith, they are removed from the zone of postoperative irradiation and become prevented from radiation castration. The important aspect in the performance of transposition is retroperitoneal conduction of neurovascular bundle and the location of appendages themselves in abdominal cavity. Transposition is carried out in several stages: It is made separation along vascular "pedicle" of ovary and fallopian tube 10–12 cm long; depending on the anatomic features of a woman its length can be adjusted; The upper and lower poles of ovaries are marked with tantalum clips, fixation of which are made with particular silk ligatures; that results in the possibility to visualize them easily on plain film of abdomen; Formation of the right and left lateral channels with the upper and lower apertures are realized by manual and knife way; The appendages are led via lateral retroperitoneal channels with a clamp and output in the abdominal cavity via the upper aperture. It is necessary to follow a careful monitoring of vascular "pedicle" to exclude its rotation, inflection, excessive tension and compression that is unacceptable and can lead to ischemia and ovary necrosis as a result of circulatory disorders; Fixation of appendages are made with certain silk ligatures to the lateral divisions of the abdominal wall in the hypochondrium; this makes available to remove the ovaries of the zone of possible exposure in postoperative period; during topometry their location is determined on the plain film of abdominal cavity. This sequence of surgical operations ensures the safety of ovaries and their vascular "pedicles".

The additional visual inspection of appendage location is performed after restoration of the integrity of pelvic peritoneum that separates the abdominal cavity from the pelvic organs and anatomical position of bowel loops.

Characteristics of radiotherapy after ovarian transposition: two-step CRT included remote telegammatherapy (RTGT) and intracavitary brachytherapy. RTGT was performed by «Theratron» or «AGAT-R» unit with split rate at 2 Gr to 50 Gr, 5 days a week. Brachytherapy was made using the "Gammamed" with ROD 5 Gr and 45–55 Gr SOD every other day. Pre-radiation preparation included topometry of pelvic organs. The effectiveness of the treatment process can not be reduced due to the reduced margins or dose reduction. It is known that the dose of 15–18 Gr is sufficient for radiation castration. However, even the conduction a "high" transposition of the ovaries and their screening can not completely rid the gonads from radiation exposure. The latter varies depending on the fixation level of appendages, and in some cases exceeds tolerated dose, leading to deprivation of ovarian function. So, if the ovary is fixed below the iliac wing, the received dose of remote irradiation is 25–35 Gr instead of 1.5–5 Gr at high fixation.

Evaluation of the nearest outcomes of the treatment was conducted at three stages: during neoadjuvant chemotherapy, directly after surgery and after radiation therapy. To evaluate the side effects of systemic and endoarterial chemotherapy systematic examination of patients (not less than 1 time per week), which included complete blood count, urinalysis, biochemical blood analysis to determine the functional state of the liver and kidneys were conducted. There made electrocardiographic examination and X-ray examination of the lungs.

Treatment effect was evaluated by: 1) the degree of toxicity of chemotherapy by scale Sommon Sriteria Toxicity NCIC, 2) the general condition of the patient (Performance status) by Karnovsky scale (activity,%) and ECOG (WHO) by grading system [Gantsev Sh.Kh. 2004; Perevodchikova N.I, 2005]. The efficacy of conducted therapy was studied in postoperative period according to the pathological analysis of postoperative material.

The main clinical criteria of the effect of antitumor treatment are the immediate objective effect, the development of side effects, recurrence and period of their development, the survival rate of patients within 3 years of observations. Overall survival analysis of patients showed that the efficacy of treatment in study and in control group were almost the same, in study group is slightly higher than in control. Unilateral and/or bilateral lymph cysts were revealed during the dynamic monitoring in 11.4% of patients who underwent conservative therapy or minimally invasive surgical correction- under ultrasound control it was performed aspiration of the content of lymphocyst and administration of antibiotics into the cavity.

To study the quality of life is a relatively new field of clinical research. However, it attracts more and more attention in the study of oncology diseases and can serve as the main criterion for clinical efficacy. Quality of life is considered one of the key parameters in the study of ultimate results of the treatment. Quality of life of patients in the dynamics of observation was determined by American system MENQOL.

Table 3. – Quality of life assessment (MENQOL)

Parameter	Before treatment		After treatment		After a year	
	Study	Control	Study	Control	Study	Control
Vasomotor symptoms	2.65±0,5	2.35±0.4	3.32±1,1	8.92±2.3	2.50±0.42	9.67±2,8
Psychoemotional state	4.52±1.2	4.43±1.5	5.12±1.6	25.51±6.8	5.63±1.4	28.15±5.5
Physical state	7.82±2.3	7.32±2.2	6.35±2.2	21.93±5.7	10.14±2.4	24.12±4.7
Sexual sphere	2.35±0.56	2.51 ±0.6	3.42±0.8	8.17±2.4	3.55±0.6	9.16±3.3

Dynamic monitoring of patients was carried out with full examination every 3 months during the first year after treatment

completion, in the sequel every 6 months. Observation periods vary more than 3 years.

**Conclusion:** the analysis of the use of different methods of treatment of patients with cervical cancer at a young age showed that the use of himioterapiya radiation lecheniya combined with radiomodification provides a real opportunity to increase the effectiveness of treatment, reduce relapse rates and metastases. Study of remote results of combination treatment with CRT showed that

the performance of 3-year survival when using radiation therapy in combination with CRT on average 10–24% higher than in the other groups. Maintaining the high quality of life allows us to consider the study in determining a promising direction in Oncology, and also enables a more personalized approach to each case depending on the size, shape of tumor growth and age aspects.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-123-124>

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## Application of computer technologies in differential diagnosis of chronic peripheral arterial occlusive disease of the lower limbs

**Abstract:** Is a block diagram of the diagnosis of chronic peripheral arterial occlusive disease of the lower limbs, which was developed on the basis of a computer program that allows you to make a differential diagnosis of these diseases and establish the correct diagnosis quickly and accurately.

**Keywords:** atherosclerosis, diagnostic algorithm, computer program.

**The relevance of research.** The prevalence of chronic peripheral arterial occlusive disease of the lower limbs is from 0.6 to 7.5% of the population [1; 3]. According to the report by WHO experts, chronic obliterating diseases of lower extremities arteries, is caused by intermittent claudication, affects about 5% of the elderly [7; 9]. Their structure is dominated *obliterating* atherosclerosis, followed by nonspecific aortoarteriit, diabetic angiopathy, thromboangiitis obliterans, Raynaud’s disease and other rare diseases of the arteries.

Among the diseases of lower extremities arteries leading position firmly holds atherosclerosis, the frequency of lesions, according to different authors, 80–90% [2; 4]. The share of thromboangiitis obliterans, according to data of the same authors, there are only 1.4%. European statistics also notes a very low numbers of thromboangiitis obliterans (0.5–2%) among chronic peripheral arterial occlusive disease of the lower limbs [6; 8] Despite this, we should pay serious attention to the patients who suffering from thromboangiitis obliterans, since this disease, in contrast to atherosclerosis, mainly hurts younger males, and in this age group leading over atherosclerosis [5; 6; 8]. At the same time in recent years, cases of atherosclerotic lesions of lower limb arteries increased at young adults [1; 4]. It is true that thromboangiitis obliterans hurts mainly vessels of small and medium diameter, and atherosclerosis are the largest and medium-sized, and therefore the greatest difficulties in the differential diagnosis arise in lesions of

the femoropopliteal segment, which occurs in 70% of patients with atherosclerosis obliterans and 20% suffering from thromboangiitis obliterans [7]. Despite the fact that the differential diagnosis of chronic peripheral arterial occlusive disease of the lower limbs problem the subject of many studies, the percentage of diagnostic errors according to different authors is 20–30% [2; 5], which leads to the wrong tactics of treatment of patients. In the differential diagnosis of chronic peripheral arterial occlusive disease of the lower limbs in addition to the clinical diagnosis are widely used instrumental and laboratory research methods, but they do not have sufficient specificity and does not clarify the clinical picture. For the correct diagnosis is necessary to make a differential diagnosis between these diseases, it is important to determine the treatment strategy.

**The purpose of research.** Improving the diagnosis of chronic peripheral arterial occlusive disease of the lower limbs on the basis of the algorithm and computer program.

**Materials and methods of research.** The Department of Thoracic and Cardiovascular Surgery of the Central Military Clinical Hospital Ministry of Defence of the Republic of Uzbekistan on the basis of our innovative research methods for the analysis of patients with chronic peripheral arterial occlusive disease of the lower limbs. 96 patients were subjected to the analysis, 83 (86%) were male, 13 (14%) — women. Of these atherosclerosis in 79 (82.3%), thrombo-

angiitis obliterans 5 (5.2%), nonspecific aortoarteriitis in 3 (3.2%), diabetic angiopathy in 9 (9.3%) patients. The average age of the surveyed — 52 years. There were used a complex clinical, laboratory, instrumental, statistical research methods and beam diagnostics. In compiling the computer program in accordance with the algorithm for improving the diagnosis of patients with chronic peripheral arterial occlusive disease of the lower limbs used modern programming language — BorlandDelphi 7.

**Results and discussion.** For diagnosis chronic peripheral arterial occlusive disease of the lower limbs patients passed a comprehensive examination, including innovative research methods. According to the algorithm of diagnosis clinical examination include: complaints of patients, etiological factors, objective study, functional tests, the determination of the shoulder-ankle index oxitenzometry.

Laboratory studies include: general clinical blood tests, blood chemistry, coagulation.

Radial diagnostics includes: ultrasound duplex sonography, MSCT angiography, x-ray angiography.

As a result of a comprehensive survey of patients with chronic peripheral arterial occlusive disease of the lower limbs formed the database, based on which is installed the correct diagnosis and treatment strategy is determined.

Based on the diagnostic algorithm of chronic peripheral arterial occlusive disease of the lower limbs developed by us, a computer program has been compiled, which received a patent for Intellec-

tual Property Agency of the Republic of Uzbekistan (number DGU 02579 from 31.07.2012.).

A computer program consists of one project (Diag.dpr) and three modules (Mod1.pas, Mod2.pas, Mod3.pas) and provides necessary image printouts for doctors.

When you click “OK” on the 2nd module screen appears. The relevant elements of the window are entered the necessary data (name of the patient, gender, age, as well as the results of the survey). The window of this module consists of three pages, “Clinical examination”, “Laboratory tests” and “Radial diagnostics”.

After entering the required data press the “Diagnosis” and displays a window 3rd modul. This window displays the results of the diagnosis, which if necessary can be printed or saved to a file.

**Conclusions:** In created by us diagnostic algorithm of chronic peripheral arterial occlusive disease of the lower limbs, were used available clinical and laboratory parameters. As a result, processing and entering data into a computer program is not only determined the most likely diagnosis of the three possible diseases — obliterating atherosclerosis, obliterating endarteritis and nonspecific aortoarteritis, but also creates a database for each patient. The use of this computer program greatly facilitates work and saves time of surgeons.

Using the developed diagnostic algorithm of chronic peripheral arterial occlusive disease of the lower limbs can achieve a statistically significant reduction in the frequency of diagnostic errors and to reduce the diagnosis time and determine the correct treatment strategy.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-124-126>

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## Insulin resistance in children and teenagers with exogenous constitutive obesity

**Abstract:** The study consisted of 100 children and teenagers with exogenous constitutive obesity (ECO) of Uzbek population aged from 6 to 16. The mean age of the patients was 11,7±0,25 years old. The conducted researches showed that the values

HOMA>97 percentile occurred more often in boys than in girls at all stages of sexual development. According to our data, the indicators HOMA-IR according to Tanner 1  $\geq 1,4$  and Tanner 2–5  $\geq 1,8$  can be used as criterion for intensive search of components of metabolic syndrome. The level of SHBG in obesity, regardless sex and stage of sexual development, is significantly lower than in the control group; herewith, it is lower in boys than in girls.

**Keywords:** children, teenagers, obesity, insulin resistance, sex hormone-binding globulin.

Insulin resistance (IR) is one of the main components of metabolic syndrome and is a reason for development of atherosclerotic changes in vessels, which creates prerequisites for appearance and fast progression of a range of serious diseases leading to early disability and early death.

Resistance to insulin in adults, as rule, is related to obesity, diabetes or impaired glucose tolerance, arterial hypertension, dyslipidemia. There is more and more evidence that the appearance of insulin resistance syndrome can take place in childhood and teenage years [6; 7]. Before the attention is accentuated on cardio-vascular risks in IR, it is required to analyze what happens to the physiological IR (PIR) appearing during sexual development, because PIR can lead to phenotypic changes.

During sexual development, BMI increases slowly. Muscle and fat mass of the body increases in both sexes, but by the end of sexual development, fat represents bigger percentage of the total body mass in girls than in boys [8].

The increase of fat and BMI strongly correlates with insulin resistance, hence, they were proposed as potential mediators of pubertal changes of IR. However, according to some researchers, insulin resistance can appear during the period of sexual development in the absence of BMI changes [2; 6; 9; 10].

Unfortunately, the researches concerning insulin resistance depending on the degree of sexual development according to Tanner are not enough.

**Goal of research:** to evaluate insulin resistance in children and teenagers with exogenous constitutive obesity.

**Materials and methods of research.**

The study consisted of 100 children and teenagers with exogenous constitutive obesity (ECO) of Uzbek population aged from 6 to 16; out of which, boys accounted for 54 (54,0%) and girls — 46 (46,0%). The mean age of the patients was  $11,7 \pm 0,25$  years old. All patients were divided according to their age, sex and stages of sexual development.

The control group included 71 healthy children and teenagers, among which, boys accounted for 38 (53,5%) and girls — 33 (46,5%) of respective age (mean age  $11,1 \pm 0,33$  years old).

All children and teenagers underwent the evaluation of anthropometric indicators: height, body mass, BMI, waist circumference (WC), hip ration (HR), WC/HR correlation. Body mass index was calculated according to Quetelet equation:  $BMI = \text{weight}/\text{height}^2$  ( $\text{kg}/\text{m}^2$ ). The criteria of excess body mass and obesity in children were defined according to the data of percentile tables of BMI (WHO) [10]. Waist circumference (WC) was evaluated according to age norms from 2 to 18 years old in compliance with the data [6] and criteria developed for Uzbek population [1]. The evaluation of sexual status was performed according to Tanner classification (1968). The volume of testicles was measured with the help of Prader orchidometer.

The level of glycated hemoglobin (HbA1c) was defined by colorimetric method. The level of sex hormone-binding globulin, IRI on empty stomach and in the course of glucose tolerance test (GTT) by method of RIA («Immunotech», Czech Republic). IR indicators were calculated according to HOMA equations (HOMA-IR index, Homeostasis Model Assessment) [4]. Regulated value of HOMA index in adults was accepted as 2,27 [2].

*Statistical processing* of the research results was conducted with the use of STATISTICA package (version 6.0). The data is presented in the form of mean arithmetic values and error of mean ( $M \pm m$ ). The critical level of the value to check statistical hypotheses during the comparison of groups was 0,05.

**Results and discussion.**

The analysis of IRI level on empty stomach in the control group both in children and teenagers did not show significant difference from the stage of sexual development and sex. In boys and girls with ECO, regardless the stage of sexual development, IRI indicator on empty stomach was higher than the control, but it was significantly increased only in boys (Table 1.).

Table 1. – IRI and SHBG indicators in children and teenagers with ECO depending on sex and stage of sexual development

Indicators	Children aged 6 to 10		Teenagers aged 10 to 16				
	Boys	Girls	Boys		Girls		
	Tanner 1	Tanner 1	Tanner 2–3	Tanner 4–5	Tanner 2–3	Tanner 4–5	
n= (C/ECO)	9/10	11/15	18/29	10/16	13/22	5/13	
IRI on empty stomach	Cont.	4,1±0,8	3,7±0,3	4,9±1,0	5,2±0,4	5,4±0,6	6,5±1,0
	ECO	14,5±1,5	19,5±7,2	17,1±3,6	26,0±7,3	21,0±5,5	12,3±1,9
	p	0,000	0,07	0,01	0,04	0,03	0,09
IRI after work	Cont.	4,3±1,5	5,2±1,0	8,14±1,8	7,1±2,7	9,0±1,4	17,8±14,3
	ECO	5,1±0,02	28,2±9,7	18,3±4,3	34,2±8,0	22,6±4,3	27,0±4,6
	p	0,585	0,06	0,08	0,02	0,02	0,43
HOMA R	Cont.	0,27±0,1	0,26±0,1	0,48±0,2	0,25±0,1	0,38±0,03	0,55±0,1
	ECO	2,57±0,4	3,23±1,2	3,2±0,6	4,6±1,2	3,74±1,0	2,3±0,4
	p	0,000	0,05	0,000	0,008	0,01	0,000
SHBG	Cont.	116,1±14,3	87,9±18,4	69,8±6,7	81,3±9,1	63,1±12,9	55,9±8,0
	ECO	38,1±17,5	50,5±19,2	47,4±7,1	55,5±11,4	41,0±6,8	59,2±14,2
	p	0,003	0,19	0,04	0,13	0,11	0,89

p — significance between compared groups.

The analysis of IRI level after 2 hours after load with glucose in the course of GTT showed the increase of the indicator with the progression of puberty both in the control group and in ECO. IR was expressed in a less degree in children in the control group before the signs of puberty (I stage according to Tanner).

HOMA-IR index was significantly higher in patients with ECO than in healthy children regardless sex and stage of sexual development. Insulin resistance (the value of HOMA > 97 percentile) was detected in ECO in, respectively, 44,4% and 18,2% boys and girls with stage 1 of sexual development according to Tanner. In teenagers (65,5% — boys and 40,9% — girls) in the initial stage of puberty, the cases of HOMA > 97 percentile were also established. 68,8% of boys and 61,5% of girls with stage 4–5 according to Tanner had index HOMA > 97 percentile. It should be noted that such values occurred in boys more often than in girls at all stages of sexual development.

Unfortunately, the matter of regulated values of HOMA-IR in children and teenagers remains open. In adult patients, its normal value does not exceed 2,27. M. Keskinetal [7] proposed to consider the index HOMA-IR greater than 3,5 as IR sign in teenagers with excess body mass. M. Lambertetal [8], in his research of diagnostics of metabolic syndrome, used the value of the 75<sup>th</sup> percentile of the index HOMA-IR.

However, in our researches, it was shown that HOMA-IR > 1,8 (> 90 percentile) for age groups above 10 years old already indicates the presence of IR, and in children of the age group younger than 10 years old — HOMA-IR > 1,4 (> 90 percentile) [3], which coincides with the data of Choi Yetal [5].

The analysis of the level of sex hormone-binding globulin (SHBG) depending on the stage of sexual development showed that in boys (stage 1 Tanner) of the control group, the level of SHBG was significantly higher than in girls,  $116,1 \pm 14,3$  nmol/l and  $87,9 \pm 18,4$  nmol/l ( $P=0,003$ ) respectively. The analogical situation was observed in teenagers (stage 2–5 Tanner) from the control group (boys —  $73,6 \pm 5,43$  nmol/l; girls —  $60,5 \pm 8,62$  nmol/l;  $P=0,26$ ). As for the level of SHBG depending on the age, it was significantly higher ( $P=0,04$ ) in boys of the control group aged 6 to 10 compared with the indicator in the group aged 10 to 16. In girls, same tendency to the reduction of the hormone with age is observed. During the study of SHBG in children with ECO depending on sex, it was revealed that in the group aged from 6 to 10 (Tanner 1), the concentration of the hormone was insignificantly lower in boys ( $38,1 \pm 17,5$  nmol/l) compared with the girls ( $50,5 \pm 19,2$  nmol/l;  $P=0,65$ ). In the group of patients aged from 10 to 16 (Tanner 2–5), on the contrary, it

was insignificantly higher in boys ( $50,1 \pm 6,01$  nmol/l) than in girls ( $47,8 \pm 6,84$  nmol/l;  $P=0,80$ ). If we compare the level of SHBG in patients with ECO depending on the stage of sexual development, insignificant reduction is observed in boys (Tanner 1;  $P=0,43$ ), and an increase compared with the level in teenagers (Tanner 2–5) is observed in girls ( $P=0,87$ ).

The analysis conducted by us showed that SHBG level in children of the control group during pre-puberty (stage 1 Tanner) is higher; apparently, it is related to the low concentration of free sex hormones during this period. At the beginning of puberty, the level of SHBG reduces and the activity of free sex hormones increases.

During ECO, in the process of pre-puberty, the presence of IR leads to reduction of SHBG level. During the progression of obesity, it contributes to the increase of IR and weight gain during puberty.

According to the data received by Moran A. et al. [9], IR was stronger in girls than in boys. Although, this difference was noted at all stages of development according to Tanner, it was significantly important only at stage T4, which can be explained by small statistical power due to small size of selection. The differences in indicators between sexes can be partly, but not fully, explained by the differences in the degree of obesity, which is evaluated according to the thickness of the folds of fat. For each given value of BMI, such indicators as the thickness of folds of fat at the level of triceps and thickness of subscapular skinfold were higher in girls than in boys. The authors concluded that in healthy children, the stage of physiological IR starts at the very beginning of the puberty period. This stage is related to quick growth and development of a child and ends by the end of the puberty period. Although, the degree of IR is equally strongly related to BMI and degree of obesity at each stage of Tanner, the results of the undertaken research show that insulin resistance during the period of sexual development cannot be explained by only these factors.

#### Conclusions:

1. The values HOMA > 97 percentile occurred more often in boys than in girls at all stages of sexual development.
2. Metabolic disorders are associated with insulin resistance as main component of metabolic syndrome in children with obesity.
3. The study of glycaemia and IRI on empty stomach with the calculation of HOMA-IR should be compulsory for children with progressing obesity.
4. The indicators of HOMA-IR according to Tanner 1  $\geq 1,4$  and Tanner 2–5  $\geq 1,8$  can be used as criterion for intensive search of components of metabolic syndrome.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-127-129>

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## **Assessment achievement of target levels of glycemic control in children with type 1 diabetes, according to the National Register (NR) in Uzbekistan**

**Abstract:** The Register cards included demographic data, duration of the disease, insulin therapy type, fasting glycemia parameters, postprandial glycemia, presence of late vascular complications, date and cause of death. Carbohydrate metabolism compensation parameters were assessed in compliance with ISPAD recommendations (2007). Analysis of carbohydrate metabolism compensation in children with type I diabetes mellitus during the National Register showed that as a whole in Uzbekistan optimum parameters of carbohydrate metabolism (fasting glycemia) were 30.5%. Suboptimal carbohydrate metabolism parameters were found in 14.0% of the children. Fasting glycemia level exceeding 8.0 mmol/l was registered in the majority of the patients (52.4%). When assessing postprandial glycemia optimum carbohydrate parameters in the children were found 38.2%. 40.0% of children had suboptimal carbohydrate metabolism parameters. 16.4% of children were at the decompensation stage, that is, postprandial glycemia was higher than 2.5 mmol/l in these children. As per 2007 National Register the satisfying degree of compensation was failed to be achieved in 47.6% of children with type I diabetes mellitus that need changes in tactics of management.

**Keywords:** children, type 1 diabetes, glycemic control.

Type 1 diabetes mellitus (DM) in children is a chronic autoimmune disease, caused by destruction of pancreatic beta-cells and leads to absolute insulin deficiency.

In order to guarantee normal physical and intellectual development of children, to prevent the development of late vascular complications, blood glucose levels should be maintained within compensation rates. It is shown that elevation of the level of glycosylated hemoglobin (HbA1s) by 1% over 8%, existing for 3 months or more, increases the risk of vascular events by 40–50%. The results of a multinational study carried out recently in several countries, showed that only one third of children with diabetes have HbA1c level of less than 8%, while the vast majority of young patients are in a state of chronic decompensation. This leads to early onset of severe microvascular complications such as diabetic retinopathy, diabetic nephropathy, neuropathy, disability and death in younger patients, as well as to the deterioration of physical health, psychological and social adaptation of children and adolescents, to communication problems with family members and with peers.

Recently, it was shown that the development of complications can occur after only a few years after the onset of the disease, particularly in childhood, which forces to address issues of intensification of treatment in pediatric practice.

It is believed that stable compensation of carbohydrate metabolism achievement is harder in children rather than in adults. The main causes of inadequate compensation are as follows:

- 1) complete absence of insulin in the body with total dependence on exogenously administered insulin;
- 2) non-systematic meals;
- 3) non-permanent physical and school load;
- 4) The hormonal changes associated with growth and development;
- 5) behavioral problems associated with psychological difficulties;
- 6) frequent childhood infections.

In this regard, one of main problems of modern diabetology is the optimization and intensification of therapeutic approaches, which would improve both the therapeutic and cost-effectiveness of the treatment of children with diabetes. The quality of life and life expectancy of children with diabetes, should not differ from those of their healthy peers.

The main criteria for the effectiveness of insulin therapy is to achieve and maintain normoglycemia, absence of severe hypoglycemia and episodes of ketoacidosis, as well as the normal rates of physical and sexual development of children. The consensus on the basic principles of the treatment of children and adolescents with type 1 diabetes (ISPAD Consensus for the Management of Type 1 Diabetes Mellitus in Children and Adolescents, 2007) recommends new criteria for the diagnosis and compensation of type 1 diabetes in children and adolescents (Table 1).

Table 1. – ISPAD Clinical Practice Consensus Guidelines 2006–2007

	<b>Ideal (non-diabetic)</b>	<b>Optimal</b>	<b>Suboptimal</b>	<b>High risk (intervention is necessary)</b>
Fasting glycemia mmol/l	3,5–5,0	4,5–7,5	7,5–8,0	>8,0
Glycemia 2 hrs after meal mmol/l	6,5	4,5–9,0	9,0–12,5	>12,5
HbA1c%	<6,05	<7,5	7,5–9,0	>9,0

**Objective:** To evaluate the degree of blood glucose target levels achievement among type 1 diabetes children according to the national register from 2000–2007 depending on the regions in Uzbekistan.

#### Materials and methods

Maps of the register included demographic data, duration of the disease, insulin regimen, fasting and postprandial glycemia results, the presence of late vascular complications, date and cause of death. Indicators of compensation of carbohydrate metabolism were evaluated according ISPAD recommendations for 2007.

Comprehensiveness of the National Register (NR) of type 1 diabetes in children is currently made up of 96%, which makes the data representative.

#### Results and discussion

Currently, WHO recommends evaluation of diabetes compensation by the level of glycated hemoglobin, but in regional centers, these tests are not being conducted. Therefore, compensation eval-

uation was made according to glycemia. 2007 ISPAD Consensus Guidelines were used as criteria for compensation of diabetes in children. According to the guidelines, optimal performance, appropriate clinical and metabolic compensation is considered when fasting blood glucose level is 4,5–7,5mmol/l, suboptimal –7,5–8,0mmol/l and unsatisfactory (decompensation) — over 8,0mmol/l.

Analysis of the level of compensation of carbohydrate metabolism in type 1 diabetes in children for the duration of the register showed that for the whole Uzbekistan optimal carbohydrate metabolism (fasting plasma glucose) in children, amounted to — 30.5%. Suboptimal performance of carbohydrate metabolism was in 14.0% of children. In vast majority of patients (52.4% of children) levels of fasting glucose were over 8.0 mmol/l. A high percentage of children in a state of decompensation observed in Jizzakh — 94.4%, Andijan –63.2%, Tashkent regions –60.0%. Among adolescents in Jizzakh 78.5%, in Tashkent 74%, and in Kashkadarya region 72.5% were decompensated (table 2).

Table 2. – Achievement of target levels of fasting glycemia in capillary blood (mmol/l) in children with type 1 DM according to National Register data (%) in 2007 by ISPAD 2007 criteria

Regions	<b>Optimal</b>	<b>Suboptimal</b>	<b>High risk (intervention is necessary)</b>
	<b>4,5–7,5</b>	<b>&gt;7,5–8,0</b>	<b>&gt;8,0</b>
Andijan	17,6	20,6	63,2
Bukhara	8,33	20,8	58,3
Jizzakh	5,56	0	94,4
Kashkadarya	25,8	21,3	52,8
Surkhandarya	6,45	6,45	32,2
Syrdarya	27,7	11,1	55,5
Karakalpak Republic	42,0	2,0	38,0
Tashkent	34,7	6,25	60,0
Fergana	50,0	2,94	47,0
Namangan	21,8	28,1	46,8
Samarkand	52	6,67	42,6
Navoi	36,8	26,3	36,8
Khorezm	22,0	12,0	58,0
Tashkent city	49,2	16,6	34,2
<b>Uzbekistan</b>	<b>30,5</b>	<b>14,0</b>	<b>52,4</b>

Optimal levels of postprandial glycemia of carbohydrate metabolism observed in 38.2% of children with diabetes. 40.0% of children had suboptimal levels of carbohydrate metabolism. 16.4% of children were in state of decompensation, so that postprandial

glycemia comprised over 12.5 mmol/l in these patients. The highest percentage of children in decompensation state was observed in Jizzakh region — 94.4%. (Table 3).

Table 3. – Achievement of target levels of postprandial glycemia in children with type 1 DM

Regions	<b>Optimal</b>	<b>Suboptimal</b>	<b>High risk (intervention is necessary)</b>
	<b>4,5–9,0</b>	<b>&gt;9,0–12,5</b>	<b>&gt;12,5</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Andijan	23,5	64,7	11,7
Bukhara	4,17	79,1	4,17
Jizzakh	11,1	27,7	55,5
Kashkadarya	70,7	25,8	3,37
Surkhandarya	19,3	19,3	3,23
Syrdarya	0	5,56	11,1
Karakalpak Republic	24,0	44,0	2,0



<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Tashkent	16,9	28,5	2,68
Fergana	41,1	50,0	2,94
Namangan	15,6	65,6	6,25
Samarkand	45,3	50,6	2,67
Navoi	63,1	31,5	5,26
Khorezm	6,0	30,0	8,0
Tashkent city	40,0	36,4	23,6
<b>Uzbekistan</b>	<b>38,2</b>	<b>40,0</b>	<b>16,4</b>

Thus, 2007 National Register data showed that 47.6% of children with type 1 diabetes had not achieved satisfactory levels of compensation and to change their treatment tactics, especially in Tashkent, Jizzakh, Andijan, Syrdarya, Khorezm and Kashkadarya regions.

#### **Conclusions:**

Thus, 2007 National Register data showed that 47.6% of children and 37.9% of adolescents with type 1 diabetes had not achieved satisfactory levels of compensation and to change their treatment tactics, especially in Tashkent, Jizzakh, Andijan, Syrdarya, Khorezm and Kashkadarya regions.

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**DOI:** <http://dx.doi.org/10.20534/ESR-16-9.10-129-133>

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## **Influence modulators of nitric oxide synthesis on the activity of liver enzymes monoxygenase in animals with acute toxic hepatitis**

**Abstract:** A nonselective inhibitor L-NAME NOS (eNOS and nNOS) and selective inhibitor 7-NI (nNOS) inhibit, and selective inhibitor iNOS- S-MT, and the donor L-arginine NO- increase the activity of enzymes of the monoxygenase system of the liver. The inhibition of the activity of microsomal liver enzymes by the action of L-NAME statistically correlated with indicators of high activity in microsomes iNOS, content of ONO<sub>2</sub>- and low activity of eNOS. Under the action of the selective inhibitor iNOS- S-MT stimulation of functional activity of microsomal enzymes is correlated with the induction of eNOS, iNOS inhibition and the content ONO<sub>2</sub>-. The lack of correlation between the NO in the microsomes and microsomal enzymes in the liver give the reason to believe that an important factor modulating the activity of monoxygenases are isozymes NOS — eNOS, iNOS and the content of ONO<sub>2</sub>.

**Keywords:** pathophysiology, liver pathologies, NO- system with monooxygenase, cytochrome P-450, endothelial (eNOS), neuronal (nNOS), inducible (iNOS).

One of the fundamental problems in modern pathophysiology is to identify the relationship NO- system with other inter-system cell compartment [2, 32]. At liver pathologies a particular interest performs interrelation NO- system with monooxygenase [19, 23]. NO-system aims at maintaining homeostasis NO in tissues, organs and systems involving the family of cytochrome P-450 — of similar enzyme using the amino acid L-arginine as a substrate [7, 22]. All isoforms NO- synthase — endothelial (eNOS), neuronal (nNOS) and inducible (iNOS) use L-arginine, oxygen and NADPH as substrates for NO synthesis [8]. Cofactors of the catalytic activity of NOS isoforms are tetrahydrobiopterin (BH4), calmodulin, flavin adenine dinucleotide (FAD), flavin mononucleotide (FMH) [9, 15]. It is noted that the reduction of L-arginine and BH4 initiates iNOS, nNOS and eNOS to a product of superoxide anion radical and formation of reactive oxygen species (ROS) [4, 34]. In this process overexpression of NO [5], holds an important place which is associated with inactivation of the enzymes of DNA damage acceleration of apoptosis [29, 30, 33]. At the same time monooxygenase system, which is mainly responsible for the homeostasis of the cell in complex with antioxidants for the detoxification of ROS and superoxide, also in its reaction it uses oxygen and the same NADPH cofactors as of NOS [1, 35, 38]. Despite the importance of these systems in the maintenance of physico-chemical cell homeostasis, their functional relationship at the level of the liver microsomal oxidation remains absolutely not clear. In recent years, for detecting of functional activity of NO-system, for contributing to this process various isoforms of NO-synthase are used nonselective and selective inhibitors of NOS [6, 24]. For non-selective NOS inhibitors refers L-NAME (N $\omega$ -nitro-L-Arginine Methyl Ester), which blocks constitutive forms of NOS — eNOS and nNOS, a selective inhibitor of nNOS — 7-nitro-indazole (7-NI) and a selective inhibitor of iNOS — S-Methylisothiourea (S-MT) [9, 13]. As an activator, of NO-synthase is used its predecessor amino acid L-arginine [21]. To estimate the functional activity of NO-synthase, along with determining level of NO, the activity of eNOS, iNOS the substance of peroxynitrite (ONO $_2^-$ ) is studied in tissues. Increasing ONO $_2^-$ -concentration is an effective measure of expressiveness iNOS, development of destructive processes in the tissues [18, 25].

In view of the above, the purpose of the research held in liver microsomes in experimental animals with acute toxic hepatitis (OTG) is to study the influence of nitric oxide synthase modulators for the activity of monooxygenase enzymes and the elucidation of their possible functional relationship with isoenzyme activity as a part of NOS.

**Material and methods.** The experiments were conducted on 48 white nondescript male rats weighing 180–250g. Animals were divided into 6 groups, 8 rats each. OTG was reproduced with classical method (NH Abdullaev, Karimov H. YA. 1986.). 1, 2, 3 and 4 groups consisted of animals injected with medications produced «Acrosorganies» US after reproduction OTG: nonselective inhibitor of NOS — N $\omega$ -nitro-L-Arginine Methyl Ester (L-NAME) at a dose of 10 mg/kg, selective inhibitors NOS- 7-nitro-indazole (7-NI) and S-Methylisothiourea (S-MT) at doses of 10 and 3 mg/kg, as well as aqueous solutions intraperitoneally L-arginine («Merk») at a dose of 150 mg/kg, once in the morning for 6 days and nights at 0.5 ml per 100 g body weight. Animals with intact rats and OTG of (5 and 6gr) were used as a control group. Investigations were carried out on the 7th day. The animals were kept under standard vivarium conditions and dietary feeding. Slaughtering of ani-

mals was under Rauschnarcosis conducted by the instant decapitation. The withdrawal and isolation of subcellular fractions was performed in a cold chamber at  $0 \pm 4^\circ\text{C}$ . The selected by preparative ultracentrifugation apparatus 601 VAC (Germany) at 105000g microsomal liver tissues fractions was determined by a two-beam spectrophotometer UV-2100 (Ltd, China) cytochrome P-450, P-420 and b5 in classical method by T. Omura, R. Sato [27]; the activity of microsomal enzymes: NADPH-cytochrome C-reductase (NADPH cit. C-red.) in C. H. Williams, H. Kamin [36]; benzo (a) pyrenehydroxylase (B (a) NG) — by C. H. Yang, L. P. Kicha [37]; N-amidopyrimidinemethylase (N-UP) — by A. Bast, J. Nordhosck [16]; aniline hydroxylase (AG) — on AI Archakova et al. [3]; Glucose 6-phosphatase (G-6-Phase) to the NS Gnosh, N. C. Kar [17]; microsomal protein (mg/ml) — by O. H. Lowry et al. [28]. At the same time allocated microsomes determined the content of NO according to the basic stability of its metabolites — NO $_2^-$  and NO $_3^-$  by P. P. Golikov's approach and et al. [8]; the activity of eNOS — according to V. V. Sumbaev, I. M. Yasinskaya [12]; the activity of iNOS and the concentration of peroxynitrite (ONO $_2^-$ ) according to M. U. Ravaeva, E. N. Chuyan [10]. The obtained data were statistically processed using statistical analysis BioStat 2008 using parametric (Student's t-test) and nonparametric (Mann-Whitney) criteria. The data were presented as arithmetic average  $M \pm m$  error of the mean. In order to study the statistical correlation calculation there was performed Spearman correlation coefficient ( $r$ ). The data were considered statistically significant at  $P < 0.05$ .

**Results and discussion.** It was found that the OTG caused by CCl $_4$ , is observed inhibition in hepatocytes all studied enzymes MOS. The content of cytochrome P-450 and b5 — decreased — 1.8 and 2 ( $P < 0.001$ ) times, reduced form P-450 — cytochrome P-420 increased — 2 ( $P < 0.001$ ) times; the activity of NADPH cit. c-red., B (a) NG AH, N-AP, G-6-phase decreased by 3.0; 3.8; 3.3; 2.6 and 3.9 ( $P < 0.001$ ) times, respectively. It was established that the non-selective inhibitor of NOS (eNOS and nNOS) L-NAME, and the nNOS selective inhibitor — 7-NI at 6 days and nights administered to animals lead to a substantial reduction of detoxifying liver function. When administered L-NAME functional activity of liver detoxification suppressed more pronounced than the introduction of 7-NI. After 6 days of administration of L-NAME cytochrome P450 and b5 decreased by 22.3 and 21.6% ( $P < 0.01$  and  $P < 0.05$ ), respectively, the reduced form of cytochrome P-450 and P 420 increased by 31.6% ( $P < 0.001$ ); activity NADPH cytochrome s-eds., B (a) NG AH, N-AP, G-6-phase decreased by 31.1 ( $P < 0.05$ ); 34.6 ( $P < 0.01$ ); 28.7 ( $P < 0.01$ ); 22.4 ( $P < 0.05$ ) and 26.5 ( $P < 0.01$ )%, respectively, compared with the group with OTG (table 1). However, after the introduction of 7-NI cytochrome P450 and b5 — has been reduced by 17.1 and 19.2 ( $P < 0.05$ ), reduced form cytochrome P-450, P-420 increased by 20.8% ( $P < 0.001$ ), the activity of NADPH cit. c-red. decreased — by 14.9% ( $P < 0.05$ ), B (a) NG — by 19.1% ( $P < 0.05$ ), AG (hypertension), N-AP-6 and T-phase, respectively, — 18.5; 16.5 and 18.4% ( $P < 0.05$ ). At intraperitoneal 6 daily administration selective inhibitor iNOS- S-MT we detected a Table 1.

Significant increase in enzyme activity of the monooxygenase system of the liver compared to animals with OTG.

Similar results were obtained when we administered the substrate L-arginine NOS-. The content of cytochrome P-450 increased in both groups compared to the group with OTG 29.6 and 34.8% ( $P < 0.05$ ), b5—23.5 and 27.3 ( $P < 0.05$ , and  $P < 0.01$ )%,

the reduced form of the P-450 cytochrome P-420 decreased — by 13.2 and 26.1% (P < 0.001); activity NADPH cit. c-red. increased by 20.8 and 25.7 (P < 0.001) % B (a) NG — 21.2 and 27.5 (P < 0.05 and 0.001)%, hypertension — by 23.3 and 36.1 (P < 0.05 and 0.01)%, N-An- 21.6 and 32.3 (P < 0.01 and 0.002)%, G-6-Phase- 22.2 and 30.7 (P < 0.01 and P < 0.001)%. Consequently, NOS modulators have the ability to alter the activity of microsomal liver enzymes. Their pharmacological effect, aimed at changing the functional activity of microsomal liver enzymes, depends on the ability to block isoforms in the active site of NOS [23]. Competitive inhibition of esters of L-arginine and specific braking of the activity of individual isoforms L-NAME blocks constitutive eNOS and nNOS, 7-NI — nNOS, S-MT — iNOS, they thereby interfere with the

process of biotransformation NO — the level of which is controlled by not only the NOS, but enzymes and microsomal oxidation [13, 15]. However, the change of NO level in microsomes under the influence of modulators NOS appears to be the important factor in the regulation of enzyme activity of the monoxygenase system of the liver of experimental animals. However, changes in the level of NO in microsomes under the influence of modulators NOS appears to be the important factor in the regulation of enzyme activity of the monoxygenase system of the liver of experimental animals. According to these experimental studies, in animals with OTG is observed increase in NO level of 1.8 (P < 0.001) times, depression enzyme eNOS 2.1 (P < 0.001) times, iNOS expression by 2.1 (P < 0.001) times, ONO2–2.3 (P < 0.001) times.

Table 1. – Indicators of activity of microsomal liver enzymes in the studied groups of animals, M ± m

Index	intact (control)	OTG	L-NAME 1 gr.	7-NI 2 gr.	S-MT 3 gr.	L-arginine 4 gr.
P-450, nmol/mg	0,96±0,031	0,53±0,012*	0,41±0,010*Δ	0,44±0,011*Δ	0,69±0,016*Δ	0,71±0,024*Δ
P-420, nmol/mg	0,05±0,001	0,10±0,001*	0,13±0,003*Δ	0,12±0,003*Δ	0,09±0,001*Δ	0,07±0,001*Δ
B5, nmol/mg	0,61±0,017	0,28±0,09*	0,22±0,007*Δ	0,33±0,008*Δ	0,35±0,011*Δ	0,36±0,012*Δ
HAΔΦH-cit. c-red., nmol/min/mg	127,9±5,24	42,8±1,77*	29,5±1,19*Δ	36,4±1,52*Δ	51,7±2,23*Δ	53,8±2,67*Δ
Benz (a), nmol/min/mg	2,68±0,072	0,71±0,026*	0,46±0,015Δ*	0,57±0,19*Δ	0,86±0,031*Δ	0,91±0,038*Δ
AG, nmola mino-phen/min/mg	0,72±0,025	0,22±0,006*	0,16±0,003*Δ	0,18±0,004*Δ	0,27±0,008*Δ	0,30±0,009*Δ
N-AP, nmol HC HO/min/mg	4,69±0,187	1,83±0,068*	1,42±0,049*Δ	1,53±0,052*Δ	2,22±0,075*Δ	2,42±0,086*Δ
Γ-6-Phase, nmol-Rneopg/min/mg	77,34±1,940	19,57±0,861*	14,38±0,525*Δ	15,97±0,631*Δ	23,91±0,992*Δ	25,58±1,102*Δ

\* – P < 0.05 compared with control

Δ – P < 0.05 compared with OTG

To carry out this version, we studied the activity of NO-system in liver microsomes after a 6-day administration of drugs L-NAME, 7-NI, S-MT and L-arginine. It was found that the inhibitor L-NAME instead of the expected decrease in NO, as a consequence of inhibiting the activity of eNOS and nNOS led to its substantial increase over the OTG by 33.3% (P < 0.001). The activity of eNOS was reduced by 26.5% (P < 0.01). Reduced activity of eNOS at the same time was characterized by hyperexpression of the enzyme iNOS by 24.2% (P < 0.001) and the number of ONO2–29,5% (P < 0.001) (table 2). When analyzing the actions of the selective nNOS inhibitor — 7NI established that its pharmacological effect in almost same direction as the action of L-NAME on the activity of NO-system in liver microsomes, but to a lesser extent.

In assessing the pharmacological activity of S-MT and L-arginine is traced the picture reducing NO, compared with the group with OTG — 13.8 and 16.2% (P < 0.05) in liver microsomes, accompanied by increased eNOS activity — 14.8 and 13.6 (P < 0.05 and P < 0.02)%, respectively, in the liver. At the same time there is a decrease level of iNOS and ONO2- in liver microsomes 21.2–24.8 (P < 0.001) and 18.7% — 27.5 (P < 0.02 and P < 0.01)%, respectively the investigated preparation in groups.

Consequently, all study drugs have an influence on the activity of eNOS, iNOS, ONO2-content in liver microsomes. Therefore it can be assumed that the increase in activity eNOS in liver microsomes in our studies with S-MT effect connected with selective blockade of iNOS, and the increase of NO as a result of the high activity of eNOS. Simultaneously, the need for increased substrate

oxidation and NO donor — L-arginine, which in a high activity of eNOS, is synthesized from residual nitrogen and creatinine function owing to increase L-ornithine cycle [20]. This is fully confirmed by experiments in animals when administered L-arginine. Decrease iNOS activity is associated with intensification of the microcirculation in the tissues, supplying tissues with oxygen, reducing the phenomena of hypoxia, the main mechanism for the formation of free radicals, reactive oxygen species (ROS) [6, 18].

On this basis, it can be assumed that the level is reduced in the liver microsomes ONO2-, the level of which is determined by the excess of NO and ROS [11, 15]. When administered to animals an unselective inhibitor L-NAME and selective inhibitor 7-NI overexpression of NO in liver microsomes and blood serum provides increased iNOS activity.

According to the literature blockade of eNOS and nNOS enzyme entails initiation iNOS [5, 11]. High levels of iNOS causes depletion stocks of L-arginine as well as adequately to a reduction of L-arginine in the body of animals, the mechanism of the maintaining tone of the vascular bed with involvement of the ET-1 protein. Its increase promotes hypoxia in the tissues and a significant increase ONO2-, having a high cytotoxic and cytolytic properties [9]. In this regard, it is believed that among the causes of a modulating effect enzymatic detoxification system of the liver by the activity of nonselective and selective NOS inhibitors and L-arginine are the processes, not only the changes in the activity of enzymes NOS, and the level of L-arginine, but also ONO2-content vibrations. To substantiate this version we carried out studies on correlation dependence between the indicators of enzyme system and the

parameters NOS detoxifying liver microsomes in groups of animals administered with L-NAME and S-MT. It was found that the administration of L-NAME was characterized by the presence of credible direct correlation link ( $r = 0.88-0.94, P < 0,001$ ) between the increase in cytochrome P-420 activity and iNOS, content of ONO<sub>2</sub>- and reverse correlation ( $r = 0.88-0.93, P < 0,001$ ) between the reduction of cytochrome P-450, b5, enzyme NADPHcit. c-red, B (a) NG AH, N-AP and with G-6-Phase. At the same time, also found a clear direct dependence with depression indicators eNOS reduction investigated indicators of detoxification enzymes of liver microsomes. With the preparation S-MT inhibition of iNOS, declining ONO<sub>2</sub>-parameters accompanied by a strong inverse relationship, the correlation index increases with an increase in the cytochrome P-450, b5, the activity of enzymes of microsomal oxidation — NADPHcit. c-red, B (a) NG AG, N-AP and F-6-Phase. There was revealed a strong direct correlation ( $r = 0.89-0.94, P < 0,001$ ) indicators eNOS with all parameters of liver detoxification (except with cytochrome P-420, with which they had a strong inverse correlation  $r = 0.90-0.95, P < 0,001$ ). At the same time we

found no correlation dependence with the introduction of animal and L-NAME S-MT between the change in a parameter of NO in liver microsomes with indicators of activity of the studied enzymes of microsomal oxidation in the body. Hence, an important cause of directed changes catalytic activity of enzymes of microsomal oxidation in the liver under the influence of NOS modulators based on processes of associated with the activity of enzyme eNOS, iNOS and level ONO<sub>2</sub>-. Thus, studies have shown that the enzyme activity at the level of the monooxygenase system of the liver microsomes functionally linked to the NOS, through modulation mechanism family of isoforms of cytochrome P-450 such enzymes using as substrate oxidation amino acid L-arginine. The orientation of the activity of enzymes MOS of the liver is determined by the intensity eNOS and iNOS, as well as the expression of ONO<sub>2</sub>-. The differences in the change of enzyme activity MOS liver depending on the modulating effects of NOS isoenzymes indicates the possibility of their participation in the specific functional and structural changes of the liver tissue when exposed to the body of pathogenic environmental factors.

Table 2. – Indicators of NO-system in microsomes in animal studying groups, M ± m

Index	Intact (control)	OTG	L-NAME 1 gr.	7-NI 2 gr.	S-MT 3 gr.	L-arginine 4 gr.
NO, mkmol/mg	5, 52±0, 164	9, 95±0, 378*	13, 26±0, 584*Δ	11, 8±0, 458*Δ	8, 58±0, 284*Δ	8, 34±0, 262*Δ
eNOS, mkmol/min/mg	17, 42±0, 627	8, 48±0, 291*	6, 23±0, 209*Δ	7, 25±0, 253*Δ	9, 73±0, 310*Δ	9, 63±0, 317*Δ
iNOS, mkmol/min/mg	0, 10±0, 002	0, 21±0, 09*	0, 26±0, 011*Δ	0, 24±0, 009*Δ	0, 17±0, 005*Δ	0, 16±0, 004*Δ
ONO <sub>2</sub> -, mkmol/mg	0, 08±0, 002	0, 18±0, 007*	0, 23±0, 008*Δ	0, 21±0, 007*Δ	0, 15±0, 004*Δ	0, 13±0, 003*Δ

\* –  $P < 0.05$  compared with control

Δ –  $P < 0.05$  compared with OTG

### Conclusions:

1. A nonselective inhibitor L-NAME NOS (eNOS and nNOS) and selective inhibitor 7-NI (nNOS) inhibit, and selective inhibitor iNOS- S-MT, and the donor L-arginine NO- increase the activity of enzymes of the monooxygenase system of the liver.

2. The inhibition of the activity of microsomal liver enzymes by the action of L-NAME statistically correlated with indicators of high activity in microsomes iNOS, content of ONO<sub>2</sub>- and low ac-

tivity of eNOS. Under the action of the selective inhibitor iNOS- S-MT stimulation of functional activity of microsomal enzymes is correlated with the induction of eNOS, iNOS inhibition and the content ONO<sub>2</sub>.

3. The lack of correlation between the NO in the microsomes and microsomal enzymes in the liver give the reason to believe that an important factor modulating the activity of monooxygenases are isozymes NOS — eNOS, iNOS and the content of ONO<sub>2</sub>.

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## Formation of circulating immune complexes (CIC) and immunoglobulins in intrauterine infection (IUI)

**Abstract:** The results of examination of 140 newborns with neonatal pathology on CIC contents and three classes of immunoglobulins (A, M, G) in the blood serum have been presented in the article. The highest CIC indices have been noted in the newborns with intrauterine pneumonia (IUP) that makes  $143,5 \pm 0,87$  cond. un. The same CIC indices have been noted in the newborns with neonatal pneumonia (NP) ( $140,7 \pm 0,89$  cond. un.) and purulent inflammatory diseases (PID) ( $136,4 \pm 0,83$ ). High CIC indices prove that there is excessive amount of antigens in the newborns body which invaded there in the intrauterine period. Complement concentration ( $C_{H50}$ ) decreases in adverse proportion to a high CIC level (43,4 un. — IUI, 42,7 un. — NP, 39,6 un. — PID, 49,3 un. in the norm), that can be explained by complement consumption in antigen — antibody reaction in CIC formation. Low indices of Ig G in comparison with the norm in the newborns in neonatal pneumonia ( $3,9 \pm 0,29$ ), purulent inflammatory diseases ( $3,76 \pm 0,3$ ) admit the thought that placental transmission of Ig G and intrauterine infection take place.

**Keywords:** Circulating immune complexes, complement, immunoglobulins, newborns.

**Introduction.** Criteria of IUI are numerous. No doubt that discovery of the causative agent from the focus of the newborn damage is the main criterion [2]. Serological study of the newborns on antibody presence using IFA gives insufficient information. In IUI immunoglobulin synthesis increases by the fetus first of all due to immunoglobulins of Ig M class but with this "collection" of monomers into pentamers is disturbed. Sometimes in IUI Ig G, Ig A syntheses sharply increase and in these cases in prolonged circulation of the causative agent abundance of immune complexes is formed and they cause damage to the tissue [5].

The study of the role of immunological mechanisms in IUI pathogenesis is being continued. Pathogenetic mechanisms of CIC are studied in various pathological conditions in recent years [1]. Formation of antigen + antibody + complement complexes (CIC) is a natural immunological reaction of a healthy body directed to the discharge of foreign antigen and persistence of homeostasis. In the norm these complexes are rapidly eliminated of the blood by mononuclear phagocyte system but in continuous effect of antigens to the body CIC level in the blood increase [6; 7].

**The aim of the research** — to study pathogenetic, prognostic aspects of circulating immune complexes and three classes of immunoglobulins (A, M, G) in intrauterine infection.

### Material and methods of the research

The blood serum has been studied on presence of CIC,  $C_{H50}$  and three classes of immunoglobulins (A, M, G) of 140 newborns hospitalized to DPN RCMC of Samarkand city. CIC have been determined by precipitation of polyethylglycol (PEG) according to V. Gashkova et al. method (1979), the complement level according to the method proposed by F.Yu. Garib and A. I. Sharapova (1973). Quantitative definition of A, M, G immunoglobulins fractions were studied according to Mancini G., Carbon A. O., Hage-man's I. F. (1965).

The received figures have been processed by variation statistical method with calculation of arithmetic mean (M), arithmetic mean error (m) on the computer by means of Microsoft Excel 2007 program.

### The results of the research and their discussion

140 newborns have been examined. Of them 52 (37,1%) developed intrauterine pneumonia during 72 hours following the birth, burdened obstetric anamnesis was noted and bacterial inoculation was confirmed during 1–2 days of life. Neonatal pneumonia was marked in 45 (32,1%) examined newborns.

The performed immunological studies show that CIC contents in the blood serum of the studied groups exceeds vibratory number of CIC in healthy newborns. The highest CIC indices have been noticed in the newborns with intrauterine pneumonia that makes  $143,5 \pm 0,87$  cond. un. The same high indices in comparison with the normal ones are noted in the other groups of newborns with neonatal pneumonia ( $140,7 \pm 0,89$ ) and purulent inflammatory diseases ( $136,4 \pm 0,83$ ) (table 1).

Formation of circulating immune complexes takes place by means of complement. In our observations the average complement index in the observed patients was low in comparison with healthy newborns. In the newborns with intrauterine pneumonia the average complement index makes 43,4 un., neonatal pneumonia — 42,7 un. and purulent inflammatory diseases — 39,6 un.;  $M \pm m$  —  $43,4 \pm 0,56$ ;  $42,7 \pm 0,57$ ;  $39,6 \pm 0,52$  un. accordingly.

In reverse proportion to a high CIC level complement concentration decreases that can be explained by its consumption in antigen — antibody reaction in formation of immune complexes. The increase of circulating immune complexes number is the evidence that there is excessive amount of antigens in the newborns body which penetrated there in the intrauterine or perinatal period. Thus, the observed CIC accumulation on the background of complement consumption coordinates with literature information [4].

In the norm in the newborns under one month Ig A in the blood serum makes from 0,01 to 0,5g/l, Ig M — 0,2–0,9 g/l and Ig G — 2,5–9,0 g/l. According to our observations the largest amount of Ig A makes 0,8g/l that is higher than normal. It is considered that the level of serous Ig A and Ig M increases in perinatal infections, diseases

es of the respiratory and intestinal tracts. In the newborns intrauterine, neonatal pneumonia and purulent inflammatory diseases had a complicated course with sepsis, diarrhea and increase of immuno-

globulins contents (Ig A — 0,8g/l; 0,6g/l; 0,7g/l; IgM — 1,9g/l; 5,6g/l; 1,8g/l accordingly) that may be considered as natural body reaction (table 2).

Table 1. – The level of circulating immune complexes (CIC) and complement in the blood serum of the newborns IUP, NP and PID

Newborn groups	Indices	CIC in cond. un.	Complement <sub>H50</sub> in un.
Intrauterine pneumonia	n	52	52
	M ± m	143,3 ± 0,88	43,4 ± 0,55
Neonatal pneumonia	n	45	45
	M ± m	140,7 ± 0,87	42,7 ± 0,56
Purulent inflammatory diseases	n	43	43
	M ± m	136,4 ± 0,81	39,6 ± 0,51
In healthy newborns	Norm	60–120	38–60

Note: The received figures have been processed by variation statistical method with calculation of arithmetic mean (M) and arithmetic mean error (m). The average meanings of the received results have been pointed out —  $p < 0,05$ .

Table 2. – The level of A, M, G immunoglobulins in the blood serum of the newborns with IUP, NP and PID

Newborn groups	Indices	The number of immunoglobulins g/l		
		A	M	G
Intrauterine pneumonia	n	52	52	52
	M ± m	0,36 ± 0,03	1,2 ± 0,06	5,0 ± 0,30
Neonatal pneumonia	n	45	45	45
	M ± m	0,4 ± 0,02	2,0 ± 0,22	4,0 ± 0,29
Purulent inflammatory diseases	n	43	43	43
	M ± m	0,3 ± 0,03	1,0 ± 0,06	3,8 ± 0,29
In healthy newborns	The norm from birth to 1 month	0,01–0,5	0,2–0,9	2,5–9,0

Note: The received figures have been processed by variation statistical method with calculation of arithmetic mean (M) and mean error (m). The average meanings of the received results have been pointed out —  $p < 0,05$ .

High Ig G contents in the blood serum has been marked in the newborns with intrauterine pneumonia. It is known that Ig G globulin contains the basic mass of antibodies, fixes the complement. It is the only of immunoglobulins which can pass through placenta.

Low Ig G indices in comparison with the normal in the newborns with neonatal pneumonia ( $3,9 \pm 0,29$ ) purulent inflammatory diseases ( $3,76 \pm 0,3$ ) and high indices with intrauterine pneumonia ( $4,9 \pm 0,3$ ) admit the thought that placental transfer of Ig G and intrauterine infection take place.

### Conclusions

1. High CIC indices in the newborns with neonatal pathology are the evidence of excessive amount of antigen in their body which penetrated their due to intrauterine infection.

2. In reverse proportion to a high CIC level complement concentration decreases that can be explained by its consumption in antigen — antibody reaction in formation of immune complexes.

3. Low Ig G indices in comparison with normal in the newborns with neonatal pneumonia ( $7,4 \pm 1,6$ ), purulent inflammatory diseases ( $7,6 \pm 1,6$ ) and high indices in intrauterine pneumonia ( $11,8 \pm 2,9$ ) admit the thought that placental transfer of Ig G and intrauterine infection take place.

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## Study of relation of polymorphism Gene *Glut9* with coronary heart disease associated asymptomatic hyperuricemia in Uzbek population

**Abstract:** According to the modern conception ischemic heart disease (IHD) relates to category of multifactorial disease in the development of it both environmental factors and individual genetic predisposition have the important role. In the article it has been presented the analyses of the results of distribution frequencies of alleles and T/G genotypes of the polymorph *GLUT9* gene in the population of Uzbek nationality suffered from IHD with asymptomatic hyperuricemia in the comparison with the healthy part of population. It has been established that in the forming of genetic structure of IHD associated with asymptomatic hyperuricemia in Uzbek population genotype *GLUT9T/T* and allele *GLUT9T* play the important role.

**Keywords:** ischemic heart disease, asymptomatic hyperuricemia, genetic polymorphism, Uzbek population.

**Introduction.** Ischemic heart disease (IHD) relates to category of multifactorial disease, i. e. in the development of it both environmental factors and individual genetic predisposition have the significant role [4]. According to the data of epidemiological investigations the contribution of genetic factors in the etiology of IHD is 20–60% [9]. As a rule, predisposition genes are those genes, protein products of which are directly or indirectly involved in the pathogenesis of the disease. In the pathogenesis of IHD one of the earliest events are asymptomatic hyperuricemia (AH). The carried out big trials — NHANES, Framingham Heart Study, MONICA/KORA Cohort Study have been showed that in patients with AH risk of the development acute myocardial infarction (AMI) and mortality from it increases in 1,5–2,0 times, development of IHD in 2,2–3 times high than in patients with metabolic syndrome (MS) [1, 3, 5]. In connection with it, for the present time in the development of IHD AH considers as independent predictor and pathogenetic factor. The results of investigations of the last years testified about close relationship of *SLC2A9* (*GLUT9*) genes polymorphisms with concentration of uric acid in the blood urea [10]. *SLC2A9* gene supplies protein instruction which calls transporter of glucose (9 *GLUT9*). This protein basically is found in kidneys, particularly in the proximal tubules. In the proximal tubules protein helps to transport uric acid. Protein helps to absorb *GLUT9* of the uric acid (or analogue variant of this substance which calls urates) in the blood flow or let it out with urine depending on the demands of the human organism. *GLUT9* protein also plays role in the reabsorption and excretion of glucose. Some trials showed variations of *SLC2A9* gene have been connected with gout and gouty arthritis [6], and data regarding relationship of *SLC2A9* (*GLUT9*) genes polymorphism with IHD in the world literature has been practically absent [2; 8].

Thus, review the data of literature on modern aspects of pathogenesis of IHD, and also extremely limited amount of scientific

works on study of the genes supplying transportation of uric acid during studied pathology have been determined the necessity of performing of this study.

**The aim** of the presented investigation was the study of frequencies distribution of alleles and genotypes of T/G of polymorphic variant of *GLUT9* gene in patients with ischemic heart disease with asymptomatic hyperuricemia and to establish “unfavorable” combination leading to the high probability of the disease development in Uzbek population.

**Material and methods.** According to the formulated aim we studied the features of distribution frequencies of alleles and genotypes of the polymorphic variant of *GLUT9* gene in patients with ischemic heart disease (IHD) and healthy individuals of Uzbek nationality. Verification of diagnoses of IHD was made according to the International Classification of WHO (X — review, ICD — 10). Genetic typing of the polymorphic T/G locus of *GLUT9* gene has been carried out in the contingent of 56 patients with IHD and 17 healthy people of Uzbek nationality. Genome DNA has been taken out of lymphocytes of the peripheral blood with the use of set of reagents for taking out of DNA Diatom™ DNA Prep 200. Then supernatant with DNA has indirectly exposed genetic typing by PCR — amplification. Typing the samples of DNA has been carried out with the use of specific oligonucleotide primers. Oligonucleotides were synthesized by IDT Company (Integrated DNA Technologies, Iowa, USA). Arrangement of PCR has been performed in the sterile conditions in the special derived room. All manipulations were carried out on ice. PCR — test was performed with the use of the set of reagents for PCR amplification of DNA GenePak™ PCR Core. Amplification programs were strictly specific: 5 minutes of preliminary denaturation in the temperature of 95 °C — 5 seconds, 40 circles; 95 °C — 20 seconds, 61 °C — 35 seconds, 72 °C — 45 seconds; the last elongation in the temperature of 72 °C during



7 minutes. Then PCR — products have been exposed by restrictive test with the use of specific restrictase BseLI. Intubation temperature was 65 °C during 16 hours. Detection of PDRF — products and genetic typing were carried out with the use of horizontal or vertical electrophoresis systems in 8% of polyacrilamide gel. For the further processing the data of electrophoresis has been transformed in the digital format. Presence of two bends (187/27 p. n. in size) testifies about homozygote GG genotype. Presence of three bends 214/187/27 p. n. in size testifies about heterozygote TG genotype. Presence of one bend 214 p. n. in size testifies about homozygote TT genotype. The results of electrophoresis of PCR — products in the examined patients with IHD and asymptomatic hyperuricemia on GLUT9 have been presented in figure 1.

Statistical processing of the association of the studied genes with the disease development has carried out with the use of the program software «StatPlus — v5», calculating —  $\chi^2$  criterion,  $P_{Value}$  OR.

**Results and discussion.** During performing genetic comparisons of alleles and genotypes of GLUT9 gene of the patients' group with IHD and asymptomatic hyperuricemia, and healthy individuals it has been noted that T allele in the group of patients with IHD and asymptomatic hyperuricemia is found reliably often than in the group of practically healthy persons (83,1% in the comparison with 50%, respectively,  $\chi^2 = 15,32$ ;  $p = 0,0001$ ).



Figure 1. The example of electrophoregram of the results of PDRF test GLUT9 GLUT9 gene (G/T polymorphism) from the 4th to 19th tested specimens

Table 1. – The frequency distribution of alleles of T/G polymorphism of GLUT9 gene in patients with IHD and asymptomatic hyperuricemia, and healthy individuals

Polymorphism	Groups	N	Allele		$\chi^2$	$P_{Value}$
			T	G		
T/G GLUT9	Control	17	17–50%	17–50%	15,32	0,0001
	Patients	56	93–83,1%	19–16,9%		

The study of polymorphism of genotypes (table 2) shows that in the group of patients with IHD frequency of homozygote variant of T/T of GLUT9 gene is significantly exceeded the indexes of the

control group of healthy people (67,8% against 35,2%, respectively,  $\chi^2 = 5,77$ ;  $p = 0,01$ ; OR=10,3).

Table 2. – The frequency distribution of genotypes of T/G polymorphism of GLUT9 gene in patients with IHD and asymptomatic hyperuricemia, and healthy individuals

Polymorphism	Groups	N	Genotypes			$\chi^2$	$P_{Value}$	OR
			T/G	G/G	T/T			
T/G GLUT9	Control	17	5–29,6%	6–35,2%	6–35,2%	5,77	0,01	10,3
	Patients	56	17–30,4%	1–1,8%	38–67,8%			

Besides the frequency of the homozygote variant of G/G in the group of patients with IHD was notably lower from the level which is typical for the healthy part of the examined population of people (1,8% in the comparison with 35,2%). The frequency of the heterozygote variant of T/G of GLUT9 gene in this group of patients almost was not differs from control group. The performed analyses of features of distribution frequencies of alleles and genotypes of T/G polymorphism GLUT9 gene showed the presence of statistically reliable differences between T allele and T/T genotype in the group of patients with IHD associated with asymptomatic hyperuricemia in the comparison with the control group of healthy persons.

**Conclusion.** Thus, the results of molecular-genetic investigation showed the importance of the polymorphic variant of GLUT9 gene in the forming of genetic structure of predisposition to IHD associated with asymptomatic hyperuricemia in Uzbek population. The received data testifies that the markers of the increased risk of IHD development with asymptomatic hyperuricemia in persons of Uzbek ethnic belonging is genotype GLUT9-T/T and allele GLUT9-T, and markers of the decreased risk is GLUT9-G/G and allele GLUT9-G.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-138-142>

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## Differential diagnostics of peripheral lymph node tuberculosis in hiv-infected patients

**Abstract:** Biopsy is more informative to diagnose the lymph node tuberculosis. Pathomorphological pattern features of the lymph node tuberculosis in HIV-infected patients are principally specified during the active period of the lymph node inflammatory process.

Three stages are classified as per changes in lymph node tissues as follow:

- low-active period — primarily by granulomatous and productive changes.
- active period — productive and necrotic changes.
- progressive period — purulence and fistula occurrence.

As the immune system deteriorates, the progressive period intensifies in combination with other opportunistic infections.

**Keywords:** peripheral lymph node, tuberculosis lymphadenopathy, HIV-infected patients.

Against deterioration of the TB epidemiological situation, the increase in the incidence of extrapulmonary tuberculosis is reported, including peripheral lymph node TB. In case of extrapulmonary tuberculosis, peripherallymph node lesion ranks almost the first all over the world [4; 3; 5]. Tuberculosis lymphadenopathy is known to be specific among other lymph node diseases. Its clinical pattern is diverse, unstable and has no pathognomonic signs. Various diseases of non-specific origin are often confused with TL [1]. As per statistic data by the Tuberculosis Research Institute of Russia, the results of histological studies of the active extrapulmonary tuberculosis structure conventionally reveal the lymph node involvement which makes 44.5% [1; 9].

In the current context of high incidence in lymphadenopathy of different etiology, the TL diagnostics remains the challenging and immediate problem in phthysiology [10; 11; 6; 7; 8]. Normally, the publications on TL diagnostics and differential diagnostics are

limited. All these circumstances were motivating to perform this study.

**Purpose of study:** To improve the procedure for comprehensive diagnostics and differential diagnostics of the tuberculous lymphadenopathy.

**Study material and methods.** The study is based on the review of medical records of patients with lymphadenopathy who underwent examinations and treatment at the clinics of the Specialized Republican Research and Practice Medical Center of Phthysiology and Pneumonology of the Ministry of Health of Uzbekistan from 2013 to 2015. We examined 150 subjects with lymph node diseases and relevant imitating processes. Patients were examined by a single method that included medical history data collection, clinical method (including the local status description as per the standard plan), radiological method (chest X-ray, lymph node sonography and computed tomography), laboratory tests (clinical analysis), bacteriological methods

(examination of sputum, urine, lymph node tissues excised and/or fistula discharge to identify Mycobacterium tuberculosis, tuberculin testing using the Mantoux test with 2TE PPD-L.

Needle biopsy was performed by the standard practice. Several drugs were prepared. After fixing with ethanol for 20–30 minutes, they were stained with azure-eosin (Giemsa stained). In case of purulent biopsy specimens, the smears were stained by the Ziehl-Nielsen and, in some particular cases, they were Gram stained for further bacteriological examination. These methods allowed to significantly expand the scope of diagnostic information and create the most favorable environment for timely diagnostics of the Peripheral Lymph Node Tuberculosis (PLNTB) and, thus, early TB management.

Based on comprehensive clinical, laboratory, sonographic and morphological studies of 150 subjects with peripheral lymphadenopathy as related to tuberculosis, 99 patients (66.0%) were TL diagnosed, 51 patients (34.0%) were diagnosed with other lymph node diseases. Resulting from these types of studies, the subjects were ranged as follows: the peripheral lymph node tuberculosis is diagnosed in 99 (66.0%) subjects, non-specific lymphadenitis was diagnosed in 34 (22.7%) subjects, lymphogranulomatosis — in 10 (6.7%) subjects, tumor deposits — in 4 (2.7%), neck cysts — in 2 (1.3%), festered atheroma — in 1 (0.7%) subject. A wide variety of conditions, including tumor and systemic diseases mistakenly diagnosed as the TL indicates the difficulty of the differential diagnosis to identify them. This is proved through the periods these patients

were observed in clinics and PDD for correct diagnosis. Of the 99 patients who were initially wrongly diagnosed with the TL, the observation period at the TB Dispensary and polyclinics in half of them (56 persons) upon the pathology identification to establishment of the true disease was more than 6 months, of which in 18 patients it was 2–6 years. Only in 25 patients the correct diagnosis was made within first three months since the date of disease identification.

99 patients with TL were classified into two groups: Group 1–59 subjects without concurrent pathology and Group 2–40 subjects with concomitant diseases (tuberculosis at other sites, patients with HIV infection, diabetes milletus, viral hepatitis, and etc.).

Table 1 shows classification of subjects by age. As it is seen based on the tabulated data, younger and middle-aged people prevailed among the subjects (74.1%). In patients under 20 years, TL Group 1 patients were almost 5 times more in number than Group 2 patients (83.3% and 16.7%, respectively,  $P < 0.01$ ). Also, in patients aged 21 to 30, the incidence of one group of patients was 3.1 times more frequent than TL Group 2 (75.7% and 24.3%, respectively,  $P < 0.01$ ). This is somewhat different when the first and second groups of TL patients are compared among elderly and senile aged patients. Thus, the incidence of Group 2 patients increased 2.5 and 4 times (71.4% and 28.6%, 80.0 and 20.0, respectively, at  $P > 0.2$ ,  $P < 0.02$ ). Thus, TL patients without comorbidities are more often reported among younerg patients and on the contrary, TL patients with concomitant diseases are more often observed among elderly and senile aged patients.

Table 1. – Classification of TL patients by age, n(%)

Age	Group of TL patients		Total
	Group 1	Group 2	
Aged 20 and younger	10 (83,3±10,7)	2 (16,7±10,7)*	12 (12,5±3,3)
Aged 21–30	28 (75,7±7,0)	9 (24,3±7,0)*	37 (37,4±4,8)
Aged 31–40	14 (58,3±10,0)	10 (41,7±10,0)	24 (24,2±4,3)
Aged 41–50	4 (28,6±12,0)	10 (71,4±12,0)*	14 (14,1±3,4)
Aged 51–60	2 (28,6±17,0)	5 (71,4±17,0)	7 (7,1±2,5)
Aged 60 and older	1 (20,0±17,8)	4 (80,0±17,8)*	5 (5,1±2,2)
Total	59	40	99 (100,0)

Note: \* — statistical significance ( $P < 0.02$ ;  $P < 0.01$ ) between Groups 1 and 2.

In TL patients, of all peripheral lymph node groups, the neck group (67.7%) is the most affected, of which in 45.5% patients, the tubercular process was localized in the anterior cervical region and in 22.2% — in the back of the neck region (see Flowchart 1).

The combined involvement of cervical lymph nodes with axillary lymph nodes was reported in 9.1% of cases. The submandibular lymphadenitis (11.1%) ranks the second and the axillary lymphadenitis ranks the third (8.1%). The tuberculosis of inguinal lymph nodes was reported in only four (4.0%) patients.

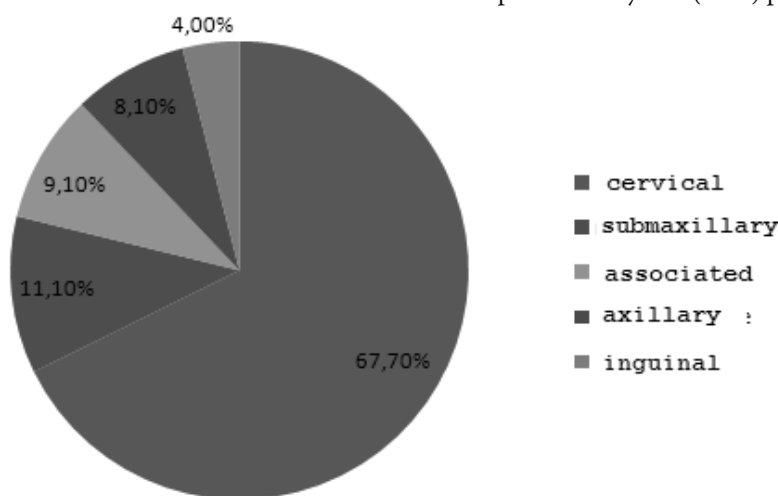


Figure 1. Incidence of lymph node groups Flowchart 1

The groups of TL patients with concomitant diseases tended to develop conglomerates of lymph nodes (62.5%). In patients without concomitant diseases, the conglomerates were normally formed by the second month of observations. In this case, the destructive process with abscess (32.3%) and fistula (25.3%) development was developed in affected lymph nodes.

The statistical analysis of study results was conducted using the IBM compatible PC based on the Microsoft Excel software package for statistic computation.

Thus, the proposed modern methods to diagnose the peripheral lymph node tuberculosis allow identifying a range of new trends, both for diagnostics and for the integrated management of the peripheral lymph node tuberculosis.

**Results and discussions.** The clinical pattern of the tuberculous lymphadenitis developed differently. As per our observations, the development of TL with scarce symptoms was reported in 88.9% patients (88 of 99) was gradual and sometimes asymptomatic for the patient. In this case, dense and elastic lymph nodes not more than 2–3 in number are initially palpable in the appropriate section of the lesions sized 2–3 cm, painless, which slowly grow in size often reaching large sizes. In 11.1% patients the acute onset of the disease is reported that was accompanied with the abrupt soreness of affected lymph nodes. Significant differences were observed between the tested groups depending on the disease localization signs.

So, in case of tuberculous lymphadenitis, fluctuation was observed in 32.3% cases, the skin redness was reported in 41.4%, in 56.6% cases the nodes sized 3 cm or larger, in 38.4% patients the node conglomerates were reported, and in 25,3% — the fistula was reported. The PPD test showed that the tuberculin sensitivity in most TL patients (54.5%) were of hyperergic nature; in 30.3% cases, they were of normergic nature; negative reaction to tuberculin was seen in 15.2% patients.

In case of local TL in most patients (54%), the peripheral blood values were within the normal range, and only in 6.1% patients abnormal values were reported to prove on the leukocytosis with the slight shift of segmented rod neutrophils.

In 68.7% patients the increased level of ESR was noted and anemia — in 65.5%. The urinalysis revealed the protein, isolated erythrocytes and leukocytes in the urine samples. An increase in ALT and AST was insignificant. All these data may be referred to para-specific signs typical for primary tuberculosis.

As per data by M. V. Chulochnikova (2005), when analysing affected lymph nodes in TL patients, the *Mycobacterium tuberculosis* (MBT) was identified by bacteriological analysis in 22.8%. As the result of our observations, the significant decrease in MBT detection (in percentage) in TL patients was obtained. These studies showed that the MBT detection by the method of regular smear is possible only in 6.1% cases and in 11.1% cases — by the MGIT

method. As per our studies, the cultured pathological material of lymph nodes significantly revealed TL forms. Most often (54.5%), the MBT was isolated in case of abscess and fistula stage of tuberculous lymphadenitis. During the PLNTB bacteriological diagnosis, given the specificity of the pathological material, additional methods (Lowenstein-Jensen liquid medium inoculation, MGIT method, HAIN test, PCR) should be used in addition to conventional methods of *Mycobacterium tuberculosis* detection.

The review of histological preparations in 68 cases of tuberculous lymphadenitis showed that pathologic pattern features at TL are primarily determined by the phase of inflammatory activity in the lymph node.

Based on morphological traits, we have identified three groups of patients with the pathological process in different phases of activity: Group 1 (29 patients; 29.3%) primarily showed granulomatous-productive changes in lymph nodes (inactive phase), Group 2 (13 patients; 13.1%) — productive-necrotic (active phase of the process), Group 3 (57 patients; 57.6%) — mostly necrotic lesions with insignificant involvement of the lymph node with slight granulomatous changes, purulence and fistula formation (progressive phase).

Differences were observed in activity groups by the nature of the disease onset and course. Thus, in TL progressive phase (Group 3) the abrupt onset was more frequent with severe intoxication and frequent melt of lymph nodes. At the same time, asymptomatic onset was often reported in the inactive and active (productive-necrotic) phases when the only disease manifestation was enlarged lymph nodes discovered accidentally. Patients of Group 3 were often disturbed with intoxication symptoms, of which were the general fatigue, increased body temperature were most frequent.

TL diagnostics remains the immediate problem in phthisiatry. According to our data, of 99 patients who initially wrongly diagnosed with TL, about half of them (56 persons) was observed at the TB Dispensary and the clinic for over 6 months within the period from the pathology detection and the real disease establishment, of whom 18 patients were observed for 2–6 years. This is to say about the inadequate level of TL diagnostics and the need to develop a single medical algorithm for differential diagnosis of TL and peripheral lymphadenopathy of other etiology.

The difficulty of diagnostics relates to inadequate efficiency of the existing research methods. Bacteriological methods are limited in significance due to paucibacillary with extrapulmonary tuberculosis and higher likeliness to detect MBT in obvious destructive forms of the disease. So, according to our study, MBT was detected only in 17.2% patients with progressive phase of TL, and not at all detected during inactive phase of the disease.

Therefore, the morphological study is the method of choice. The process of tuberculous lymphadenitis diagnostics should include the sequence of steps as the range of diagnostic and therapeutic actions.

Table 2. – classification of tl patients by the disease stage, n(%)

TL stage	Number of patients	Group 1	Group 2
Proliferative	29 (29,3)	25 (86,2±6,4)*	4 (13,8±6,4)*
Caseous	13 (13,1)	8 (61,5±13,4)*	5 (38,5±13,4)*
Abscessed	32 (32,3)	16 (50,0±8,8)*	16 (50,0±8,8)*
Fistulose	25 (25,3)	10 (40,0±9,7)*	15 (60,0±9,7)*
Total	99	59	40

Note: \* — statistical significance ( $P < 0.001$ ) between Groups 1 and 2.

In the TL proliferative stage, the patients with concomitant conditions were 4.2 times less than patients without co-morbidities (13.8 and 86.2%, respectively,  $P < 0.001$ ). And, on the contrary, in the TL fistulose stage, patients with co-morbidities were 1.5 times more

than patients without co-morbidities (60.0 and 40.0%, respectively,  $P > 0.2$ ). In the TL caseous stage, no statistical significance was revealed between patients with and without concomitant conditions (38.5% and 61.5%, respectively,  $P > 0.2$ ). Also, in the TL abscessed stage, no

statistical significance was revealed in patients with and without concomitant conditions (50.0% and 50.0%, respectively,  $P > 0.1$ ).

Based on results of own researches, as well as literature data, we propose the algorithm of the physician action to perform the TL differential diagnostics that may be useful for doctors of general health care and TB facilities to early diagnose the tuberculosis lymphadenitis (Scheme 1).

Of high significance to improve the PLNTB differential diagnosis based on pathogenesis study was the evolutionary and patho-

genetic classification developed at the St. Petersburg Research Institute of Tuberculosis (N. A. Brazhenko 2013) which isolates 4 stages of the disease: 1) initial, proliferative; 2) caseous; 3) abscess; 4) fistula (ulcer). As per this classification, given the clinical data of the process and nature of morphologic changes in lymph nodes, 29 patients (29.3%) were detected in their proliferative stage, 13 (13.1%) — in caseous, 32 (32.3%) — abscessed, 25 (25.3%) — fistulose stage of TL (see Table 2.) In other words, the majority of patients (57.6%) experienced abscessed and fistulose stages of TL.

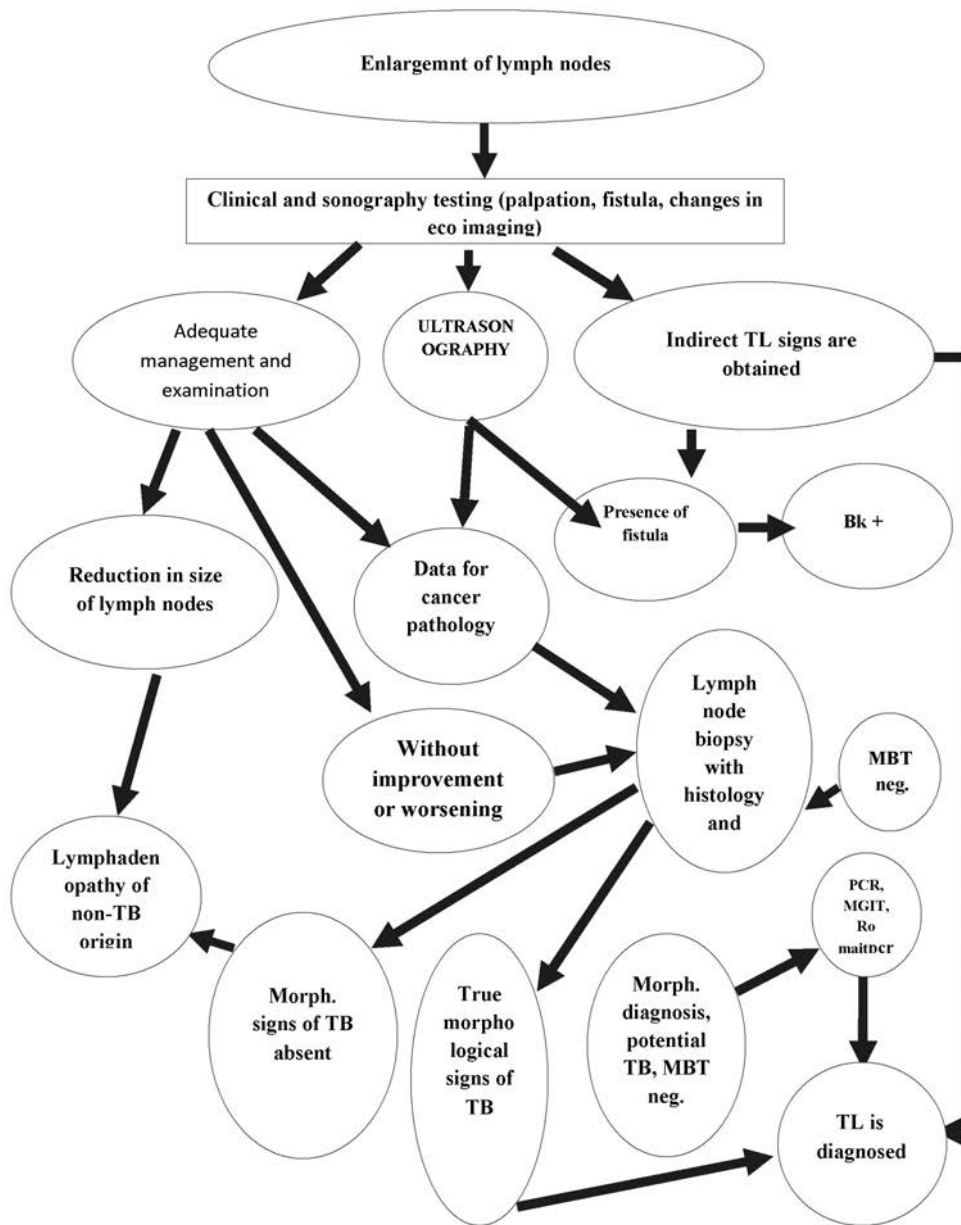


Figure 2. Algorithm of TL differential diagnostics

**Conclusion**

In the current conditions, the tuberculous lymphadenopathy differs in torpidity, scarcity of clinical signs and blood parameter changes. In 40.4% patients, the peripheral lymph node tuberculosis develops in association with other diseases (pulmonary tuberculosis, HIV, Hepatitis C, Hepatitis B, abdominal tuberculosis). In more than half of cases, several groups of lymph nodes (56.6%) are affected, the process is most often detected at the advanced abscessed stage (32.3%) and the fistulose stage — (25.3%). From the lymph node, the Mycobacterium tuberculosis was isolated only in 17.2% cases. At the specialized in-patient hospital, the tuberculosis lymph-

adenopathy was detected in 99 (66.0%) patients, non-specific lymphadenitis — in 34 (22.7%), lymphogranulomatosis — in 10 (6.7%), tumor metastasis — in 4 (2.7%), neck cysts — in 2 (1.3%), festered atheroma — in 1 (0.7%) patient with the lymphadenopathy. The histological pattern of removed lymph nodes was reviewed and made it possible to distinguish three phases of tuberculous lymphadenitis activity: inactive phase in 29 (29.3%) patients (predominantly granulomatous-productive changes in the lymph nodes), active in 13 (13.1%) patients (productive-necrotic changes) and the progressive phase in 57 (57.6%) patients (predominantly necrotic lesions with minimal lymph node granulomatous changes, purulence and fistula formation).

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-142-144>

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## Estradiol-progesterone correlation as a marker of severity of premenstrual syndrome

**Abstract:** The level of estradiol in the luteal phase of menstrual cycle was significantly higher in women with severe course of PMS compared to patients from other groups. During PMS, a correlation relation between the level of estradiol ( $r=0,87$ ;  $P<0,0001$ ), estradiol-progesterone correlation ( $r=0,81$ ;  $P<0,0001$ ) and degree of severity of PMS in the luteal phase of menstrual cycle was observed.

**Keywords:** premenstrual syndrome, estradiol, progesterone, correlation estradiol/progesterone.

Premenstrual syndrome (PMS) is a complicated complex of symptoms cyclically appearing in women in luteal phase of menstrual cycle and is characterized by various neuro-psychotic, vegeto-vascular and metabolic-endocrine disorders, which reduce professional and household working capacity and level of social adaptation.

There are numerous theories about pathogenesis of PMS. One of the key theories is the hormonal theory of PMS, according to which, the disease is determined by the disruption of the correlation of estrogens and progesterone during luteal phase of menstrual cycle [3; 5]. Estrogens affect the receptors in the limbic system of the brain, which determines the appearance of a range of symptoms in the phsyco-emotional sphere [1; 5].

In some researches, the formation of PMS is related to the activity of neuro-active metabolites of progesterone, including those, which are produced spontaneously in the CNS [2; 3; 9]. Also, it is noted that women with clearly expressed deficit of progesterone in luteal phase of the cycle showed no disposition to PMS. PMS is not observed during anovulatory cycles, when relative hyperestrogenism is developed. The authors reckon that PMS can be the result of disruption of the balance of estrogens and progesterone [1].

**Goal of research:** to study estradiol-progesterone correlation in women with PMS depending on the degree of disease severity.

**Materials and methods:** 129 women aged 18 to 40 with complaints about somatic and/or psycho-emotional symptoms appear-

ing before menstruation were examined. The mean age was  $28,8 \pm 6,19$  years old (95% CI 27,8–29,9). The control group consisted of 26 women of same age with the absence of clinical manifestations of PMS. Depending on the degree of severity of disease, the patients were divided into 3 groups. The group with light degree included 66 (51,2%) women; with medium degree of severity — 43 (33,3%) and severe degree — 20 (15,5%) women. PMS diagnosis was established on the basis of complaints and anamnesis.

The research of the levels of estradiol and progesterone in the blood serum was done by radio-immune method with the sets made by «Beckman Coulter» on the meters «Gamma-12» and «Strangt 300» at the laboratory of RSSRMCE.

The obtained data was processed with the help of the package of applied programs StatSoft Statistica 6.0. and Biostat. The odd ration (OR) and 95% confidence interval (95% CI) were calculated with the use of logistic regression. The significance of differences of the indicators was evaluated with the help of non-parametric criterion  $\chi^2$  (Pearson's test). The quantitative indicators were presented in the form of a median (Me) and 25 and 75 percentiles (IQR). The differences between groups were considered statistically significant at  $p=0,05$ .

**Results.** Conducted studies showed that regardless the degree of severity of disease, the level of estradiol and progesterone in the follicular phase differed from the control group insignificantly (Table 1.).

Table 1. – Level of steroid sex hormones in women with PMS in the follicular phase of menstrual cycle

Indicators	Control, n=26	PMS form		
		light, n=66	medium, n=43	severe, n=20
Follicular phase of MC				
Estradiol, pmol/l	278,3; 230,0–327,5	275,7; 243,2–289,3	278,2; 191,0–313,3	287,0; 275,7–298,6
Pc		0,06	0,86	0,99
Pl			0,42	0,12
Pm				0,88
Progesterone, nmol/l	2,14; 1,65–2,83	2,35; 1,79–2,97	1,85; 1,34–3,42	2,24; 1,50–3,21
Pc		0,97	0,96	0,83
Pl			0,94	0,85
Pm				0,84
E/P	127,9; 99,3–180,4	110,4; 79,6–154,1	120,5; 71,5–206,2	129,1; 85,6–184,3
Pc		0,29	0,93	0,79
Pl			0,23	0,23
Pm				0,75
Testosterone, nmol/l	2,11; 1,68–3,14	2,79; 2,10–3,24	2,54; 2,03–3,29	2,87; 2,01–3,32
Pc		0,04	0,07	0,14
Pl			0,90	0,96
Pm				0,90
Cortisol, nmol/l	278,3; 230,0–327,5	278,6; 222,9–330,8	267,9; 230,1–328,3	278,4; 234,5–350,0
Pc		0,89	0,98	0,85
Pl			0,90	0,72
Pm				0,83
Pm				0,59

Remark: E/P – correlation estradiol/progesterone; Pc –; Pl –; Pm – significance with regard to control, light and medium degree of severity of PMS respectively.

At light degree of severity of PMS, the concentration of estradiol ( $451,5 \pm 91,4$  pmol/l) in LP is significantly higher than in control group ( $374,8 \pm 79,4$  pmol/l;  $P < 0,0001$ ), whereas the level of progesterone remains practically unchanged ( $38,9 \pm 5,48$  nmol/l

compared to  $37,8 \pm 5,30$  nmol/l in the control group;  $P=0,39$ ). Women in this group showed significant increase of E/P correlation ( $11,8 \pm 2,38$  compared to  $10,2 \pm 2,86$  in the control group;  $P=0,02$ ) in the luteal phase of menstrual cycle (Table 2.).

Table 2. – Level of steroid sex hormones in women with PMS in the luteal phase of menstrual cycle

Indicators	Control, n=26	PMS form		
		light, n=66	medium severity, n= 43	severe, n=20
1	2	3	4	5
Luteal phase of MC				
Estradiol, pmol/l	361,8; 322,7–401,6	483,6; 372,3–513,1	597,2; 556,8–667,1	740,9; 657,2–866,7
Pc		<0,0001	<0,0001	<0,0001
Pl			<0,0001	<0,0001

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<i>Pm</i>				<b>&lt;0,0001</b>
Progesterone, nmol/l	36,3; 34,1–41,1	38,4; 35,1–41,8	40,1; 37,0–42,6	38,4; 33,5–42,8
<i>Pc</i>		0,39	0,25	0,87
<i>Pl</i>			0,65	0,59
				0,44
E/P	9,73; 8,10–11,3	11,5; 9,99–13,9	15,0; 13,1–17,2	19,7; 17,0–21,5
<i>Pc</i>		<b>0,02</b>	<b>&lt;0,0001</b>	<b>&lt;0,0001</b>
<i>Pl</i>			<b>&lt;0,0001</b>	<b>&lt;0,0001</b>
<i>Pm</i>				<b>&lt;0,0001</b>
Testosterone, nmol/l	2,29; 1,94–2,75	2,71; 2,12–3,20	2,78; 1,99–3,10	2,75; 2,16–3,11
<i>Pc</i>		<b>0,03</b>	0,27	<b>0,04</b>
<i>Pl</i>			0,32	0,96
<i>Pm</i>				0,50
Cortisol, nmol/l	282,8; 218,1–355,0	286,5; 233,3–351,0	285,0; 243,9–353,5	288,3; 225,4–379,3
<i>Pc</i>		0,89	0,58	0,41
<i>Pl</i>			0,63	0,37
<i>Pm</i>				0,59

Remark: E/P — correlation estradiol/progesterone; *Pc* -; *Pl* —; *Pm* — significance with regard to control, light and medium degree of severity of PMS respectively.

The patients with medium degree of severity of PMS showed statistically significant increase of the concentration of estradiol ( $595,4 \pm 99,0$  pmol/l;  $P < 0,0001$ ) compared with these indicators in women with light degree of severity and without the manifestation of this disease. The level of progesterone was within the limits of control values ( $39,4 \pm 1,19$  nmol/l;  $P = 0,25$ ). The analysis of correlation E/P ( $15,1 \pm 3,96$ ;  $P < 0,0001$ ) in the luteal phase of menstrual cycle showed significant excess compared to the data in both, the control group and the group with light degree of severity of PMS.

In women with the severe course of PMS, the level of estradiol ( $729,1 \pm 141,0$  pmol/l;  $P < 0,0001$ ) in the luteal phase of menstrual

cycle was significantly higher than identical indicators of the patients in other groups. The concentration of progesterone in blood didn't change significantly ( $38,1 \pm 6,83$  nmol/l;  $P = 0,87$ ).

Positive correlation relation between the level of estradiol ( $r = 0,71$ ;  $P < 0,05$ ), the indicator E/P and degree of severity of PMS ( $r = 0,63$ ;  $P < 0,05$ ) in the luteal phase of menstrual cycle was revealed.

Thus, based on the conducted research, one can state that women with PMS show direct correlation dependence between the severity of the course of disease and concentration of estradiol in blood as well as estradiol-progesterone correlation. It provides ground to reckon that E/P is an objective test of the severity of PMS course and efficiency of treatment.

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## Diagnostic value of the lung surfactant in sudden infant death syndrome (SIDS)

**Abstract:** Morphological, physic-chemical and immunohistochemical properties of the lung surfactant from 50 corpses of infants aged 1 month to 1 year were studied. In the babies with sudden infant death syndrome (SIDS) the physic-chemical studies have shown pronounced decrease of the surfactant stability. Immunohistochemistry revealed decreased expression of surfactant protein B in most cases of SIDS, which is probably due to qualitative changes in lung surfactant. The comprehensive studies of lung surfactant of infants may contribute to clarifying the degree of risk and more accurately determining the causes of death in some cases of sudden infant death. This will help reduce the risk of diagnostic errors, i.e., hypo- or over-diagnosis SIDS and is of practical importance for forensic examination.

**Keywords:** Sudden infant death syndrome (SIDS); lung surfactant; surfactant stability; surfactant protein B; immunohistochemistry.

### Introduction

Sudden infant death syndrome (SIDS) includes sudden, non-violent deaths of infants aged 1 month to 1 year. In this syndrome results of scene investigation, review of the clinical history, autopsy, morphological and other laboratory studies do not provide clear evidence about the cause of infant death. This issue is of great interest not only for pediatricians but for pathologists, forensic scientists and other professionals. To date, there are many hypotheses, dedicated to the aetiology and pathogenesis of sudden infant death syndrome. However, based on a critical analysis of all existing hypotheses, P.N. Goldwater (2011) rightly points out that there is not such a hypothesis, which would meet all the requirements of pediatricians, pathologists, lawyers and etc. [6]. He believes that every hypothesis must consider pathological and epidemiological risk factors. Many authors agree that SIDS is a complex syndrome that may have multiple etiologies with a lot number of possible risk factors. In their view, great prospects in this area are new approaches to identifying predisposing to SIDS risk factors disclosure molecular genetic mechanisms of this syndrome [1; 3; 6; 8; 13].

Despite the ongoing debate, one of the most common is respiratory hypothesis that infant death due to sudden occurrence of apnea. It is believed that sleep apnea may be the primary genesis, due to lack of regulatory function of the respiratory center of the brain stem, or it may be secondary to reflex the influence of a diseased lung feedback type [15]. Unfortunately, the background to the emergence of apnea and pulmonary possible mechanisms to ensure conditions for a sudden apnea, remain unknown. Almost all the researchers are unanimous in the fact that when detected in the lungs of SIDS moderate morphological changes is not enough to cause reflex respiratory arrest [5; 11; 12; 13; 14]. Promising in this respect are the studies of lung surfactant system (LSS), which plays a leading role in the respiratory function of the organism. Quantitative and functional changes of LSS may entail profound disturbances in the respiratory system, including death. LSS condition at SIDS has been

studied by some authors [4; 9; 10]. Unfortunately these works were made using different, not comparable research methods and their results are contradictory. Only some immunohistochemical studies have appeared, indicating a significant decrease in surfactant protein type A (SP-A) in children with SIDS in the first months after birth [16]. Nevertheless, the role of the LSS in the pathogenesis of SIDS remains substantially open. We hypothesized that the cause of death in some cases of SIDS could actually be a sudden development of secondary apnea caused by unknown until structural and functional changes in the lungs. We assume that these changes may be primarily associated with the hidden congenital or acquired deficiency of lung surfactant in the whole or its individual components (proteins of type B, C and A, phospholipids and others). All this leads to the urgency and the need for further comprehensive research status of LSS in children with SIDS using morphological, physic-chemical and immunohistochemical methods. The data obtained will undoubtedly contribute to the optimization of the differential diagnosis of lung diseases in children, identifying high-risk groups to the development of SIDS with further development of preventive measures, and, last but not least, clarification of the place and importance of LSS in a highly complex pathogenesis of this syndrome.

The aim of this work was a comprehensive study of the morphological, physic-chemical and immunohistochemical features of the lung surfactant system (LSS) in SIDS, comparing them with other cases of sudden infant death with a verified diagnosis.

### Material and Methods

The material for the study was collected from 50 corpses of children aged 1 month to 1 year. Of these, in 20 cases there was SIDS (I group). 18 children patients died of pneumonia and acute respiratory infection (II group). In 12 cases was a category of violent death (mechanical asphyxia, mechanical injuries and thermal burns – III group). The last two (II and III) groups served as controls for SIDS. For morphological studies of lung tissue taken within 2-12 hours after death were fixed in 12% formalin solution in phosphate

buffer (pH - 7,3) and after the respective wires embedded in paraffin. Paraffin sections 5-7 microns thick were stained with hematoxylin-eosin and Schiff's reagent. To identify of pneumocytes type II (P2) sections were stained by Sudan III. Counting the number of P2 in each case carried out by 1000 all pneumocytes and expressed in absolute numbers and percentages.

The surface-active properties of the lung surfactant were examined in broncho-alveolar lavage (BAL) by modified methods Langmuir-Willhelm [9]. The minimum and maximum surface tension ( $ST_{min}$  and  $ST_{max}$ ) of surfactant film expressed in milliNewtons / m (mN / M), from which was calculated the surfactant stability index (SI).

Immunohistochemical detection of mature surfactant protein B-type was performed on paraffin sections of lungs using a set Ultra-Vision (Thermo Scientific, USA). These studies were conducted in 10 samples of lung SIDS, 5 - in cases of pneumonia and acute respiratory infections, and 5 - in the categories of violent death. Evaluation of the results of immunohistochemical studies were conducted on a scale of intensity and localization of the reaction product. All digital data is processed by the method of variation statistics using the software package Microsoft Excel 2010. Differences satisfying  $P < 0.05$  were considered significant.

### Results

Macroscopic examination of the lung tissue with SIDS in some cases revealed the presence of foci of punctate hemorrhages under the visceral pleura, segmental pulmonary edema with emphysema-

tous areas. A microscopic examination revealed a slight swelling and minor bleeding lesions of lung parenchyma, and pulmonary vascular engorgement in violation of the permeability of the walls and diapedesis of red blood cells in the surrounding tissue. In the lumen of the large bronchi determined locally homogeneous mass of reddish color, and in some cases showed a small peribronchial infiltrates consisting mainly of lymphocytes. Small pockets of advanced alveolar atelectasis and disatelectasis have been found frequently. Often in the alveoli and bronchi increased epithelial desquamation, and sometimes the presence in the lumen of the alveoli small hemorrhagic exudates were revealed. Approximately one-third of infant deaths from SIDS in the respiratory passages and the alveoli found signs of moderate catarrh. Along with them in about one-third of deaths in SIDS morphological manifestations of lung immaturity have been found. Microscopic changes in the lungs of the control groups of infants (II and III) are fully consistent with the diagnosis and cause of death, revealed by the expert investigation.

Thus, in some cases of SIDS in the lung tissue are revealed slight morphological changes with characteristics of moderate serous-desquamative or serous-catarrhal pneumonia. These changes are not enough to qualify as a major cause of death. However, it is possible that they may play a role as provoking factor (trigger) that causes sudden respiratory failure during sleep with outcome to death.

The results of quantification indexes of type II pneumocytes (P2) in the lung tissue are shown in Table 1.

Table 1. – Quantitative indicators of type II pneumocytes (P2)

The studied groups	n	The absolute number of type II pneumocytes	% of type II pneumocytes
Sudden Infant Death Syndrome, SIDS (I group)	20	78±12,5*	7,8
Pneumonia and acute respiratory viral infection, ARVI (II group)	18	92,7±6,8	9,2
Cases of violent death (III group)	12	115,5±6,2	11,5

Note: the sign \* marked significant changes as compared with the III groups ( $P < 0.05$ ).

Quantitative analysis of P2 showed that babies who died a violent death (III group), they range from 9 to 12% of all cells. Absolute number in this group ranged from 87 to 122 per 1000 pneumocytes lung tissue that was equal to an average of  $115.5 \pm 6.2$ . These figures we have taken as a basic reference, since they reflect the true number of P2 healthy babies.

Several other data obtained in the group of infants who died from pneumonia and ARVI (II group). The number of P2 in this group ranged from 6 to 10%, and their absolute amount varied from 67 to 118, which was equal to  $92.7 \pm 6.8$  per 1000 lung tissue cells on average. As can be seen from the above figures, when pneumonia and ARVI, the number of P2, though somewhat reduced compared to Group III, however, this decrease was not of a significant nature

( $P > 0.05$ ). It can be explained by the increase in frequency of lung tissue dysfunction pneumocytes in general and in particular P2, in infants who died from pneumonia and ARVI.

The number of P2 in infants with SIDS significantly fluctuated widely, ranging from 5 to 10% of all cells. The absolute number of more than 50% in cases ranged from 48 to 75 per 1000 lung tissue cells. In other cases, the number was more than 80, and in three cases reached 110-120 per 1000 cells. The average absolute number of P2 was  $78 \pm 12.5$  per 1000 cells, which was significantly lower than in group III with a violent death ( $P < 0.05$ ).

Research results biophysical indicators surface activity of lung surfactant for SIDS and control groups are shown in Table 2.

Table 2. – The biophysical indicators surface activity of lung surfactant ( $M \pm m$ )

The studied groups	n	Minimum surface tension ( $ST_{min}$ )	Maximum surface tension ( $ST_{max}$ )	Surfactant stability index (SSI)
Sudden Infant Death Syndrome, SIDS (I group)	20	27,3±0,85*	41,6±1,3	0,41±0,02*
Pneumonia and acute respiratory viral infection, ARVI (II group)	18	17,8±0,92	39,5±1,1	0,76±0,08
Cases of violent death (III group)	12	14,6±0,93	40,2±1,6	0,93±0,04

Note: the sign \* marked significant changes as compared with the II and III groups ( $P < 0.05$ ).

As can be seen from the table 2, the children who died a violent death, lung tissue has a high surface activity of surfactant. This is evidenced by low rates of  $ST_{min}$  and high index of surfactant stability (SSI). In the group of children who died of inflammatory lung diseases, it was a slight increase in  $ST_{min}$ , and, accordingly, a slight decrease in rates of surfactant stability. However, these changes were not statistically significant. The most pronounced changes in the biophysical properties of lung surfactant discovered in SIDS. Indicator of  $ST_{min}$  in most children of this group, appeared enlarged. Surfactant stability index (SSI) was significantly lower compared with the control groups.

Immunohistochemical studies have shown that surfactant protein is localized in the surface of the alveoli and terminal bronchioles and bronchi of various calibers. Typically, the reaction product was localized in the form of aggregates, its diffuse distribution on the surface of the airways is determined very rarely. In the lung tissue of infants of the II and III groups showed rather intense and widespread deposition of surfactant protein B. At the same time, in the lung tissue in 6 of the 10 infants with SIDS expression of surfactant protein B was negative or very low compared to the control groups. This is indicative of the qualitative changes of lung surfactant, which generally confirmed the results of our biophysical researches.

### Discussion

Our histological studies in approximately one-third of infant deaths from SIDS showed signs of moderate catarrhal inflammation in the respiratory passages and alveoli. Along with them, in about one-third of deaths in SIDS morphological manifestations of lung immaturity has been revealed [17]. However, these changes were not enough to qualify as a major cause of death. In respiratory function, especially in the age of 2 to 4 months, plays a special role of pulmonary surfactant. Structural and functional impairments of the pulmonary surfactant lead to aggravation of hypoxia, which is the basis of many respiratory diseases in children and adults [2]. Study of surfactant system of the lungs in SIDS devoted few works. Some researchers in the broncho-alveolar lavage (BAL) of SIDS infants found various changes in the chemical composition of the surfactant in the form of reducing the concentration of phosphatidylcholine, violation ratio of phospholipids/proteolipids, reducing the physical properties of surfactant [9; 10]. In contrast, other researchers did not find any significant changes in surfactant, which could explain the cause of sudden infant death [4].

Our studies showed that the vast majority of children with SIDS had marked impairment of the functional properties of lung surfactant. These changes are manifested in the form of disruption of the surface-active properties of lung surfactant, significant reduction in performance stability. Using immunohistochemistry method A. Stray-Pedersen, A. Vege, A. Stray-Pedersen, et al.

(2008), have found that children with SIDS in the first months observed a significant decrease in surfactant protein-A [16]. It is these periods of life coincide with the peak of the highest infant death. Based on this, the authors had been hypothesized that the reduction of SP-A is a one of risk factor for SIDS. We have also found that SIDS in some cases accompanied by severe reduced number of pneumocytes type II. It is known that pneumocyte type II (P2) is the main source of phospholipid and protein components of the lung surfactant [2]. Lack of maturity, reduced number and impaired functional activity of pneumocytes type II, of course, can lead to quantitative and qualitative changes in lung surfactant. By method of immunohistochemistry we also have found decreased expression of surfactant protein B in the majority of children with SIDS compared to infants who died of pneumonia or in accidents. However, in violation of the lung surfactant system cannot exhaustively explain the cause of death in SIDS. As we are discussed above, many authors are deciding that the prenatal or perinatal defects of regulatory mechanisms of respiratory or/and cardiovascular centres of the brain stem in SIDS have no conclusive evidences [7]. In this regard, the concepts of multifactorial causation with interaction of risk factors with variable probabilities are less restrictive and more in keeping with the large number and varying prevalence of demonstrated risk factors [8]. In our opinion, the SIDS has undoubtedly multi-etiological character with the sophisticated multi-level pathogenesis. In the development of the syndrome very important role are playing multiple risk factors arising in the prenatal and postnatal periods in the life of infants [1]. Based on these data, we also believe that impaired lung surfactant system is just one of the risk factors, which creates a kind of unfavorable background. Against this background, under certain conditions (wrong position the baby during sleep, lack of oxygen in the room, parental smoking and other risk factors), it is possible worsening hypoxia neurons of the brain stem. This, in turn, leads to a negative reflex effect, contributing to infringement of self-repair mechanisms (autoresuscitation) with sudden death. It is not excluded that this same hypoxic depression has an adverse effect on the cardio-vascular center and causes impaired heart function up to sudden heart failure.

### Conclusions

In the most children with SIDS revealed pronounced changes in the physico-chemical and immunohistochemical properties of lung surfactant. The comprehensive studies of lung surfactant of infants may contribute to clarifying the degree of risk and more accurately determining the causes of death in some cases of sudden infant death. This will help reduce the risk of diagnostic errors, i.e., hypo- or over-diagnosis SIDS and is of practical importance for forensic examination.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-148-150>

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## **Anomalies of spine and spinal cord in children with anorectal malformations**

**Abstract:** Associated malformations with anorectal malformations (ARM) are observed in various combinations, in 10–60,7% of combined anomalies of the spine and spinal cord. Objective: to determine the nature of concomitant pathology of the spine, spinal cord and related disorders in children workstation. Results: We included 51 children after surgery for various forms of ARM carried out in the clinic 2004–2015 year. The prevalence of functional disorders (60.8%) in normal and satisfactory anatomical structure (76.5%) of the surveyed data prompted us to study after surgery. The results showed that neurospinal cord anomalies/dysraphism (ND) or sacrovertebral anomalies/dysraphism (SD) are widespread at the workstation, which confirms the need for a focused examination of each patient for diseases of the spine and spinal cord, the observation and treatment of co pediatric surgeon and a neurologist.

**Keywords:** anorectal malformations, Associated anomalies of the spine and spinal cord, diagnostics, children.

Anorectal malformations (ARM) — one of the many groups proctologic pathology, requiring surgical treatment. The high mortality rate is not typical for this group of anomalies, but after surgical correction of functional disorders observed in 30–60% of cases. The situation is compounded by the presence of associated anomalies that the risk of violations of social adaptation of patients. Associated malformations observed at the workstation in a variety of combinations in 10–60.7% of the combined anomalies of the spine and spinal cord [1; 2; 4; 6; 7; 8]. Although the pathogenesis of ARM remains completely obscure their superior combination of them with the pathology of the spine associated distal common embryogenesis [3; 10]. A more informative methods of diagnosis of these anomalies are ultrasound and MRI of the lumbosacral spine [5; 9].

**Objective:** to determine the nature of concomitant pathology of the spine, spinal cord and related disorders in children undergoing surgery for anorectal malformations.

**Materials and methods.** The study included 51 children (35 girls with, boys — 16) aged from 1 day to 15 years after surgery for ARM performed in the clinic in 2004–2015. Preoperative diagnostic measures were aimed at establishing forms of anomalies, evaluation of anatomical and functional condition of the perineum and sphincter apparatus of the rectum (contrast igrography, ultrasound of internal organs). Related osteoneural spine abnormalities, spinal cord and spinal hidden dysraphism installed on the results of the inspection and consultation neurologist, additional studies of the spine spondylography digital (Siemens) or MSCT (before

surgery — 15 patients after treatment for long-term results — 36). In 5 cases performed MRI of the spinal cord. The patients' age at the time of investigation: 3 months. up to 1 year — 8 (15.7%); from 1 year to 3 years — 12 (23.5%); 3 to 7 years — 19 (37.3%); from 7 to 15 years — 12 (23.5%).

Distribution of patients according to nosological forms in accordance with the International Classification adopted in Krikenbek: rectovestibular fistula — 15 (29.4%); rectourethral fistula — 12 (23.5%); rectovesical fistula — 1 (2%); rectoperineum fistula — 3 (5.8%); rectovaginal fistula — 7 (13.7%); rectovestibular fistula with normal anus — 1 (2%); without fistula — 2 (3.9%); cloaca — 7 (13.7%); ectopic anus — 1 (2%); stenosis anus — 1 (2%); mixed forms — 1 (2%). Patients performed the relevant operations ARM correction recommended by the expert group in congress Krikenbek [2].

**Results and its discussion.** normal anatomical structure and functional state of the anorectal area — 20 (39.2%): In a clinical examination of children operated on different anatomical and functional status were identified. In normal (19) and satisfactory (7) anatomical structure of functional disorders of the anorectal area — 26 (51%) (persistent constipation — 10, fecal incontinence — 9, urinary and fecal incontinence — urinary 5 urine — 2). In case of violation of the anatomical structure in 5 (9.8%) without sphincter relegation rectum — 2; stenosis of the anus — 1; lack of sphincter muscles — 1; dropping out rectum mucosa — 1, proceed with functional disorders (fecal incontinence — 2, chronic constipation with paradoxical incontinence — 2, chronic constipation — 1).

The prevalence of functional disorders 26 (51%) in normal and satisfactory anatomical structure of the surveyed after surgery prompted us to conduct targeted research to identify the pathology of the spine and spinal cord.

In assessing neurological status in 20 (39.2%) of this group of disorders have been identified; aggravation of neurological signs or anorectal dysfunction is not marked. In 26 (51%) were observed moderate violations of motor activity, the weakness of the lower limbs and sphincter apparatus of the rectum. In 5 (9.8%) patients had evidence of CNS lesions, associated with undergoing intrapartum asphyxia and lesions at delivery: a clear neurological disorders spinal nature, including dysfunction of the pelvic organs.

In 31 (60.8%) marked decline in child ahilov and anal reflexes, asymmetry of reflexes, sensory disorders, wasting of muscles of the lower extremities. sensory disturbances (4–12,9%) were shown segmental, radicular and conduction changes from the lower extremities and perineum as gipoestezi, in rare cases — anesthesia. Severity of motor impairment (1–3,2%) ranged from minor to plegia reflex disorders in long lesions. In 26 (83,9%) children in this group were observed constipation, periodic incontinence signs of neurogen bladder dysfunction in the form of delays or urinary incontinence. In 6 (11.8%) of 51 patients had cutaneous stigma disemбриogeneza (hypertrichosis skin, nevus, capillary hemangioma, coccygeal traction, lipoma), located along the spine, in the perineum; asymmetry of the gluteal folds characteristic of occult SD.

22 (43.1%) patients underwent digital spondylography: in 17 (77.3%) failed determine different vertebral pathologies (hypoplasia and agenesis of the coccyx — 12, — 5 sacral malformation). In 14 patients the violations combined with spina bifida mainly lumbosacral localization coverage of (2) two or more vertebrae (12). However, this method proved sensitive enough to detect certain types of occult SD.

All patients underwent MSCT for the detection of spinal pathology. In 6 (11,8%) change is not detected in 45 (88,2%) set as-

sociated with a predominance of spinal abnormalities sacrovertebral dysraphizm — 33 (73.3%) over neurospinal dysraphizm — 12 (26.7%). Changes in the spinal column in 6 (11,8%) patients were shown scoliosis, 5 of them are due to the presence of curvature in the thoracic spine of the wedge ( $Th_{XI}$  — 4) and lumbar ( $L_V$  — 1) sections. In 4 (7,8%) change at the same time the children were observed in the thoracic-lumbar and sacral spine. In 2 patients there has been a fusion of ribs from 1 — no one edge, is a variant of vertebral anomalies. 2 patients in the presence of these strains and other anomalies detected cleft posterior arch of the spine with preferential localization in the lumbosacral region. When MSCT data and thread localization terminal structure spinal cord were shown in 6 (11,8%) cases. In 4 patients ascertained tetring syndrome, in 2 — with intradural lipoma.

Spina bifida okkulta in isolation, identified in 13 patients was the most common type of spinal dysraphizm hidden. Cleft arches a vertebra (mainly lumbar — 2; sacral — 0) was observed only in 2 cases; two vertebrae — in 4 of 7 patients have cleft arches observed over several vertebrae in the lumbar localization — 0, sacral — 4 at the same time within the specified locations — 3.

In 19 (37,2%) surveyed revealed isolated anomalies of the coccyx and sacrum. This is usually expressed by the absence of one or more sacral vertebrae — 6; asymmetric hypoplasia — gemisakrum — 4; sacred hemivertebrae — 3; coalescence their abnormal — 8 and coccyx agenesis — 6. As a rule, malformations of the spine sacrococcygeal department suffers from the development of the sacral plexus, whose branches innervate the sphincter apparatus of the bladder and rectum, which may account for decrease in tactile sensitivity of the perineum and functional disorders of different dynamics after operative correction of ARM. Violations of pelvic organs, alone or combined (persistent constipation — 11, chronic constipation with paradoxical incontinence — 2, fecal incontinence — 11, fecal incontinence and urine — 5, incontinence — 2) without marked anatomical abnormalities of the anorectal area and the predominance of long cleft arches in the lumbosacral region, covering “interested zones» —  $S_I$  and  $S_{II}$  does not exclude a role neurospinal and lumbosacral dysraphizm their genesis violations. Orthopedic disorders as manifestations of NSD and SVD as hip dysplasia and asymmetry of the gluteal folds were found in 6 patients.

14 (27.5%) patients with diagnosed before surgery ultrasound pathology of the urinary system is further configured with MSCT urography, will provide information about anatomical and functional condition of the kidneys and urinary system. Agenesis of the right kidney is set in 4 patients, ureterohydronephrosis — 8 (one of them on both sides); y 2 — partial doubling (one of them in the right ureter ectopia crotch).

In 22 (43,1%) patients with persistent constipation MSCT with contrast irrigography allowed to assess the condition of the colon. Revealed the following changes: dolihokolon — 11 megarektum — 8, — 3 dolichosigma. These anomalies of the urinary system and the colon indirectly constitutes a violation of organogenesis in the zone of segmental innervation of organs, which can be explained by common ARM embryogenesis and pathology spine distal [1, 10].

The study showed that NSD or efficiency are widespread at ARM, which confirms the need for a focused examination of each patient for diseases of the spine and spinal cord, the observation and treatment of co pediatric surgeon and a neurologist.

According to the literature, ultrasound may be screened — by comorbidity diagnosis of the spine and urinary system in infants with ARM in the neonatal period to determine the indications for targeted screening. At neurosonography neonatal spinal cord

located at the upper boundary and  $L_{III}$  5 years in a starting position lying adult at or above the upper boundary  $L_{II}$ . Tethered Cord (TC) is a common type neurospinal dysraphism may occur when abnormalities of the spine and spinal cord, limiting the movement due to the fixation to the caudal situated fixed intra — or extradural structure. TC as an independent state, observed in 0,1% (Bademci G 2006) or in combination with the ARM can be asymptomatic in the neonatal period. In the subsequent spinal dysfunction manifested varying degrees, referred to as “the syndrome of fixed spinal cord” (TC) with progressive orthopedic, urological, proctological disorders. US sensitivity decreases after infancy as ossification begins in the spine. A more informative diagnostic method in TC is an MRI of the spine and spinal cord. Comparative analysis of the data of MSCT and MRI has shown that the MSCT is more informative for detection of pathology of the spine and MRI provides a structural change of the spinal cord. Perhaps this is due to the predominance in

our observations of changes in different parts of the spine, compared with myelodysplasia and TC.

Our observations suggest that, regardless of the anatomical shape ARM, high combination with spinal pathology extensive violation prevail in the lumbosacral region. Disorders of functional character and neurological disorders suggest involvement of the spinal structures in the area of their segmental innervation. Osteoneural anomalies often observed regardless of the severity and location of the forms of anorectal anomalies. Of the 51 surveyed only 5 with severe multiple disabilities Spine found such complex variations of anorectal abnormalities as cesspool and rectovaginal fistulas associated with such anomalies as a rectal pouch, a doubling of the vagina, the pathology of the US. The data indicate the feasibility of early detection osteoneural pathology of the spine and spinal cord, regardless of APM forms of treatment and preventive measures aimed at their aggravation.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-150-153>

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## The relationship between development of inflammatory diseases of pelvic organs and expression of proinflammatory cytokines in women with intrauterine contraceptives

**Abstract:** We determined the level of proinflammatory cytokines in blood serum of women, wearing intrauterine contraceptives, and their relationship with the development of inflammatory processes in organs of small pelvis. Long wearing of intrauterine copper-containing contraceptives leads to the development of intrauterine inflammation and bleeding. When wearing intrauterine contraceptives, the levels of IL-1, IL-6 and TNF- $\alpha$  are increased, especially in patients with presence of inflammatory processes in organs of small pelvis. Activation of proinflammatory cytokines in blood serum coincides with histological pattern of local inflammation of the endometrium.

**Keywords:** intrauterine contraceptives, inflammatory processes in organs of small pelvis, women.

**Introduction.** Among women of reproductive age intrauterine contraceptives (IUC) are the most popular in the developing countries of Asia, Middle East and Latin America. Of them, China (49%), Tajikistan (68.9%) and Uzbekistan (46%) are the leaders by the absolute number of IUC users, while this rate is slightly lower in Russia (12.8–18%) [1; 4; 6; 7]. This method of protection is the choice option for breastfeeding women, who do not have contraindications to their use [3; 12; 13]. However, the use of IUC may develop side effects and complications such as expulsion, the development of inflammatory processes, and disorders of the menstrual cycle [2; 7; 9].

Local immune responses, which regulation mechanism is associated with the production of cytokines, have essential significance in the genesis of infectious lesion of the cervical epithelium [5; 12]. It was established that the system of cytokines, which includes interleukins, interferons, growth factors, plays the important role in the development of inflammatory reactions, intercellular interactions in a cervical biopsy, endocrine effects, and largely determines the nature, clinical manifestations and outcome of various pathological processes [7; 10]. Assessment of the levels of cytokines allows obtaining information about the severity of inflammatory process, its transition to a systemic level, and prognosis; about the functional activity of cells of the immune system that is very important in the differential diagnosis of numerous infectious and immunological processes. However, such studies in women with IUC that determined the purpose of the present study.

**The purpose** is to determine the level of proinflammatory cytokines in blood serum of women with IUC and their relationship with the development of inflammatory processes in organs of small pelvis.

#### Materials and methods

The studies were conducted at the maternity complex № 2 of Andijan city. Ninety one women of reproductive age (from 17 to 36 years), who were using copper IUC for 1 year (the main group), were surveyed. The control group consisted of 14 healthy women of reproductive age without IUC. Women had no contraindications for the use of IUC, according to the medical eligibility criteria of the WHO [3; 14; 15]. Of the observed women, 16 females used IUC after miscarriage, 8 — after abortion, 12 — after premature birth and 55 women — after timely delivery. Prior to admission or dispensary at the consulting polyclinics, before the use of IUC, 16 women received antibacterial and anti-inflammatory therapy. According to the recommendations, copper-containing T-shaped IUC (Cu T380A) were inserted not later than 48 hours after miscarriage, abortion or childbirth, considering the absence of infection and inflammation [4].

The studies were conducted in the dynamics (at 40 days, 3 and 6 months after inserting IUC). Complete clinical examination was performed, the presence of pain, discomfort, volume, number, and intensity of excretes were identified. Determination of the levels

of proinflammatory cytokines in blood serum (interleukins IL-1 $\beta$ , IL-6 and tumor necrosis factor TNF- $\alpha$ ) was performed by ELISA using commercial test systems “Vector-Best” (Novosibirsk, Russia) [10]. Test systems are based on sandwich method of the solid-phase enzyme immunoassay using horseradish peroxidase as a tracer enzyme. Quantification of results was performed using the program Excel 2004, reflecting the dependence of optical density on the concentration of standard antigen. The sensitivity of the method at using the data of these test systems is 2–30 PG/ml. Materials obtained were processed by variation statistics.

#### Results and Discussion

There were different complications after IUC use: pain — in 12 (13.2%), bleeding of varying intensity — in 21 (23.1%), expulse — in 21 (23.1%), endometritis — in 5 (5.5%), adnexitis — in 12 (13.1%), erosion — in 13 (14.3%), the frequency of which varied depending on the duration of IUC wear. So, expulse was mainly noted in the early stages, while bleeding and especially inflammatory processes developed at 6–9 months. Later on, the rate of complications slightly decreased. Histological studies of the endometrium after removing IUC in connection with the occurrence of uterine bleedings, pain, inflammation of internal genital organs, desire to have a child, the onset of menopause or change of contraceptive method showed the presence of separate foci of superficial erosion of the endometrium and flattening of its stroma. In some patients, there was deeper endometrial erosions and stromal edema. They mostly occurred during the first 6 months of the use of contraceptive. Our findings correspond to literature data that demonstrate the development and severe course of acute inflammatory diseases of pelvic organs (IDPO) with distinct morphological changes [7; 9]. According to several researchers, they were due to the following factors: the presence of inflammatory diseases, fibroids, adenomyosis in the anamnesis was not considered; duration of IUC use in the majority of patients exceeded 5 years, etc. It was found that Th1-cells produce powerful cytokines with proinflammatory properties, such as IL-1 $\beta$ , TNF- $\alpha$ , etc. [7; 11]. Th2-cells secrete anti-inflammatory cytokines, such as IL-4 that stimulate mainly humoral immunity. The imbalance of cytokine production of Th1/Th2 is important in the immunopathogenesis of development of inflammatory processes. Based on the foregoing, we studied the cytokine content in blood serum of women with IUC in the dynamics.

Our studies have shown that the level of proinflammatory cytokines in blood serum was increased in 1.79; 1.31 and 1.49 times, in comparison with the control group. Later on, (at 3 and 6 months) after IUC insertion, the level of IL-6 in blood serum of women of the main group was reduced to values of the control group, the content of IL-1 $\beta$  was significantly higher than normal values in 1.53 and 1.49 times, and the level of TNF- $\alpha$  increased in 1.4 and 1.29 times, respectively to periods of wearing (Table 1). These changes coincided with the histological changes in the endometrium.

Table 1. – The levels of proinflammatory cytokines in blood serum of women with intrauterine contraceptives in the dynamics of wearing, M $\pm$ m

Groups and study periods	The levels of proinflammatory cytokines, pg/ml		
	IL-1 $\beta$	IL-6	TNF- $\alpha$
Control group, n=14	9.39 $\pm$ 0.78	2.34 $\pm$ 0.21	3.44 $\pm$ 0.31
Main group, n=91, at:			
40 days	16.83 $\pm$ 0.77*	3.06 $\pm$ 0.28*	6.63 $\pm$ 0.34*
3 months	14.44 $\pm$ 0.94*	2.18 $\pm$ 0.17	4.83 $\pm$ 0.28*
6 months	13.98 $\pm$ 1.23*	2.07 $\pm$ 0.18	4.44 $\pm$ 0.31*

Note: \* — significant differences between the indicators of main and control groups,  $P < 0.05$ .

It should be noted that in the main group women noted a wide variability of the levels of interleukins. In this regard, the surveyed women were divided into 3 groups: 1<sup>st</sup> group — 61 women with IUC without IDPO; 2<sup>nd</sup> group — 14 women with IUC and IDPO, who have previously had no inflammation and did not receive treatment; 3<sup>rd</sup> group — 16 in women with IUC and IDPO, who have previously had inflammation and received treatment. The prospective analysis of the levels of interleukins in these groups showed significantly higher values of the studied cytokines in groups of women with IDPO (Table 2). Thus, at 40 day of the study, the levels of IL-1 $\beta$  in the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> groups exceeded the control levels in 1.55; 1.9 and 2.1 times, respectively. Moreover, high values of interleukins maintained in subsequent periods of study, exceeding the values of control group in 1.39; 1.42 1.64 times at 6 month of the study. Along with this, they significantly differed from the values of a group of women, who have had no inflammatory processes.

According to the literature, IL-1 $\beta$  is a multifunctional cytokine with broad spectrum of activity, plays the key role in the development and regulation of non-specific defense and specific immunity, one of the first is included in the second protective reaction of organism against the action of pathogenic factors [11]. IL-1 $\beta$  initiates

and regulates the inflammatory, immune processes, activates neutrophils, T- and B-lymphocytes, stimulates the synthesis of acute phase proteins, cytokines (IL-2, —3, —6, TNF- $\alpha$ ), adhesion molecules (E-selectin), procoagulants, prostaglandins. We observed increase in the level of IL-1 $\beta$  in the examined by us patients. This is probably connected with stimulation with CD40 ligand processing of pre-IL $\beta$  and release of the biologically active cytokine in endothelial cells.

At the same time, the values of IL-6 were changed to a lesser extent, and at 40 day were significantly higher than the control values, more significantly in the 2<sup>nd</sup> and 3<sup>rd</sup> groups. We should note that by 3 month, we noted significant increase in the content of this cytokine only in the 3<sup>rd</sup> group, and they significantly differed from the values of a group of women, who have had no inflammatory processes. By the end of follow-up (at 6 month) in all groups there were no differences from the control. We should note that IL-6 induces the synthesis of acute phase proteins, in this connection can be attributed to the cytokines of inflammation (like IL-1 $\beta$  and TNF $\alpha$  as well). According to the literature, IL-6 causes significant increase in the level of mRNA of *c-sis* gene in cultured endothelial cells that may mediate inflammatory vascular effects [11].

Table 2. – The levels of proinflammatory cytokines in blood serum of different groups of women with intrauterine contraceptives in the dynamics of wearing, M $\pm$ m

Группы и сроки исследования	Содержание провоспалительных цитокинов, пг/мл		
	IL-1 $\beta$	IL-6	TNF- $\alpha$
Control group, n=14	9.39 $\pm$ 0.78	2.34 $\pm$ 0.21	3.44 $\pm$ 0.31
Main group, n=91, at:			
40 days:			
1 <sup>st</sup> group, n=61	14.53 $\pm$ 0.41 <sup>a</sup>	2.76 $\pm$ 0.17 <sup>a</sup>	5.87 $\pm$ 0.30 <sup>a</sup>
2 <sup>nd</sup> group, n=14	17.85 $\pm$ 0.77 <sup>a</sup>	3.51 $\pm$ 0.26 <sup>a, b</sup>	6.76 $\pm$ 0.47 <sup>a</sup>
3 <sup>rd</sup> group, n=16	19.76 $\pm$ 0.77 <sup>a, b</sup>	5.43 $\pm$ 0.32 <sup>a, b</sup>	7.53 $\pm$ 0.34 <sup>a, b</sup>
3 months			
1 <sup>st</sup> group, n=61	12.44 $\pm$ 0.39 <sup>a</sup>	1.82 $\pm$ 0.14	3.61 $\pm$ 0.23
2 <sup>nd</sup> group, n=14	14.01 $\pm$ 0.94 <sup>a</sup>	2.43 $\pm$ 0.22	4.36 $\pm$ 0.28 <sup>a</sup>
3 <sup>rd</sup> group, n=16	17.64 $\pm$ 0.65 <sup>a, b</sup>	3.09 $\pm$ 0.25 <sup>a, b</sup>	5.83 $\pm$ 0.32 <sup>a, b</sup>
6 months			
1 <sup>st</sup> group, n=61	13.02 $\pm$ 0.61 <sup>a</sup>	1.92 $\pm$ 0.12	3.74 $\pm$ 0.28
2 <sup>nd</sup> group, n=14	13.37 $\pm$ 0.49 <sup>a</sup>	2.16 $\pm$ 0.12	4.36 $\pm$ 0.29 <sup>a</sup>
3 <sup>rd</sup> group, n=16	15.41 $\pm$ 0.68 <sup>a</sup>	2.45 $\pm$ 0.19	5.81 $\pm$ 0.33 <sup>a, b</sup>

Note: a — significant differences between the indicators of main and control groups,  $P < 0.05$ ; b — significant differences to the 1<sup>st</sup> group,  $P < 0.05$ .

The level of TNF- $\alpha$  significantly increased in all groups, especially in the 2<sup>nd</sup> and 3<sup>rd</sup> groups at 40 day of the study. The high values of this cytokine remained until the end of observations in the surveyed groups, and they differed significantly from values of a group of women, who have had no inflammatory processes. It is known that TNF- $\alpha$  and  $\beta$  (lymphotoxin) are factors of tumor necrosis. TNF- $\alpha$  is a product of monocytes/macrophages, endothelial, fat and myeloid cells, glial cells, and, in special cases, activated T-lymphocytes. The release of TNF increases the permeability of capillaries, damages vascular endothelium, develops intravascular thrombosis. Namely TNF- $\alpha$  plays the important role in the development of inflammatory lesions of blood vessels. Excessive levels of proinflammatory cytokines, such as TNF- $\alpha$ , IL-1 $\beta$  and IL-6 contributes to the maintenance of the inflammatory process in the body as a whole.

Our results indicate the prognostic value of determination of cytokines in blood serum of women with IUC with the risk of development of inflammatory processes in organs of small pelvis.

#### Conclusions

1. Long wearing of intrauterine copper-containing contraceptives leads to the development of intrauterine inflammation and bleeding.

2. When wearing intrauterine contraceptives, the levels of IL-1, IL-6 and TNF- $\alpha$  are increased, especially in patients with presence of inflammatory processes in organs of small pelvis.

3. Activation of proinflammatory cytokines in blood serum coincides with histological pattern of local inflammation of the endometrium.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-153-155>

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## The remote results of the treatment of “pectus carinatum” of the thorax in children

**Abstract:** Developmental anomalies of the thorax in children concern a serious illness representing big complexities for correction. In this work the developed author’s methods of surgical treatment of children with various variants of “pectus carinatum” (PC) are presented. The results of the treatment in the remote postoperative period are analyzed.

**Keywords:** thorax, children, thorax operations.

Malformation of the thorax in children are serious diseases that pose serious difficulties for the correction. PC occurs in 0,3–1,7% of children and to share it accounts for between 6–22% of all strains of the chest. It is characterized by symmetrical or asymmetrical anterior curvature of the sternum and the ribs articulate with it, includes several strain components at the same time defeat rib cartilage can be single- or double-sided, and the sternum stands in front in the

upper and lower section. At birth, says a third of patients with this pathology, and almost half of it appears only after the onset of puberty “leap” in growth. A characteristic feature of PC is a cosmetic defect. When evaluating the data of psychological survey found that dissatisfaction with the appearance of the chest, mainly manifested in patients older age. Currently, preference is minimally invasive, less traumatic at the same time more efficient surgical intervention

aimed at full correction of chest deformities, with the maximum cosmetic effect.

**Aim of work.** To evaluate the effectiveness of newly developed minimally invasive methods thoracoplasty various kinds PC in children.

**Materials and methods.** This paper analyzes the results of surgical treatment of children with PC based on the Department of Thoracic Surgery of Andizhan regional multi-profile children's Medical Center and the Department of Pediatric Surgery of Andizhan State Medical Institute. During the period from 2012 to 2016 by the author's method operated on 59 children with different variants PC in the age group of 6 to 18 years. These children are the main group (MG). The boys were 50 (84.7%), girls-9 (15.3%). The largest number of children with PC between the ages of 12–16 years. This is due to the fact that the progression of the maximum deformation begins in puberty — the age of the most active growth of the child. Performance indicators copyright transactions compared with the control group (CG). CG were children, operated during the period 2007–2011, which were carried out in various modifications Ravich's thoracoplasty operations — 32 children. Just CG holds the predominance of boys over girls –23 (71.8%) boys and 9 (28.2%) girls in the age group 6–16 years. The average age of children in the comparison group was  $13,4 \pm 0,1$  years, in the exhaust gas  $13,9 \pm 0,2$  years. Statistically significant differences in the age structure and sex groups were found ( $p > 0,05$ ). This allowed to consider them equivalent samples and used for further comparison. In our study, all patients were from the II and III century. Of PC and underwent surgical correction. Patients with first degree PC owing just noticeable cosmetic defects, were under the supervision of a dynamic, not to operate in our study are not included. All patients underwent thoracoplasty on the author's methods. During the development

and implementation of complex technology thoracoplasty received the certificate of the right to intellectual property of the Republic of Uzbekistan: DGU 03580 “Method thoracoplasty keeled chest deformation.” on 03.03.2016., registered in the State Register.

The author's method of surgical treatment of PC providing surgery and correction of distortion with transverse sternotomy, wedge resection of the sternum and bilateral resection of ribs, characterized in that it produced a vertical section through the skin on the chest wall is no longer than 8 cm, the skin mobilization, the subcutaneous tissue and pectoral muscles one flap, made complete resection of deformed costal cartilages on both sides and stitched them end-to-end single interrupted sutures, transverse sternotomy at the top most of the bending, the complete removal of the xiphoid process and shortening retrosternal ligament suturing it to the back surface of the lower third of the sternum 3–5 cm higher.

The statistical accuracy of the estimation of observed variables clinical effect expressed by confidence intervals (95%). Statistical data processing was carried out on a PC using the «SPSS Pro» software package. The critical level of significance when testing statistical hypothesis was  $p = 0,05$ .

**Results and discussion.** Evaluation of long-term results in the exhaust gas was carried out according to the criteria: good, satisfactory, unsatisfactory. These results are evaluated in terms of up to 1 year to 3 years over 3 years. Timing estimation results of treatment groups in clinical treatment comparisons and statistically significant differences are not. To assess the effectiveness of long-term outcome of treatment by copyright thoracoplasty comparative evaluation of results in the MG in 30 (87,5%) in the CG 23 (87,5%) of sick children. The analysis results showed that good results in the MG obtained in 95,2%, and satisfactory and unsatisfactory results were obtained in two children, 2,38%, respectively (Fig. 1).

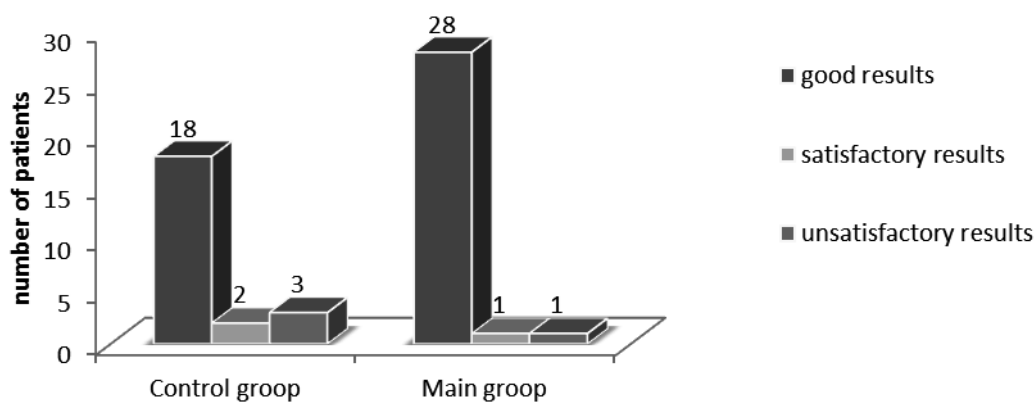


Fig. 1. Comparative indicators of long-term results of treatment KGDK in children, depending on the operations performed

For good clinical results we assigned patients with complete correction of deformation, with the absence of hypertrophic scars and overcorrection anterior chest wall. For satisfactory results included patients with recurrent partial deformation of the sternum to the I-th degree, as well as patients with a complete correction of the deformity, but with the presence of overcorrection of the sternum, and the combination of one of these changes with hypertrophic or keloid scars. Unsatisfactory postoperative results we assigned patients with relapsed complete deformation.

Table 1. – The results of treatment in the control and the study group in the late postoperative period

№	Outcomes number of treatment	Control group (n=23)		Main group (n=30)	
		abs	%	abs	%
1	Good	18	$78,26 \pm 8,68$	28	$93,3 \pm 4,7$
2	Satisfaction	2	$8,69 \pm 3,54$	1	$3,33 \pm 3,14$
3	Unsatisfaction	3	$13,04 \pm 4,32$	1	$3,33 \pm 3,14$

As the table shows, the positive outcomes of treatment in kg is  $78,26 \pm 8,68\%$ , and satisfactory —  $8,69 \pm 3,54\%$ , which is quite a

low figure. Satisfactory results were obtained in 3 children ( $13,04 \pm 4,32$ ). When comparing the percentage of good outcomes in

the CG relative to the MG where the proportion of good results is  $93,3 \pm 4,7\%$ , figures are statistically significant, because Student's  $t$ -test = 3,41, ( $p < 0,05$ ), which is the result of using a more effective method of surgical treatment PC. Satisfactory and unsatisfactory outcomes in the MG and the same number was on  $3,33 \pm 3,14\%$ . Satisfactory results referred a patient who after 8 months of the postoperative period developed local bone deformation due to the 7<sup>th</sup> costal cartilage, which required repeated surgery. Resection of cartilage 6–7 ribs on the right and the left rib cartilage 7, led to the complete elimination of the deformation. Unsatisfactory results in the exhaust gas carried with the patient's connective tissue dysplasia

syndrome. The patient had in addition PC morphologic appearance, scoliosis of the spine, joint hypermobility. We believe that the presence of this disease in the patient contributed to the development of relapse keeled deformation in a year.

Finally, summarizing all the results of our study, it is clear that we have developed a method thoracoplasty at PC are minimally invasive and very effective methods of treatment allows us to reduce the trauma of surgery, reduce the operation and, thus, anesthetic time, accelerate the activation time of patients and reduce the duration of pain, minimize operating and postoperative complications, improve cosmetic results.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-155-156>

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## Review on prediction of results of dental implantation at patients with the accompanying pathology

**Abstract:** Dental implantation is actively introduced into everyday practice of maxillofacial surgeons and dental surgeons. Despite its high results achieved during the last decades, there is a number of unsolved issues associated with implants rejection. The number of such complications according to different authors varies from 3 to of 10%.

**Keywords:** dental implantation, prognostication, clinical and laboratory results, oral fluid.

At the present stage the method of dental implantation took the worthy place among other dental interventions and plays one of the leading roles in system of complex rehabilitation of patients with defects of dentitions [1; 2; 3]. Revived in the middle of the 20th century, he thanks to the scientific capacity and integrative potential endures rapid development. Perfecting of implants and techniques of their statement is carried out in various directions for the purpose of increase in their quality and elimination of the shortcomings revealed during clinical operation [1; 4; 5]. The modern achievements of scientific and technical progress in metallurgy, chemistry, physics, materials science, biology and toxicology are involved in this process [2; 3; 6; 7].

The listed above facts convince that dental implantation continues to take root actively into daily practice of maxillofacial surgeons and stomatologists — surgeons that emphasizes relevance of the submitted publication.

The work purpose — based on the analysis and synthesis of data of domestic and foreign express literature to provide theoretical justification of carrying out researches on development of the system of prediction of result of dental implantation.

Now particular progress in introduction of the composite and productive techniques for optimization of provision of implants and achievement not only the adequate functional, but also cosmetic results is observed [3; 4; 8; 9; 10]. Overwhelming number of ex-

press sources of information are devoted to surgical technology of statement of implants [1; 5; 9], the characteristic of a bone tissue and to requirements imposed to an alveolar shoot, a jaw bone when carrying out the specified AND operations contain, generally given beam research techniques, results of pathomorphologic, is more rare — biochemical characteristics of processes of osteointegration [4; 6; 7; 10].

Long-term success of implantation depends as from medical (the exact selection of patients, ensuring stable primary fixing of an implant), and on efficiency factors (optimum material, the production technology, reactivity of a surface of an implant, its macrostructure) [9]. It is known that at optimum osteointegration the dental implant has to: to have clinical stability, to function not less than 5 years, not to damage fabrics, adjacent to it; not to cause at the patient of negative symptoms and feelings, to satisfy the patient both in the functional, and in esthetic aspects.

The detailed analysis of express literature specifies that failures when using a method, unfortunately, are very widespread and meet more often than it is accepted to speak about them and furthermore to consider them at assessment of results of treatment [2; 7].

In most of the basic managements and monographs [1; 5; 6] in sections of absolute contraindications to performing dental implantation such states as are specified: pathology of immune system and dysfunction of leukocytes; the diseases demanding periodic applica-

tion of steroids; diseases of bone system; violations in coagulating system of blood; the new growths needing a chemotherapy; uncontrollable endocrine diseases and diabetes mellitus; frustration of the central and peripheral nervous system; specific infectious diseases.

At the same time the list of the relative contraindications includes unsatisfactory hygiene of an oral cavity; centers of a chronic ontogenous infection; local inflammatory processes; malocclusion; diseases of a temporal and mandibular joint; bruxism; oral cavity mucosa diseases, especially facultative and obligate precancers.

In the social plan implantation is contraindicated to patients, carelessly falling into health, and also persons who abuse coffee that breaks a ratio of calcium and phosphorus in blood and their assimilation by a bone tissue [30].

According to M. D. Perova (2001), in 3 years the positive take of intra bone dental implantation makes not less than 92%, the increase of loss of bone structures for 3 years does not exceed 0,3 mm [8]. However it is necessary to emphasize that neither in domestic, nor in foreign sources and the annals of express literature there are no data on the uniform standard of assessment and prediction of results of dental implantation.

In spite of the fact that the world practice of dental implantation for the last 60 years of development proved the solvency, a part of maxillofacial surgeons falls into to this method of rehabilitation of dental patients with great doubt.

It is known that the changes developing owing to primary and secondary osteoporosis caused by endocrine pathology happen in all parts of a skeleton including in a bone tissue of jaws [8, 9]. Violation of bone remodeling affects on intensity of defeat of fabrics of a periodontium at generalized periodontitis [4, 5, 6, 9], promotes emergence and progressing of carious process [10].

According to certain authors, the adequate contact between a surface of an implant and an environmental bone tissue can be reached even at osteoporosis [9, 10]. However the fact of ensuring osteointegrative contact at the specified state is not a guarantee of efficient functioning of an implant [8] as even physiological load of a bone with such type of very tectonics often causes "failure" of processes of its activity and functioning, there comes pathological reorganization and a resorption [9; 10].

Regionary osteoporosis of jaws is observed at women at the age of 40–50 years, that is at the age corresponding to the beginning

of a menopause when the third type of a bone which is characterized by the fact that preparation of the last during operation is performed with smaller effort is more often stated. This type of very tectonics is defined at nearly 60% of women of the specified age [1; 4; 7].

At age "switching off" of function of ovaries 60–80% of women can have various clinical manifestations estrogen — a scarce state, so-called functional frustration, one of which is menopausal osteoporosis. In structure of osteoporosis it makes 85% [7]. The numerous epidemiological researches conducted abroad show various abundance of osteoporosis not only in the different countries, but also in regions separately of the taken state [6; 7; 9]. According to the expert opinion of WHO, incidence of osteoporosis takes the third place in the world after cardiovascular pathology and Diabetum [8; 10]. This disease falls into to group heterogeneous, characterized by the progressing loss of the bone tissue beginning after a natural or surgical menopause. These phenomena in an organism involve features of approach to all medical manipulations including to dental implantation [4; 6; 9].

Urgent problem in achievement of long-term and stable result of rehabilitation of dental patients with use of implants is the lack of knowledge and experience in scheduling of treatment and monitoring of the patients who passed it. Sources of complications of any operative measure can be as features of an organism of the patient, his behavior, and specifics and technologies of realization of medical manipulations. At the same time it is almost always not so much about natural communications between the phenomena how many about degree of risk of development of this or that type of complications. However so far in sources of express literature there is no information on existence or system development for prediction of results of the dental implantation considering all factors in total.

#### Conclusion

The presented material, including the analysis of results of the pilot and clinical laboratory studies by preparation, performing dental implantation, in the course of overseeing by patients during the postoperative period and when functioning implants, represents a theoretical basis for development of uniform system of prediction of result of dental implantation that will promote decrease of number of complications and upgrading of rendering the dental help to patients.

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## Section 7. Pedagogy

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-155-156>

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### Cluster-module as a method of improving the current trend in the structure of the lesson of physical culture for students with different levels of physical fitness

**Abstract:** This article deals with the application of new technologies in physical training of higher educational institutions. Also there were studied the Implementation of cluster-modular method in groups of students with different levels of physical fitness.

**Keywords:** cluster-modular method, physical training, fitness, non-discrete system, cluster analysis.

The relevance, timeliness, or even evidence of the need for co-temporal clustering process today does not almost cause the doubt. Curiously, the actual scientific approach to clustering today is relatively little developed and relatively reflected in the scientific literature; in addition to this, the term “cluster” has firmly entered the cage is not too clear, but obviously fashionable notions that, “clogging” the categorical scientific apparatus, often do not carry any meaning, nor, especially, practical significance. Meanwhile, the clustering phenomenon was studied, — though almost exclusively in the natural sciences — long before he became so fashionable.

The etymology of the concept of cluster (from English Cluster, in details — “beam, swarm, bush”) — very controversial: a term borrowed from the sciences, not having purely economic nature, now easy to “take root” in the humanitarian fields of scientific knowledge. Now the term is widely used in computer science and programming, mathematics, physics, chemistry, economics, sociology, etc. Let’s note, that, however, neither edition, nor even common understanding of how clustering and cluster formation processes of social clusters in modern science, unfortunately, did not happen [3, 1–2].

Let’s distinguish the given the scope of the article, the main characteristics, sociological and semantic indicators of accepted cluster model.

The cluster cannot serve as a symbol that does not exist in the system, including the social, nor, moreover, the designation of a single event or phenomenon. In this case, taking into consideration the classical dialectic models of Aristotle, V. Leibnitz, G. Hegel, Kant, thinkers of the Vienna School and the positivist tradition in general, the concept of a cluster would simply not accurate with respect to the well-established system of categories and the element; single, particular and general; norms and deviations, social dissipation, etc.

The concept of a cluster, according to the ideas of authors, describes specific condition of social community, including description of not only of this community, but also the process of its formation, structuring and its interaction with social environment.

For example, fans of emerging company to play volleyball on the beach at weekends mostly contain of relatively few core with

softly pronounced situational leadership, and also noticeable “variable” part. According to authors ideas, until formation of own stable team, with almost constant composition and stable leadership, this community can be designed to the simplest example of the social cluster. Thus, *cluster* — is union of objects and subjects in which their specific and individual characteristics are equivalent, i. e. being a part of the cluster one wants any bit not less than “be yourself”, to be alone, and at the same time “surviving”- competitive.

Cluster, therefore expresses non-discrete system of education period and its genesis. We emphasize once again that cluster does not describe each association of people, social groups and fragments.

In our case, the procedure of cluster analysis as a modern tendency of improving health-restorative nature technique is treated as a special form of regulation of quality of physical exercises, depending on the characteristics of fitness and physical development of students.

In physical education cluster analysis procedure is meant as identification of object groups among the elements of the sample. At the same time the units of analysis in particular database may appear thoughts, statements according to the survey, especially physical readiness engaged in particular in the border conditions between norms and pathology, also in initial pathological conditions, the group of the external environmental factors, in accordance with the achievements of physical development and readiness.

Consequently, clusters can be formed from any containing selective complex, the content of which definitely depends on specificity and scale of a particular social research.

The exploitation of cluster analysis procedures in copyrightable vale logic researches (especially in monitoring) has repeatedly shown that clusters are unstable, easily changeable, like everything else in the modern dynamic world.

Finally, we can note that the interpretation of the actual cluster in the image of the successive process, in particular in the process of physical education as a process that describes not only the sequence of formation of clusters, but also the logic, dynamics and clustering scale is extremely complex, since it is a question about the segments of the educational process totally with characteristi-

cally practiced criteria and standards of individual physical status as an indicator of physical fitness, health but not fantasy of sociologist, uniting diverse groups of data on free bases.

Currently, teachers of physical culture are unfamiliar with cluster analysis, since it no longer applies in sociology and economic disciplines and there is little adapted to the structure of physical education, but a rational combination of general-profile, selectively and recreational areas of physical culture in various aged periods of ontogenesis and under different conditions of life activities, provides for modern ways and conditions of motivation to physical activities specifically oriented in the aspect of preserving and strengthening health and physical fitness of young students.

In general, implementation of general didactic and profiled conceptions and approaches to the theory and methodology of teaching, especially computerization and extended use of technical training, provides for a relatively short period of time mastering the students' theoretical and practical section, and teacher — online survey the group and revealing enough gained material and releases the students from the routine activities. All this certifies the effective didactic approach in training and control of knowledge with the use of information technologies.

The computer itself is embedded in information technology education and training becomes so desired element of the educational system, in its absence, there appears some discomfort, as for a learner so for a teacher.

The peculiarity of using information technologies in physical education and sports means the organization of management of biological objects that formalizes with difficulties. From this point of view, there are discussed questions regarding to objective-subjective relations between teachers and students taking into consideration their biological features. Thus, we can select affordable and informative indicators of physical conditions for practical use in physical education that can be measured and evaluated. They can be: somatic-metric, somatic-scoped and physical-metric performance, physical fitness, physical activity, the incidence. When selecting measured symptoms of physical condition must be taken into account the ease of measurement, methods of evaluation and motivation of students.

*Cluster analysis* — is a set of methods that allow classifying multi-dimensional observation, each of which describes a set of variables of specific variables. The goal of cluster analysis is the formation of groups of similar objects with each other, which are called clusters [2].

Nowadays, researchers have so many software packages in the arsenal that allow optimizing and simplifying the analysis procedure. The most widely used packages are such as Vortex, SPSS, Statistica. The software "VORTEX" is designed for: inputting of primary information.

The software Vortex allows conducting descriptive statistics of studied variables (calculation of statistics: mean, mode, median, quartiles, dispersion, mid-quadratic deviation, coefficient of variation, excess etc.);

It allows conducting segmentation on multiple grounds, as well as the selected target groups (emphasis contexts — sub massive documents for in-depth analysis, for example, only men or only to respondents of 20–25 aged people).

Using a **cluster-modular** method for the development of individual recovery programs, the correct evaluation of the functional and physical condition is of great importance, as it allows not only studying the influence of physical exercises on body, but sometimes helping to diagnose latent disease, to establish adaptability to physical exercise, determining its optimality etc.

The module can be presented as a training element in the form of standard booklet that consists of the following components:

- Precisely formulated learning goal;
- A list of necessary materials equipment;
- A list of related educational elements;
- Proper training material in the shape of a summary of a particular text, following by detailed illustrations;
- Practical exercises to practice action skills;

At present, an urgent need to develop scientific bases of systematization and analyzing new educational technologies in physical education that can solve variety of tasks: transferring the knowledge, control the course of assimilation, demonstration of illustrative materials and development of physical fitness.

Solovyova E. B. [4] considers that the major problem of organization of the process of physical education is searching for education system, which allows monitoring the educational activity process the degree of assimilation loads of students that were obtained during the lesson that enables to individualize physical development of the individual [4].

It is important to know own body, learn how to encourage own actions, be able to remove nervous and muscular tension and psycho-emotional exhaustion. This is confirmed by various researches that are statistically proven decreasing morbidity among students, whereas increasing physical and intellectual capacity of capability of those who deliberately (in the period of all 4–5 years of education) used the system of rehabilitation measures.

Modeling serves as a method of «indirect practical or theoretical operating entity in which we investigate not directly the object we are interested at, but used an auxiliary artificial or natural system («Quasi-object»), located in the certain objective according to the known object that can replace it at certain stages of learning and providing when researching ultimately, information about the modeled object.»

The activities of the teacher should be considered not only as giving each student structured, focused and motivated information on conceptual and methodological content, methods of work in the areas of knowledge from different sectors of physical education, but also as direct and indirect control of the teacher their physical activity on achieving skills and abilities in accordance with the intended learning objectives.

The usage of computers in medicine and physical education provides great opportunity. To summarize, it is necessary to note that individualization of physical education classes means developing the dynamic monitoring observation (monitoring) for physical education and student's health condition.

It is possible to carry out with the help of modern information technologies by using cluster-modular educational method which in physical training the students with weakened health practically do not use, all of the above points to the need, searching for new forms of assessment of knowledge quality and skills for students, having serious disturbances in health.

However, despite the high potential modern information technologies, they have not found more widespread usage in the higher physical education system. In view of the above, introduction of modern information technologies in educational process on physical training of students with different levels of physical fitness, today is very important.

Cluster-module method is considered to be a new trend in the modern method of coordination abilities, and endurance of other physical and psycho acting abilities of students with different levels, in general the problems targeting their development.

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## Section 8. Political science

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-160-161>

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### The economic dimension of interaction between Mexico and the USA

**Abstract:** The article examines U. S. — Mexico economic cooperation. It defines the main forms of American-Mexican interaction, describing in particular the activity of joint enterprises known as “maquiladoras”. Outlined are also the disproportions of bilateral cooperation in this field.

**Keywords:** USA, Mexico, economic cooperation, “maquiladoras”, asymmetry, NAFTA.

**Relevance of the research topic.** The economic dimension of interaction between Mexico and the USA is a priority area for bilateral relations. External conditions, such as territorial proximity and geographic isolation, close interethnic and trade relations favoured the development of economic cooperation between the two countries, especially in the near-border regions. The conclusion of North American Free Trade Agreement enhanced the economic interplay between these countries to a greater degree. However, the asymmetry of quantitative and qualitative indices is evident in this field of U. S.-Mexico relations, as well as in the majority of other fields. Therefore, the analysis of economic component of bilateral interplay allows for understanding the interests and concerns of both countries.

**Analysis of recent publications.** The economic dimension of U.S — Mexico relations is widely covered in scientific literature. Among the authors who analyse different issues of economic cooperation between the two countries, one should mention Villarreal M. A. [1], Wilson C. E. [2], Davydov V. M. [3], Semenov V. L. [4]. A large number of publications is devoted to cooperation between the USA, Canada and Mexico within NAFTA, in particular articles of Komkova E. [5] and Ataev M. [6]. The energy dimension of bilateral cooperation is highlighted in the work of Seelke C. R. [7].

**Problem identification.** This article aims to determine principal spheres of U. S.-Mexico economic cooperation and to identify relevant issues. To achieve this goal the author sets the following tasks: 1) to examine commodity exchange (export/import) and investment between the two countries; 2) to identify the main forms of economic interaction between Mexico and the USA; 3) to define disproportions in this field, especially within joint enterprises.

**Results of the research carried out by the author.** NAFTA took effect in 1994. Since then the commodity exchange between the USA and Mexico has increased. U. S. export to Mexico in 1993–2014 rose from \$41.6 billion to \$240.3 billion and Mexican export to the USA during the same period increased from \$39.9 billion to \$294.2 billion. Thereafter, bilateral trade flows reached comparable figures, although the overall economic effect turned out to be greater for Mexico (478% export growth from the USA versus 637% export growth from Mexico).

In terms of service trade relations the situation is quite reversed, whilst they are dominated by the northern neighbour. For instance,

service delivery from the USA to Mexico in 2013 amounted to \$29.9 billion, while the services worth only \$17.8 billion were imported from Mexico, thus American trade surplus in service delivery amounts to \$12.1 billion [8].

The USA is the biggest trade partner for Mexico. The main bulk of Mexico’s international trade profit comes from export to the USA. In turn, Mexico is ranked only 3<sup>rd</sup> among the exporters to the USA (after China and Canada) and 2<sup>nd</sup> as export market for American goods and services (the first rank belongs to Canada). Thus, there is an asymmetry in commodity exchange between these countries which is manifested in Mexico’s greater dependence on American market. Given that the share of American export to Mexico decreased from 83% to 54% between 1996 and 2013, Mexican dependence on the USA as export market decreased slightly, from 84% to 79% in the same period [8].

As soon as NAFTA took effect the American companies started to relocating their production plants to Mexico [5, 77–78]. There was a gradual increase in the number of special raw materials zones and enterprises — “maquiladoras”. They operate on preferential terms as regards import and export of goods and services across the American-Mexican border. Upon the introduction of NAFTA, there were already more than 2000 of maquiladoras, producing a half of export and import of goods and raw materials between Mexico and the USA [4, 46–47].

Foreign direct investment is an integral part of American-Mexican economic relations since NAFTA conclusion. According to statistical data, the northern neighbour is the biggest foreign direct investment source for Mexico. Stock market of foreign direct investment from the USA has grown from \$17.0 billion to \$101.5 billion between 1994 and 2013. Mexican foreign direct investment to the USA is much smaller. Shares cost of Mexican foreign direct investment to USA in 2013 amounted to \$17.6 billion [9].

However, the opening of Mexican market for investment and creation of raw materials zones lead to certain negative consequences which deepened the asymmetry between the USA and Mexico. First, cooperation with the USA determines the concentration of Mexican production facilities near the northern border, whereas Mexican south states remain depressed. American partners are not interested in the development of the south, whilst cooperation with other Latin American countries cannot boost industrial



production. Second, the activities of “maquiladoras” were generally focused on meeting the requirements of U. S. market: raw materials were imported from the USA and not produced in Mexico; only American manufacture technologies were used, since they fully met American standards; all finished products were imported to the USA. Moreover, there are disproportions in the distribution of property ownership: the majority of parent companies for joint American-Mexican enterprises are American by origin [1].

As a result of the abovementioned state of play, the Mexican industrial potential grew increasingly dependent on American market, which has negative impact on Mexican economy. However, this negative effect was not significant, when Mexico was still the leader in exports to the USA.

With the China’s economic growth, Chinese manufacturers became serious competitors for the Mexicans on the American market and they gradually pushed out the Mexicans to the third place among the exporters to the USA [3, 140–141.]. This has a considerable impact on the general situation of Mexican manufacturers, as they do not have alternative market, as big as the American market. Mexico appeared not to be ready for open business competition on American markets. All this has a negative impact on the possibility of efficient Mexican participation in NAFTA.

Asymmetry of American-Mexican interplay exists also in the energy sector. Natural gas and oil output and production are important factors of Mexican economy development and of the U. S. energy security. The main market for Mexican oil-and-gas companies is the USA, which testifies to the asymmetric dependence. Over the last years, situation of the biggest state oil-and-gas company in

Mexico — Petroleos Mexicanos (Pemex) — became critical: due to the reduction of natural gas output Pemex fell back on gas import from the USA to provide for its own needs in oil production that increased self-cost of this process. The USA did not agree to raise the purchase price, and so the profit loss and dwindling cost-effectiveness of oil production aggravate the company’s finances [7].

**Conclusion.** The NAFTA creation boosted economic cooperation between Mexico and the USA. The commodity exchange between the countries increased considerably. The USA provided national businesses with a wide market, resources, as well as a particularly cheap labour. Mexico, in turn, received an influx of American investment, succeeded in a certain way in economic development and extended its exports to the USA. Nevertheless, the present study allows for acknowledging the transformation of economic partnership into dependence, where the USA dominate. An economic interaction in particular within joint American-Mexican enterprises is characterised by serious disproportions which deepen technological marginalization of Mexico compared to the USA and prevent the emergence of competitive Mexican goods. The production capacities for high-tech semimanufactured products are concentrated near the American border, thus conditioning the functional structure of Mexican industry and its focus on the USA. There is the same focus on American market in the field of oil and natural gas output and production by Mexican companies. Such a heavy dependence of Mexican export on American market is dangerous for Mexican economy, especially considering the fact that Chinese products partially replaced Mexican goods and Mexico shifted to the third place after Canada and China among the exporters to the USA.

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## Section 9. Agricultural sciences

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-162-167>

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### Improvement of drainage water quality through biological methods: a case study in the Bukhara region of Uzbekistan

**Abstract:** Agriculture is major sector in the economy of Uzbekistan, which uses about 92% of available water. Due to the country's climatic conditions, almost all agriculture depends on irrigation. Emerging climate change issues have led to the decline of water availability to local farmers. Therefore, the current paper focuses on the effective use of available irrigation water in the period of water scarcity. By decreasing salinity of drainage water we would have a chance to use water for irrigation again. This paper identifies the analysis of the research work on the use of different methods of irrigation to effectively use irrigation water. Particular attention is related to the decrease of drainage water salinity in the Bukhara oasis by biological methods, i. e. by growing *Lemna minor* water plants.

**Keywords:** Drainage water, dry residue, *Lemna minor*, salinity, water plants, water scarcity.

#### Introduction

Today there is a lack of water resources in the countries engaged in farming, including in Uzbekistan. Along with the increase in population in the globe, as well as environmental issues gain increasing demand of healthy food and clean drinking water. The population of the Republic of Uzbekistan in 1990 was 20 million. Man. Today this figure has reached 31.5 million in the country. People (2016) or if it is expressed as a percentage of increased for 1.5 times. Based on this water saving and rational use, and the exact same creation of additional water sources is one of the most pressing problems.

In Uzbekistan, the area of irrigated agriculture is 4.3 mln. hectares, while there is lack of water, because of this, arise great difficulty in irrigating of fields. To prevent the water insufficiency, reduced water salinity using algae, which are output from the collector drains biological way, then the resulting water is mixed in such a way the river water is used for irrigation of crops. This method creates an effective opportunity that provides sustainable harvest in agriculture.

It is sufficiently known that the salinization of the soil and water resources in the mainly cotton producing agricultural areas of Uzbekistan is limiting both the fertility of land and the utilization of water. During the last 50 years, irrigated areas were expanded largely without considering resource conservation.

Salinity is closely related to drainage conditions. Groundwater tables are too high because of excessive irrigation intensity and

often insufficient drainage systems. Therefore, the Government of Uzbekistan decided a State program (2013–2017) which is focused on new ways for sustainable usage of water resources and the improvement of living conditions for the rural population [2, P. 1–3].

One of the irrigation regions in Uzbekistan is the Bukhara oasis which is covered by 275,000 ha irrigated land. Amelioration systems with drainage and irrigation channels are set up for 219 000 ha. The total length of open channels amounts to 7,045 km. The main natural water source is the Amudarya River, which gets the surface water from the Tajik highlands and discharges into the Aral Sea region. In transit, water is removed for irrigation and is distributed into the channel system (Fig. 1). To control the groundwater tables of the irrigated land as measure against the groundwater salinization, percolation water is discharging back to the main water course or into lakes via drainage systems. In consequence, the salinization level is increasing across the water course and in the open water bodies with serious problems for the environment [6, P. 171–175].

The focus of this research is the Bukhara region, in central Uzbekistan. The Bukhara region was also selected as it contains a diverse ethnic population (e. g. Uzbeks, Tajiks and Turkmens), and suffers from frequent water shortages, severely salinized soil and groundwater, and extensive waterlogging. Its geographical proximity to an ecologically catastrophic zone, the Aral Sea, also makes it worthy of study.

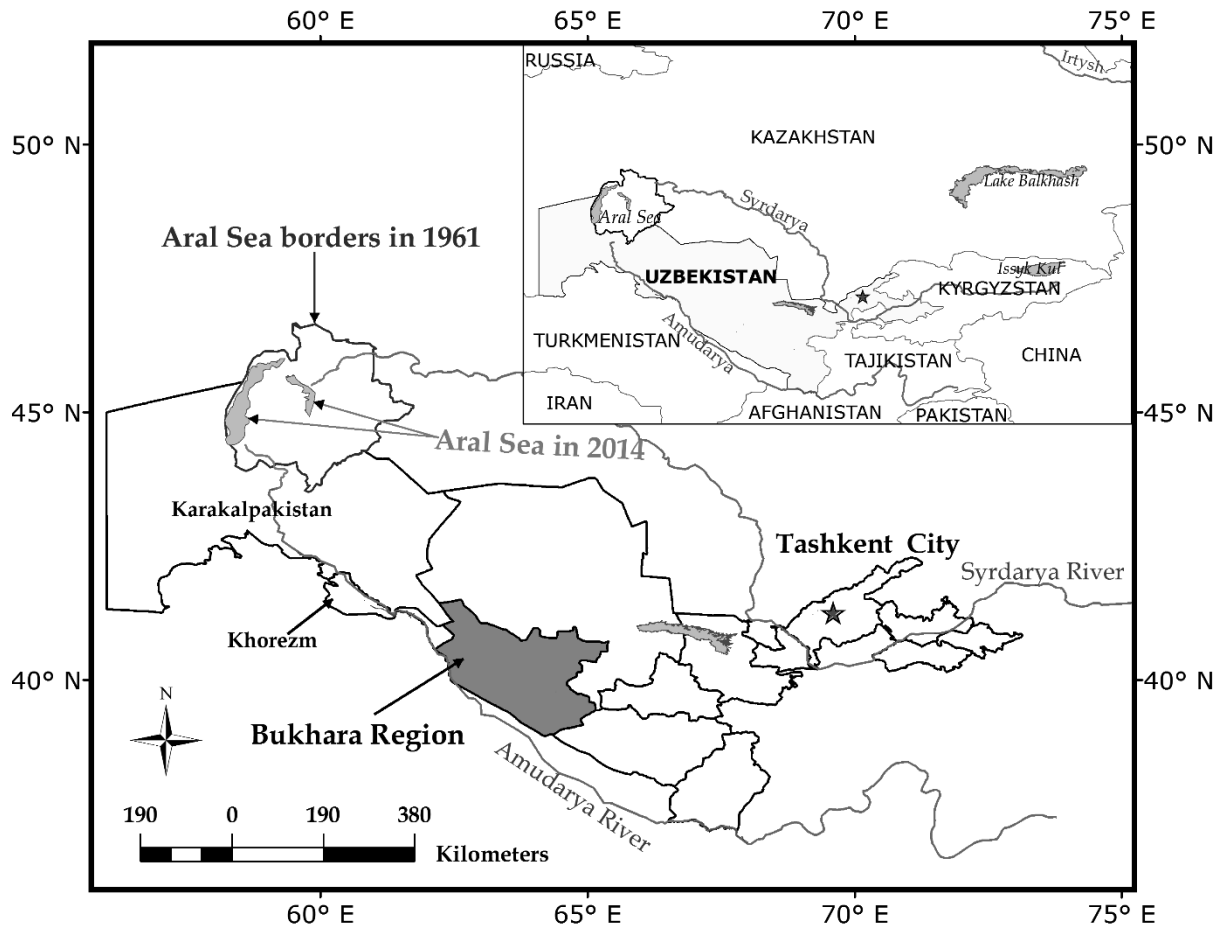


Figure 1. Location of the study region

The sharp decline in the fertility of soil salinity of care plants, crops and needs a lot of funds for crop production. Scientists noted that the yield of agricultural crops decreases harvests by the degree of salinity, at the low salinity fields decreases 20–30%, at the average salinity 40–60% and at the heavy salinity fields decreases by 70–80% of harvests. According to the plant to reduce the harmful effects of the salts in the saline land crops, agricultural activities and irrigation system maintenance order to develop their own methods.

Scarcity of water resources in Central Asian countries, such as the Republic of Uzbekistan will also impact significantly. After all, among the countries of the region's growing population and the natural ecosystems of social, economic and environmental needs to ensure the sustainable development of water demand remains high [1, P. 23–24].

Evidently, watching water scarcity in Uzbekistan, prevention and the creation of additional sources of water used in irrigation is one of the pressing issues facing the country. Today, in the Republic 55–56 billion  $m^3$  consumption of local river water of Amudarya and Syr Darya rivers, 92% of this water is used for irrigated farming. This 50% of the used water sticks under the earth itself, and out of the territory through the collector-drainage areas. In particular, the average annual consumption of irrigated areas of the Bukhara Region (4.2–4.6 billion  $m^3$ ) of water, this indication about 50%, or at least 1.9–2,3 billion  $m^3$  of collector-drainage through the expulsion from the territory of the region [10, P. 39–41].

**The aim of research:** The current issue is using agriculture water of high salinity collector-drainage waters in Bukhara oasis. This collector-drainage waters with high salinity, and with using this water for agriculture in water scarcity period leads a lot of serious problems. The main objective of the research work is growing

*Lemna minor* water plant in mineralization about 3–5 g/l collector-drainage waters, and decrease drainage waters' mineralization. With irrigating variety of cotton "Bukhara-6" reduced mineralization of collector-drainage waters get stable and high yield of cotton and to identify the impact of soil salinity.

#### Materials and Method

In general, desalination removes dissolved salts from water to certain extent depending on the method applied: distillation in evaporators (thermal method), the ion-exchange method, electro-dialysis, or the reverse-osmosis (membrane) method. Besides these technological, cost-intensive methods for water purification it also may be possible to adapt some low-cost measures like bioremediation [14, P. 114–116]. Although these measures could be less effective than technical methods, and depend strongly on climatic and natural conditions, they could play an important role for the environment [12, P. 24–25].

Methods of phytoremediation of nutrients by plant uptake are used throughout the world, mainly in natural and constructed wetlands. Examples of the main groups of plants used for these ecotechnologies are submerged plants such as algae, surface-floating plants such as duckweed (*Lemnaceae*) and water hyacinths (*Eichhornia sp.*), emerged plants such as reeds (*Phragmites australis*) and bulrushes (*Typha latifolia*) or, in the subtropical and tropical zones, papyrus sedge (*Cyperus papyrus*) [3, P. 146–149].

Sewage treatment with the small aquatic plant duckweed (*Lemnaceae*) has undergone a revival during the last decades. There is a wealth of literature about its purification behavior (e.g. nutrients, trace metals, toxic substances), and technical solutions for the adaptation of duckweed for waste water treatment. The advantages of duckweed are its fast growth, worldwide occurrence, ease of maintenance and high protein content as fodder.

Growing *Lemna minor* water plant in mineralization about 3–5 g/l collector-drainage waters in Bukhara oasis in the period of water scarcity, decrease collector-drainage waters' mineralization by biological method, with the result of irrigating variety of cotton "Bukhara-6" reduced mineralization of collector-drainage waters and identify soil salt regime, the growth of cotton, development and productivity. To conduct observations in the Bukhara region, the Bukhara district flows "YULDUZ" drainage canal was selected and carried out a small pond dug, the pool water is re-



moved from the ditch and water plant *Lemna minor* on drainage waters was grown.

The experiments have been conducted in 2012 and 2013 under the real climate condition. Thus, because of high temperatures during the experimental period the evapotranspiration was to be considered by measured water loss if estimating the salt uptake by plants.

For field investigations in the Bukhara district (Yulduz collector, "Muhammad Choruqiy" farm territory) a cleaning pond was excavated (length: 30 m, width: 5 m) (Fig. 2).

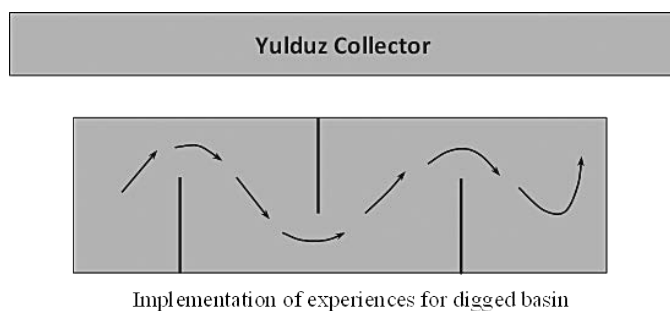


Figure 2. Excavated cleaning pond (left) and flow chart of the implementation with collector, and baffles within the cleaning to prolong the retention time (right)

Pool's width is 6.0 m and the length is 120 m, whereas the pond water depth is 2.5 m. Research in the cotton field was done during 2013–2015 on the basis of the adopted methods by the Uzbek Cotton Research Institute's "field of experimental methods" (UZCRI Tashkent-2007) and the Leibniz Centre for Agricultural Landscape Research (ZALF), Germany.

During the research of cotton variety "Bukhara-6" recommended by the Bukhara Branch of Cotton Research Institute of Irrigation, soil moisture LiFCW (Limited field capacity wet) 70–75–65% compared to mineral fertilizers N250, P175, K100 kilos/hectares care. Experiments were carried out on 1 tier, 5 options and 3 repetitions. The amount of water used for irrigation of cotton "STAR" collector mineralization dry residue of 3.9 g/l, Cl-0.374 g/l, SO<sub>4</sub>-1.348 g/l, HCO<sub>3</sub>-0.476 g/l, Ca-0.228 g/l, Na-0.367 g/l and Mg-0.412 g/l,

after growing *Lemna minor* water plant on "YULDUZ" collector, decreased mineralization by biological method the amount of salted water residue of 2.8 g/l, the amount of Cl 0.291 g/l, SO<sub>4</sub>-1.084 g/l, HCO<sub>3</sub>-0.246 g/l, Ca-0.174 g/l and Na-0.311 g/l, Mg-0.284 g/l was equal respectively. Biological treatment of cotton through a variety of methods of irrigation water in the ditch, "Bukhara-6" is carried out irrigation works, cotton growth, development and yield.

Experience in the field of irrigation options for the installation of the regime of the soil 1-meter layer of soil (0–30, 30–70, 70–100 cm) samples at the beginning of the growing season, and after each irrigation and irrigation period, as well as an option at the end of the growing season, soil samples and taken soil samples from the soil Cl; HCO<sub>3</sub>; SO<sub>4</sub>; and determined the amount of dry residue (% of the dry weight of the soil) (Table-1).

Table 1. – System of the Experience

Variant number	Irrigation soil moisture% LiFCW (Limited field capacity wet)	Measures of mineral fertilizers	Method of irrigation	Names of organized events
1-variant	70–75–65%	N250; P175; K100.	River water for irrigation	River water for the area with cotton applied the accepted mode.
2-variant			River water irrigation ditch water to the biological treatment (50/50%)	The river water is mixed with the water of the ditch cleaned with biological cotton for the region during the growth of the watering regime.
3-variant			Salted water to river water for irrigation (50/50%)	River water drainage water mixed with cotton applied the accepted modes of irrigation for the region.
4-variant			Biological peeled salted water for irrigation	Biological peeled salted water with cotton applied the accepted modes of irrigation for the region.

### Results and Discussions

The cultivation of agricultural crops should be select watering regime exactly to one type of plant one climate condition needs to provide the necessary water regime. Cotton growth and its development, collecting harvest, the opening duration of cotton bolls and its

quality depends on irrigation terms and times, irrigation schemes, the duration of watering, irrigation at the period of cotton growing, and seasonal irrigation. As well as depending on the phases of developing cotton selecting optimal sustainable irrigation times, and timely irrigation cotton leads to high yield.

By years of experiences irrigation in cotton fields was carried out by system which accepted special for Bukhara district Bukhara province. At the same time, options selected the duration and principle of irrigation depending on the moisture content in the soil. At all options first irrigation moderate in determining soil moisture at 70 cm, then at the next irrigations identified soil moisture in 1 metric layer.

Cotton irrigation limits were calculated by the formula of S. N. Ryjov.

$$m = 100 \cdot h \cdot J \cdot (W_{LiFCW} - W_{NW}) + K \quad m^3 / ha$$

Here:  $W_{LiFCW}$  – capacity of the field is limited compared to the weight of the soil moist, %;

$W_{NW}$  – weight of the pre-irrigation soil moisture, %;

$J$  – weight fraction of the soil moisture,  $g/cm^3$ ;

$h$  – value of layer, m;

$K$  – consumption of water used for evaporation,  $m^3/ha$  (layer due to sufficient moisture 10%).

The amount of water given to each field test area, bullet – installed on top of the water in the waterway were measured using a device for measuring the water “Chipoletti” BЧ-60. Based on the results of 2-table. Conducted experiments in the areas of irrigation on 1–3–1 system and 5 times watered.

On the period of research studied the methods of irrigations' effects of salt accumulation in the soil. Salinity of soils declines fer-

tility of plants, to care of plants and a lot of funds for crop production. According to these, in order to reduce harmful effects of salts to plant in the saline land crops irrigation system implementation and maintenance of order will have to develop their own methods [8, P. 87–90].

Research methods for cotton irrigation watering seasonal salt accumulation in the soil analyzed. During the experiments, the amount of salt by taking samples of the soil before the seeds before drilling laboratory analysis. The analysis,  $HCO_3$ –0.033%, the amount of  $SO_4$  0.048%, and the dry residue amount was equal to 0.128%. At the end of the validity period of growth can be seen an increase of the value of all salts in the soil, only the amount of  $HCO_3$  decreased compared to the first position by the end of the vegetation.

At the end of the vegetation chlorine (CL), if we analyze the changes in the amount of land irrigated with river water 1 variant arable (0–40 cm) layer of chlorine, which is equal to the amount of 0.014%, plowing the ground (40–70 cm) layer, the first to result from the amount of chlorine exceed 0.003%, 0.014%, 0.015% at the end of the vegetation in the 0–100 cm layer, the company said. Research has 2options, that cleared the water of the river biologist fields irrigated by water from the ditch to the soil arable (0–40 cm) layer of chlorine amounted to 0.015%, plowing the ground layer of 0.014%, 0–100 cm layer of this amount was equal to 0.015%. This is 1 option 0,001–0,002% increase in the amount of chlorine.



Figure 3. The Process of analyzing experimental results holding field and laboratory work

Research on the 3-option chlorine quantity to soil structure by the ending of growth period, on arable layer 0.018%, on under arable layer 0.016% and on layer of 0–100 cm was equal to 0.017%. 5-option of researches, only salted water irrigated cotton field to the highest amount of salts in the soil. This option arable layer chlorine amount of 0.034%, plowing the ground layer of 0.031% and 0–100 cm layer is equal to 0.031%, compared to options 1 and 2 of the arable layer 0,019–0,020% of arable ground layer is 0.018% of chlorine increase.

Irrigation methods studied the effect of the amount of dry residue in the soil arable layer of the beginning of the validity period of growth 0.153%, plowing the ground layer is equal to 0.136% and 0–100 cm layer, which is equal to 0.128% by the end of the validity period of growth options residue 1 The amount of arable layer — growth period increased by 0.079% compared to 0.232%. Driving an underground layer of this value can be equal to 0.193%.

Experiences option-2 residue of the amount of arable layer is equal to 0.241%, 0–100 cm layer of the dry residue amount was equal to 0.178%. 3-version is that the water of the river drainage area of irrigated water to the soil compared to the results obtained in the first layer of dry residual amount of arable exceed 0.091%, indicates 0.244%, 0–100 cm layer, which is equal to 0.196%. Cotton biologist irrigated with water from the ditch cleaned only 4-variant the soil dry residual amount of arable layer 0.243%, plowing the ground layer is 0.210%, 0–100 cm layer of dry residue amount was equal to 0.185%. Experiments 5-variant, which is irrigated with water from the ditch, the amount of residual soil dry fields at the end of the validity period of growth arable layer of 0.283%, plowing the ground layer is 0.236% and 0–100 cm layer 0.244%. The results of the observations made in the years 2014 and 2015, similar to the above given experiments results.

Table 2. – The effect of the irrigation to amount of salts in the soil

A layer of soil, cm	At the beginning of the growing season				At the end of the growing season			
	Cl	HCO <sub>3</sub>	SO <sub>4</sub>	dry residue	Cl	HCO <sub>3</sub>	SO <sub>4</sub>	dry residue
Irrigated with river water field (Option-1)								
0–30	0,009	0,029	0,049	0,153	0,014	0,024	0,068	0,232
30–70	0,011	0,032	0,050	0,136	0,014	0,029	0,073	0,193
70–100	0,013	0,035	0,048	0,122	0,016	0,033	0,064	0,161
0–70	0,010	0,030	0,049	0,142	0,014	0,026	0,066	0,202
0–100	0,012	0,033	0,048	0,128	0,015	0,031	0,065	0,167
A biologist with the river water purified water from the ditch to the irrigated field (Option-2)								
0–30	0,009	0,029	0,049	0,153	0,015	0,028	0,068	0,241
30–70	0,011	0,032	0,050	0,136	0,014	0,031	0,072	0,206
70–100	0,013	0,035	0,048	0,122	0,016	0,034	0,065	0,166
0–70	0,010	0,030	0,049	0,142	0,014	0,028	0,066	0,208
0–100	0,012	0,033	0,048	0,128	0,015	0,032	0,067	0,178
River water and drainage water to the irrigated field (Option-3)								
0–30	0,009	0,029	0,049	0,153	0,018	0,031	0,069	0,244
30–70	0,011	0,032	0,050	0,136	0,016	0,030	0,074	0,212
70–100	0,013	0,035	0,048	0,122	0,017	0,036	0,068	0,176
0–70	0,010	0,030	0,049	0,142	0,017	0,030	0,071	0,215
0–100	0,012	0,033	0,048	0,128	0,017	0,032	0,069	0,196
Biologists irrigated with water from the ditch, cleaned the field (Option-4)								
0–30	0,009	0,029	0,049	0,153	0,016	0,029	0,068	0,243
30–70	0,011	0,032	0,050	0,136	0,014	0,030	0,071	0,210
70–100	0,013	0,035	0,048	0,122	0,016	0,035	0,067	0,170
0–70	0,010	0,030	0,049	0,142	0,015	0,029	0,069	0,211
0–100	0,012	0,033	0,048	0,128	0,015	0,031	0,068	0,185
Irrigated with water from the ditch field (Option-5)								
0–30	0,009	0,029	0,049	0,153	0,034	0,056	0,127	0,283
30–70	0,011	0,032	0,050	0,136	0,031	0,062	0,148	0,236
70–100	0,013	0,035	0,048	0,122	0,029	0,0481	0,091	0,214
0–70	0,010	0,030	0,049	0,142	0,033	0,059	0,138	0,260
0–100	0,012	0,033	0,048	0,128	0,031	0,055	0,122	0,244

### Conclusions

1. Nowadays often observed water scarcity in Uzbekistan for irrigation has been great difficulties. As a result, getting crops from these fields dramatically decreased.

2. In conditions of the Bukhara region observed of water scarcity areas of high mineralization of collector-drainage waters with growing *Lemna minor* water plants, decrease water salinity by biological method, irrigation with added to the water of the river, will be economize 50% of the river waters.

3. In conditions of Bukhara region Bukhara district meadow alluvial soil, with irrigation cotton variety “Bukhara-6” yield

41,8 c/ha, adding to river water treatment by water plant *Lemna minor* by biological method yield of the cotton will be 40,1 c/ha respectively. Drainage water directly to the watered option irrigated with river water option, compared to 13.5 c/ha, and irrigated by river water salted water to the biological treatment option, compared to 11.8 c/ha.

### Acknowledgment

This research has been funded by the Federal Ministry of Education and Research of Germany (BMBF) and was implemented by the coordinatorship of the Leibniz Centre for Agricultural Landscape Research (ZALF), for which Authors are highly indebted.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-167-170>

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## Vegetable fat-composite mix for the production of flour products

**Abstract:** Scientifically proved the reasonability of using vegetable-fat composite blends of animal fats, vegetable oils and wheat flour embryonic product positioned as functional additives, improvers of flour products. The compositions of composites and their cooking technology are worked out.

**Keywords:** vegetable-fat composite mixture, animal fat, vegetable oil, flour of wheat germinal products, fatty acid composition, flour products.

At the present stage of development of oil industry the most promising direction of research and development is to create combination products are characterized by a balanced composition of fatty acids. The qualitative composition of fats is essential for the homeostasis of the human body processes. Inadequate dietary intake of polyunsaturated fatty acids (PUFAs) leads to cardiovascular disease, and structural and functional disorders of the organization of cell membranes [1, P. 20; 2, P. 5–6; 3, P. 287–291].

One of the most important areas in the development of new types of fatty foods is a possibility of formation of their functional properties due to the combination of traditional and non-traditional ingredients. Preferably creating vegetable-fat systems (VFS), balanced fatty acid composition (FAC) and fortified with essential nutrients. Synergistic combinations of vegetable supplements, fats and oils make it possible to obtain products with desired functional properties. Vegetable raw materials are natural source of biologically valuable substances. Using it, it is possible to create products preventive and improving orientation that ensures optimum psycho physiological adaptation to ecologically harsh environments.

As the plant fraction of VFS is advisable to use non-defatted oil-containing vegetable raw materials. The most significant and prom-

ising is the embryo of wheat product (*Triticum vulgare*, *Triticum durum*), PUFA oils which are relatively balanced ratio of families  $\omega 6$  and  $\omega 3$ . Triacylglycerols wheat germ contains a significant amount of  $\omega 3$ , which is virtually non-existent in many common vegetable oils and fats [3, P. 151–153].

Special attention deserves wheat germ oil as a natural antioxidant, which properties are due to the content in it of tocopherols and carotenoids (provitamin A). It should be noted that the content of tocopherols is superior to all known natural sources (more than 400 mg / 100 g oil). The composition of wheat germ oil also includes octacosanol, which is a regulator of lipid oxidation, enhances the antioxidant effect of tocopherols and vitamin A. It is found that the blending of vegetable oils with a low content of vitamin E supplemental application of it becomes necessary [1, P. 21; 3, P. 300–303].

However, the direct use of embryonic product in order to take full advantage of the content of botanical oils and other biologically valuable ingredients is constrained due to its instability during storage, even after industrial processing (cleaning, drying, grinding). Therefore particular interest draws possibility of using of non-defatted flour from wheat embryo product as a component of vegetable-fat composite mixes with anhydrous fats and vegetable oils are also

able to provide a certain preservative effect on the product during storage. Such VFS can be used as alternative substitutes for fats in flour products recipes.

The purpose of the study was to develop the technology and formulations of functional vegetable-fat composite blends high biological value and low-fat that are resistant to microbial contamination during storage.

The objects of study were samples of non-defatted flour from wheat embryo product ( $F_{WEP}$ ); anhydrous fats; vegetable oils; fat flour mixture (FFM) containing 50% of  $F_{WEP}$  (to the total amount of raw materials), and powdery fat blends (PFB) containing more than 50% of  $F_{WEP}$ . Comparing samples were fat product ( $F_{PR}$ ) and  $F_{WEP}$ .

To carry out the experiment on the basis of a priori literature data [5, p.158-160,163-165] on the physical and chemical indicators and FAC were selected solid fats, which are characterized by

a certain degree fixed fatty acid composition, as well as the most common and affordable vegetable oils: animal (mutton) fat (AF); clarified butter (CB); Palm (PO), sunflower (SFO) and soybean oil (SBO).

The experimental data on chemical composition and quality parameters of  $F_{WEP}$  is given in Table 1.

Calculation-analytical method determined the fatty acid content and the ratio of anhydrous compositions. Comparing samples were fat product ( $F_{PR}$ ) and  $F_{WEP}$ .

Calculation results are shown in Table 2.

Analysis of the data in the table 2 showed that the proposed compositions contain high saturated fatty acids (SFAs) and low - PUFA. Value of PUFA  $\omega_6$  and  $\omega_3$  in mixtures with CB and AF, seeming at first sight, acceptable for clinical nutrition, amid the apparent deficit of PUFA has no significant physiological importance.

Table 1. – The chemical composition and quality parameters of flour from wheat embryo product ( $F_{WEP}$ )

Mass fraction, in % to 100 g product						Fatty acid composition of oil $F_{WEP}$ , %				Organoleptic indicators	
water	proteins	carbohydrates	fats	cellulose	ash	SFA	MUFA	PUFA		color	taste and smell
								$\omega-6$	$\omega-3$		
11,2	25,8	43,2	10,1	5,8	3,9	17,0	21,5	54,5	7,0	Cream	sweet, odorless

Table 2. – Fatty acid ratio in the anhydrous compositions of solid fats, oils and  $F_{WEP}$

№	Mass fraction, %		Fat blend, %	The ratio of fatty acids in the fat phase mixture											
				$A_F + F_{WEP}$		$CB + F_{WEP}$		$PO + F_{WEP}$		$A_F(50\%) + SFO(25\%) + SBO(25\%) + F_{WEP}$		$CB(50\%) + SFO(25\%) + SBO(25\%) + F_{WEP}$		$PO(70\%) + SBO(30\%) + F_{WEP}$	
	1			2		3		4		5		6			
	$F_{PR}$	$F_{WEP}$		SFA: MUFA: PUFA	$\omega_6$ : $\omega_3$	SFA: MUFA: PUFA	$\omega_6$ : $\omega_3$	SFA: MUFA: PUFA	$\omega_6$ : $\omega_3$	SFA: MUFA: PUFA	$\omega_6$ : $\omega_3$	SFA: MUFA: PUFA	$\omega_6$ : $\omega_3$	SFA: MUFA: PUFA	$\omega_6$ : $\omega_3$
1	100	0	100	55:40:5	2,8:1	62:33:5	2,6:1	49:40:11	–	35:32:33	10,2:1	39:28:33	10,0:1	40:34:26	8,5:1
2	90	10	91	55:40:5	3,0:1	62:33:5	2,9:1	48:40:12	156:1	35:32:33	10,1:1	39:28:33	9,9:1	39:34:27	8,5:1
3	80	20	82	54:40:6	3,2:1	61:33:6	3,2:1	48:39:13	74:1	35:31:34	10,0:1	39:28:33	9,9:1	39:34:27	8,4:1
4	70	30	73	53:39:8	3,8:1	60:33:7	3,4:1	47:39:14	46:1	35:31:34	9,9:1	38:28:34	9,8:1	39:33:28	8,4:1
5	60	40	64	53:39:8	4,2:1	59:33:8	4,0:1	46:39:15	32:1	34:31:35	9,8:1	37:28:35	9,7:1	38:33:29	8,4:1
6	50	50	55	51:39:10	4,6:1	58:32:10	4,4:1	46:38:16	24:1	34:31:35	9,7:1	37:27:36	9,6:1	38:33:29	8,3:1
7	40	60	46	50:38:12	5,1:1	56:32:12	4,9:1	45:37:18	19:1	33:30:37	9,5:1	36:27:37	9,4:1	37:32:31	8,3:1
8	30	70	37	48:37:15	5,6:1	54:31:15	5,5:1	43:36:21	15:1	32:30:38	9,3:1	35:27:38	9,2:1	35:31:33	8,2:1

Adding fat to the dough products with a high content of PUFA capable flour by lipoxygenase to form peroxidic compounds can fortify the oxidation of sulphhydryl groups in test protein - proteinase complex flour and thereby improve the structural and mechanical properties of the dough. When choosing VFS components for flour products were also taken into account the necessity and usefulness of the products in the liquid fat solid crystalline phase having a melting point higher than the temperature of the dough prior to baking. It is established that at this stage of the test fat improves gas-retaining capacity and slows down the formation on the surface of the baked blank dehydrated solid layer – the crust [6, P. 161-163].

Complete replacement of hard fats with liquid vegetable oils is not possible because of the sedimentation of particles of flour component. In this regard, from 30 to 50% of solid fat in VFS replaced with vegetable oils. As a result, the proposed compositions were characterized by quite optimal ratios of SFA: MUFA: PUFA and  $\omega_6$ :  $\omega_3$ . Moreover, changes in the dynamics of these data, as the share of

$F_{WEP}$  in the compositions indicates a significant role in optimizing the final FAC when combined with fats and vegetable oils. Versions with 70% of  $F_{WEP}$  has the most balanced FAC.

It should be emphasized that these combinations of  $F_{WEP}$  with fats can significantly optimize the ratio of PUFA families  $\omega_6$  and  $\omega_3$ , and the ratio of SFA: MUFA: PUFA mixture data close enough to the American Heart Association requirements (1: 1: 1) [4, P. 394].

It should be noted that for the preparation of VFS with  $F_{WEP}$  should not be limited to fats given in Table 2. Do not preclude the use of hydrogenated, interesterified, modified fats and other vegetable oils in view of ensuring food safety and functionality of the compositions obtained. For example, as the fat component of VFS with  $F_{WEP}$  can successfully utilize the functionality of the fat composition, proposed by the authors [7, P. 63-71], based on a combination of milk fat with other fats and vegetable oils. This germ oil of  $F_{WEP}$  is able to elevate even more the composition of the resulting composition.



The average results of the study are shown in Figures – 1, 2.

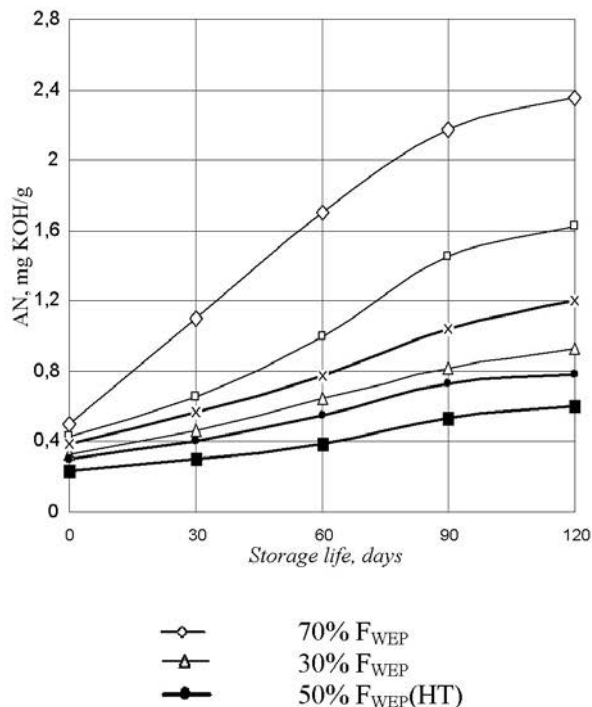


Fig. 1. Change acid number (AN) of the selected fat VFA during storage

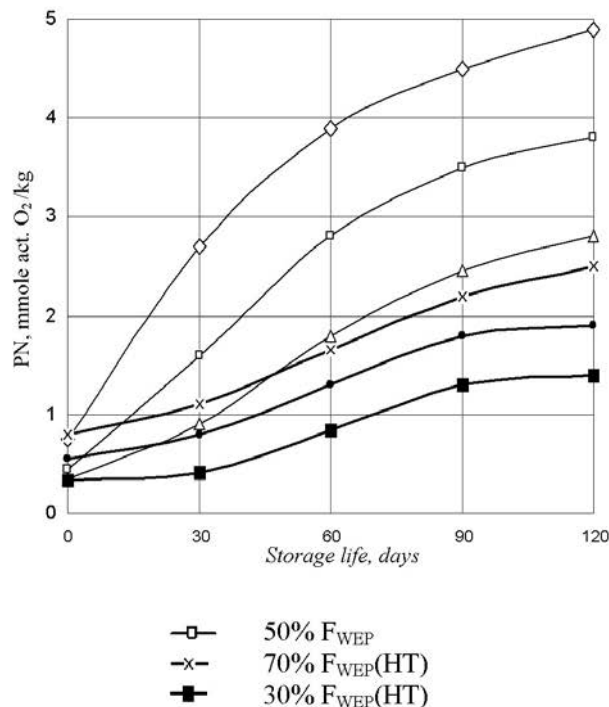


Fig.2. Change peroxide number (PN) of the selected fat VFA during storage

It is found that the heat treatment mode mixes the components to inhibit the enzymatic action of enzymes flour component and extend product shelf life.

It should be noted that the minimum wage is not a sterile product and dissemination of specific micro flora, which is also a cause of damage to the product during storage, as well as factor reducing its nutritional and consumer value. Therefore determined microbio-

logical contamination test compositions by conventional methods of crop on specialized for different environments microorganisms. The test samples were stored at 5±10 °C temperature for 3 months. Monthly their microbiological contamination and compliance with the requirements of sanitary rules and norms are checked [8].

The study results are given in Table 3.

Table 3. – Changes in the composition of the microbial ecosystem in VFC during storage

Time incubation, days	The number of mesophilic aerobic and facultative anaerobic microorganisms, NCFU/g		Yeast(×103), NCFU/g		Mold mushrooms (×102), NCFU/g		Bacteria E.coli, NCFU/g		Compliance with the requirements of sanitary rules and norms 0138-03	
	1*	2*	1	2	1	2	1	2	1	2
Experimentwith 30% of FWEP										
0	157±5,0	68±5,6	–	–	–	–	n/d	n/d	meets	meets
30	203±5,6	122±5,0	–	–	–	–	n/d	n/d	meets	meets
60	448±5,2	196±5,2	–	–	0,2±0,1	–	–	–	meets	meets
90	646±6,6	275±5,3	0,4±0,1	0,2±0,1	0,5±0,1	0,2±0,1	–	–	meets	meets
Experimentwith 50% of FWEP										
0	217±5,0	102±6,5	–	–	–	–	n/d	n/d	meets	meets
30	465±5,6	194±6,2	0,3±0,1	–	–	–	n/d	n/d	meets	meets
60	668±5,2	242±6,0	0,7±0,1	–	0,6±0,1	–	–	–	meets	meets
90	848±6,6	350±6,3	1,1±0,1	0,5±0,1	1,3±0,1	0,6±0,1	–	–	not meets	meets
Experimentwith 70% of FWEP										
0	307±6,2	179±7,0	–	–	–	–	n/d	n/d	meets	meets
30	517±5,8	218±7,5	0,4±0,1	–	–	–	n/d	n/d	meets	meets
60	898±6,5	324±7,8	0,9±0,1	–	0,9±0,1	–	–	–	meets	meets
90	1082±6,5	436±8,1	1,5±0,1	0,7±0,1	1,7±0,1	0,8±0,1	–	–	not meets	meets

\* Note: 1- samples prepared without heat treatment; 2- samples subjected to heat treatment; n/d - not detected; meets- meet sanitary requirements and norms.

It should first be noted that composites studied after incubation for 2 months at a temperature of 37 ± 2°C on the environment Endo

the groups of bacteriaE coliare not detected, so further crops in the environment Endo are not produced.

It is found that the increase in the total number of microorganisms in VFS subjected to heat treatment, during storage occurs less rapidly than comparable samples without heat treatment (HT). In general, microbiological studies have shown compliance of treated VFS even after 3 months of storage and only 30% of the flour without heat treatment requirements of sanitary regulations.

Thus, the proposed method of use in baking VFS pastry product directly embryo, not only the oil from it allows 100% use

biopotential vegetable raw prescription to reduce the number of special fat products, to increase the nutritional value and reduce the cost of the final product. Development of new technologies of production of combined food based on vegetable fat and raw functionality, as well as research in the direction of the organization of a «healthy» and safe supply of the population is a priority for the food technologists.

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## Section 10. Technical sciences

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-171-173>

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### Increase of an overall performance of a deduster on cotton ginning enterprises

**Abstract:** In this article different ways of improving dust filter type CS-6 used for cleaning dust-laden air in the factories are shown. If the cleaning results of dust filter will be improved, the ecology of environment will be less harmed.

**Keywords:** Dust, cotton, dust filter, concentration, cleaning, model, formula.

**Introduction:** In the cotton ginning factories dusty air is generally cleaned by utilizing dust filter. The process of primary cotton processing is mostly depends on the dust outlet and its incidence depends on binding of the variety, type of cotton and stages of the technological process.

**Analyses:** The whole dust coming from technological machines and system of pneumatic transport during the all stages of technological process of primary cotton processing (picking, drying, cleaning, separating, linter and pressing) is cleaned by dust filter. In the first stage there is more dust, so comparatively with the next stages its concentration is  $1 \text{ m}^3$  in air up to 10 grams.

The size and weight of a dust atom is very important to find out the dust trajectory. Also, it is essential to know the air speed, dynamic and static pressure, as well as the size of the dust filter.

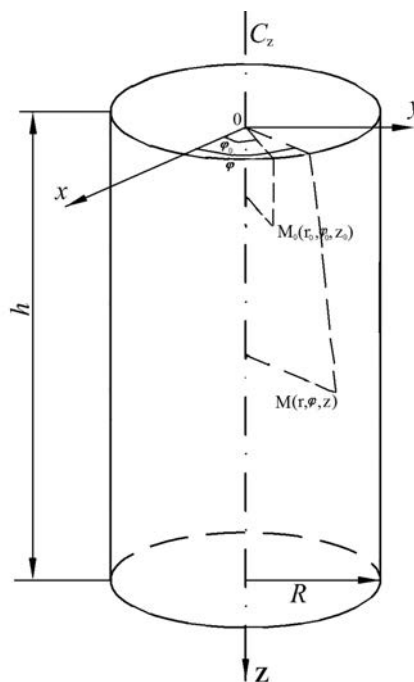
Taking into account the constructive composition of the dust filter, we'd like to compare the attempt of an atom in the work-in camera. Based on the scheme shown in picture 1, let's see the forces that effect on dust atom. In order to show trajectory in the air we will prove effective forces in the axis  $x, y, z$ .

**Recommendation:** In our opinion, it is possible to clean outlet of dusty waste coming from cotton ginning factories with the help of dust filters. In order to make work stable the device of dust filter, it is important to look through atom trajectory and parameters, as well as learning connection of the air flow. If the air flow entering to dust filter passes through the wall as more as possible, then dust atoms come a lot, moreover it is also depends on speed of air flow.

For that axis of OZ, should look vertically down, and then we will find out the condition of an atom in the cylindrical coordinate system.

$$x = r \cdot \cos \phi, \quad y = r \cdot \sin \phi, \quad z = z \quad (1)$$

$r, \phi, z$  are the united coordinates, and on (2) stage we will use Lagrange equation:



Pic. 1. Forces influencing a dust of the holder

$$\begin{aligned} \frac{d}{dz} \left( \frac{\partial T}{\partial \dot{r}} \right) - \frac{\partial T}{\partial r} &= Q_r, \\ \frac{d}{dz} \left( \frac{\partial T}{\partial \dot{\phi}} \right) - \frac{\partial T}{\partial \phi} &= Q_\phi, \\ \frac{d}{dz} \left( \frac{\partial T}{\partial \dot{z}} \right) - \frac{\partial T}{\partial z} &= Q_z \end{aligned} \quad (2)$$

here:  $T$  — kinetic energy of atom, and it is equal to the following:

$$T = \frac{1}{2} m (\dot{r}^2 + r\dot{\phi}^2 + \dot{z}^2) \quad (3)$$

$Q_r, Q_\varphi, Q_z$  — united forces:

$$\text{In this case } |\vec{F}| = c \cdot \rho \cdot \frac{S_0}{2} \left[ (v_r - \dot{r})^2 + (v_\varphi - r\dot{\varphi})^2 + (v_z - \dot{z})^2 \right]$$

F vector's components which are directed along the coordinate axis are calculated by the following formula.

$$\begin{aligned} Q_r = F_r &= \frac{c\rho S}{2} \cdot (v_r - \dot{r}) \cdot F_0 \\ Q_\varphi = F_\varphi &= \frac{c\rho S}{2} \cdot (v_\varphi - r\dot{\varphi}) \cdot F_0 \\ Q_z = F_z &= \frac{c\rho S}{2} \cdot (v_z - \dot{z}) \cdot F_0 \end{aligned} \quad (4)$$

here:  $F_0 = \sqrt{(v_r - \dot{r})^2 + (v_\varphi - r\dot{\varphi})^2 + (v_z - \dot{z})^2}$

From (3) formula we can determine T and from (4) formulas we can take  $Q_r, Q_\varphi, Q_z$  and put them to (2) formula, so to find out  $r, \varphi, z$ , we can make the following system of equations.

The system of equation (5) can be solved when initial condition  $r=r_0, z=z_0, \varphi=0$  with the method of Runge-Kutte.

Using the solution of the equation system, we will determine the trajectory of dust filter coming to the wall. The time of dust atom

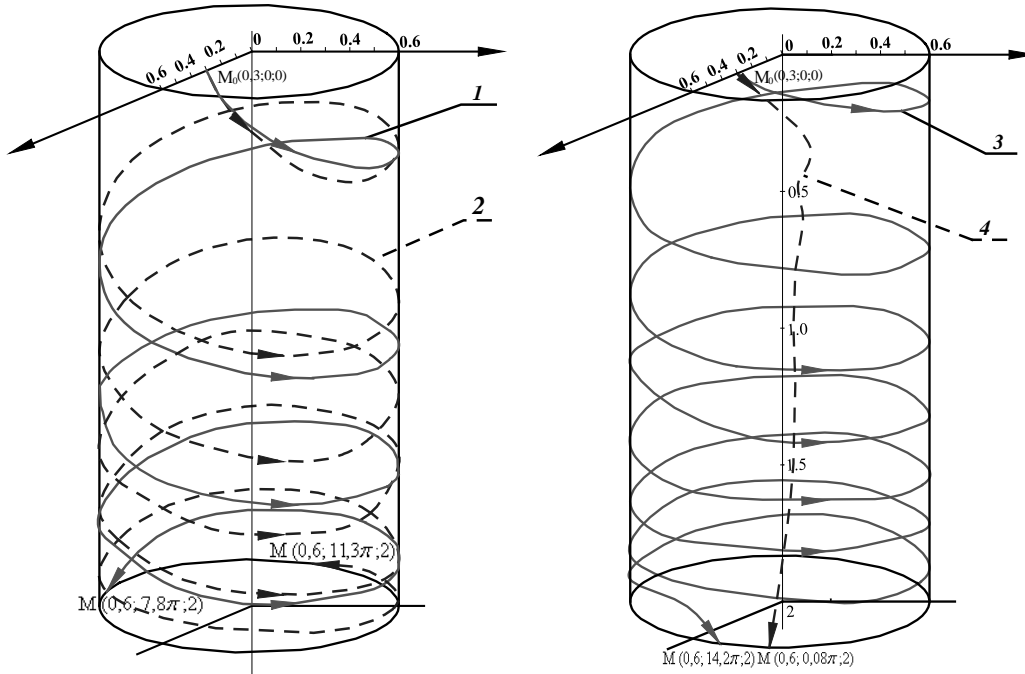
reaching to the bottom of cylinder can be stated as  $t=t_0$ , then we offer the differential equation system of the attempt of dust atom through the wall when  $t > t_0$ .

$$\begin{aligned} \ddot{\varphi} &= c \cdot \frac{\rho S_0}{2r^2 \cdot m} (v_\varphi - r\dot{\varphi}) \cdot F_1 - f \cdot \frac{\rho S_0}{2mr^2} \cdot v_r \cdot \frac{r\dot{\varphi}}{\sqrt{r^2\dot{\varphi}^2 + \dot{z}_2}} \\ \ddot{z} &= c \cdot \frac{\rho S_0}{2 \cdot m} (v_z - \dot{z}) \cdot F_1 - f \cdot \frac{\rho S_0}{2 \cdot m} \cdot v_r \cdot \frac{\dot{z}}{\sqrt{r^2\dot{\varphi}^2 + \dot{z}_2}} \end{aligned} \quad (6)$$

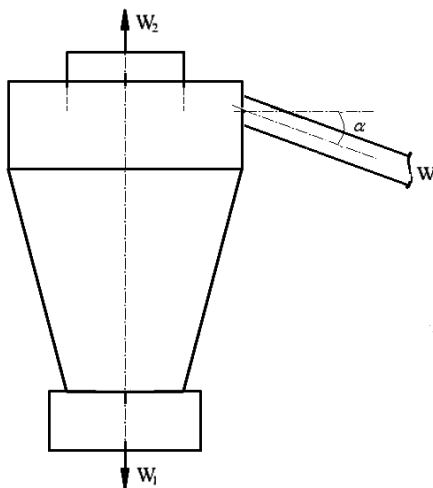
here:  $F_1 = \sqrt{(v_\varphi - r\dot{\varphi})^2 + (v_z - \dot{z})^2}$

The system of equation (5) and (6) will be solved with the use of program Maple-8, so we indicate that general speed of air flow is equal to  $v_0 = \sqrt{v_z^2 + v_\varphi^2 + v_r^2}$  m/s the axis of the real parts of the separated dust filter make a stand than to shout down, speed inside the cylinder  $v_0=0$  m/s, then how long it takes air flow to reach dust filter, what is the speed of reaching the wall and time of being there.

From the 2<sup>nd</sup> picture, when  $v_0=0$ , dust atoms are having different speeds  $v_r$  and  $v_\varphi$  while moving along the dust filter walls. The trajectory of moving is given below.



Pic. 2. When  $v_0=0$ , the trajectory of dust atoms while they are moving along the dust filter walls given below with  $v_r$  and  $v_\varphi$



Pic. 3. The scheme extended to dust filter

- 1)  $v_r=45$  m/s and  $v_\varphi=45$  m/s; 2)  $v_r=32$  m/s and  $v_\varphi=55$  m/s;
- 3)  $v_r=0$  m/s and  $v_\varphi=64$  m/s; 4)  $v_r=63,99$  m/s and  $v_\varphi=1$  m/s.

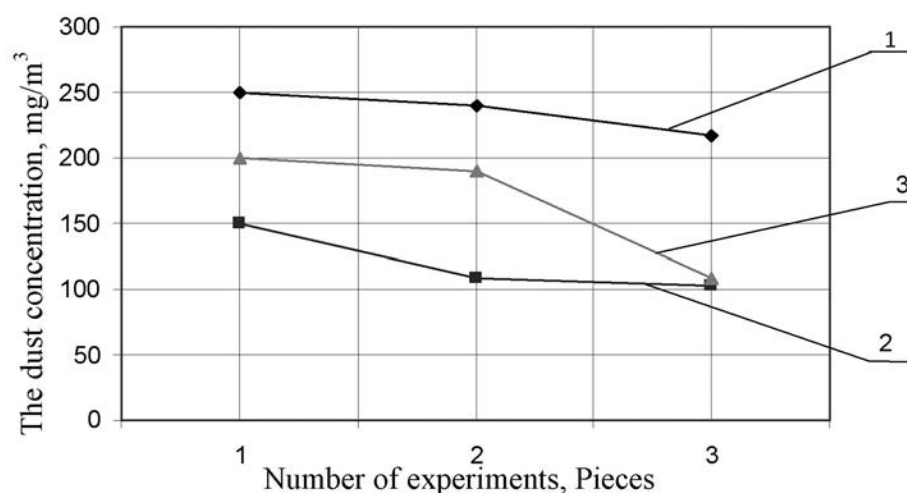
From the given results we may conclude, that the speed of air flow coming inside by shout down is  $v_0=64$  m/s, the speed by the radius is  $v_r=0$  m/s, the speed of the atom along the corner is equal to  $v_\varphi=64$  m/s  $v_\varphi=64$  m/s. The atom on the trajectory with beginning point  $M(0,3;0;0)$  can reach the camera walls in 0,138 seconds. After moving around about over 1,862 seconds it moves down to the bottom of dust filter. During this movement atom move around 7 time.

To be more confident about taken results and decrease the amount of dust we investigated dust filters CS-6 in the "Karasuv" cotton ginning factories.

The main purpose of investigation is learning the impact of the angle of air pipe entering dust filter to the dust concentration. For this we put air pipe entering into dust filter CS-6 horizontally under the angle  $\alpha = 10^\circ, \alpha = 20^\circ$  and  $\alpha = 30^\circ$  watched how the dust concentration is coming out (Picture 3).

If we turn the air coming to dust filter, using equipment of the laboratory which air permeability 10l/min, we were able to find out dust concentration via weight filter of dust concentration. Taken results are shown on the picture 1.

We can see from the graph, if the angle of air pipe has  $\alpha = 20^\circ$  comparing to the axis, then dust concentration coming out would be lower.



Pic. 4. With connection to the dust filter for the air pipe as an axis with dependent outgoing dust concentration  
1-angle  $\alpha = 10^\circ$ , 2-angle  $\alpha = 20^\circ$ , 3-angle  $\alpha = 30^\circ$

As the fiber condenser of the cotton ginning factory "Qorasuv" outgoing dust-air tube was set up as a horizontal axis of the dust filter under the corner of the turning in the operation, it was researched the effect of the dust filter cleaning as the best fictional result.

**Conclusion:** As a conclusion, we can say that if the dust filters replacing the air tube as horizon improved  $\alpha = 20^\circ$  to the atmosphere, the outgoing dust concentration can be better for 40–60% comparing with previous one.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-173-176>

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## Possibility of silk coloring by natural dyes

**Abstract:** The development of production based on local resources and the expansion of corporate cross-cutting industry is the main source of economic development. By establishing production based on local resources which replacing imports of these products can achieve the development of the economic independence of the country. Performing program of localization using materials by local secondary resources decrease dependence of external factors and fills markets with consumer products, as well as create opportunities to save [1].

**Keywords:** Coloring; intensity of color; dyeing; natural dyes; mordant's; silk.

**Introduction:** In the process of development of our Republic a lot of attention is paid to the implementation in various sectors of non-waste technologies with the use of secondary resources and local chemicals. Therefore we need new innovative ideas aimed at the conservation of natural resources and macrobiotic.

One of the advanced and developing industries of the Republic of Uzbekistan is the textile and light industry. Taking into account

the level of population can be easy to predict an impressive amount of demand for various textile products. On the assumption of the result in the development and introduction of new resource-saving technologies based on the replacement of expensive materials local secondary resources, significant economic benefits the country and tangible environmental and social efficiency in the industry can be dramatically achieved [2].

Considering the above points, the development of technology coloring of various fibrous materials, natural dyes is very actual direction to work on. One of the opportunities of strong, saturable colors and increasing the efficiency of production is the use of natural dyes. These days in our republic synthetic dyes are not produced yet. Meanwhile, in the flora of Uzbekistan grow more than 300 species of dye plants, from which we can highlight the eco-friendly and cheap dyes.

The main advantage of the use of natural dyes in the dyeing of different textile materials is a great strength of color and brightness of the colors. In the world market of fabrics dyed with natural dyes are in great demand. These fabrics unlike, some synthetic colored dyes fabrics do not act on the human carcinogenic during the exploitation [3].

The current global environmental and economic situation of natural resources and human health, as well as the high scientific and standard of living and high demands on the quality of the goods requires making certain adjustments to the traditional recipe and the technology of application of natural dyes.

**Analyses:** This article presents the results of researches aimed at exploring the possibility of obtaining natural dyes from plants and their waste, widely grown in our region. Us-

ing dyes of plants, especially discarded material such as the per carp of walnut, onion peel and pomegranate peel, walnut leaves and many other makes it possible in addition to improving the quality of color replacement of imported synthetic dyes available and cheap raw materials. Application of the above waste for the production of luxury, eco-friendly piece products (shawls, scarves) of natural fibers offers great economic opportunities for private and small enterprises, due to increased competition and the ability to export goods.

The object of the study was boiled crêpe de Chine. During the research process of the influence on the concentration of the colorant color intensity satisfactory result was obtained even at a concentration of coloring agent equal to 3% by weight of silk mordant's all except  $\text{Fe}^{3+}$ , for which the black color is at a concentration of 10% colorant. Based on these experiences, to get a different color intensity, the concentration of the coloring material for the black chosen by 10–25%, while for the other colors (mordant's), equal to 3–10% by weight of silk.

Furthermore, it was studied the influence of pH of the medium, temperature, concentration of extract of pomegranate peel strength and intensity of the given colors in Fig. 1, which shows that were among the best pH 5, at temperature of 95.

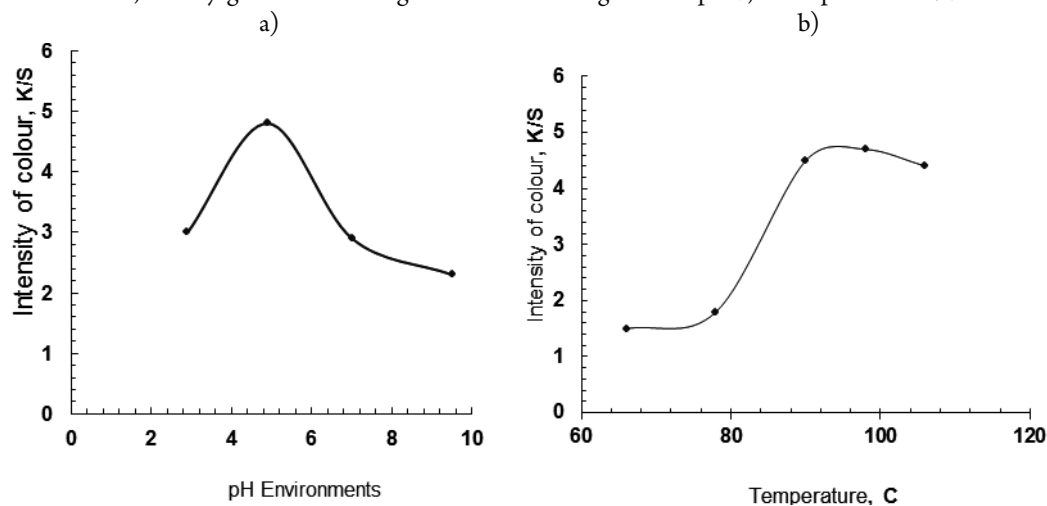


Fig. 1. Effect of dyeing parameters (as well — the pH; b-temperature °C) on the intensity of color without the salt additives

Natural dyes technical classification classified as mordant. In the presence of metal layers most natural organic dyes form stable water-insoluble complexes. It is because of these properties of color, produced by these dyes have high resistance to wet treatments and sunlight.

In order to improve durability of color and color intensity of the dye solutions pomegranate rind extract were administered mordant — salts of various metals:  $\text{Cu}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{Cr}^{6+}$  with concentrations from 0 to 10% by weight of silk.

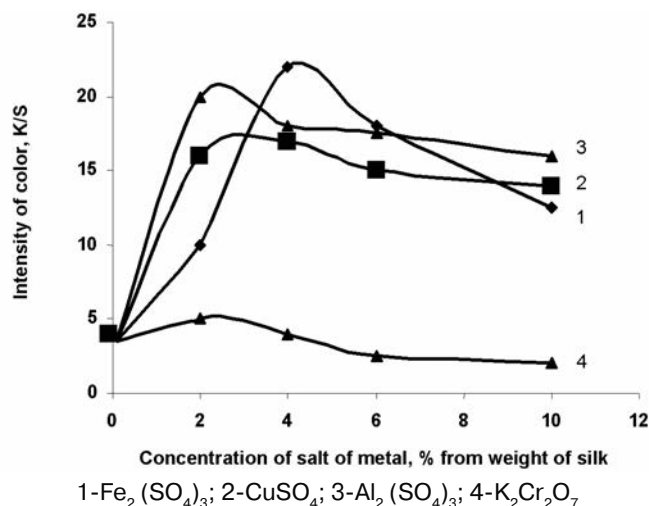
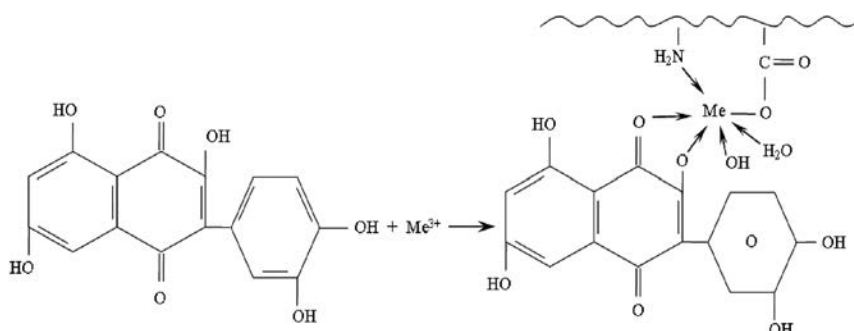


Fig. 2. Effect of the concentration of metal salt in the color intensity

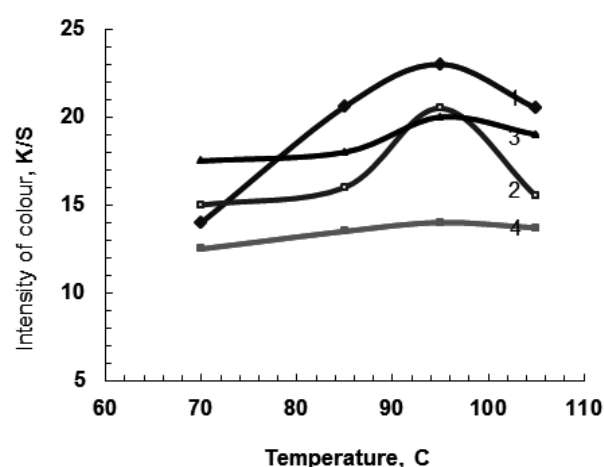
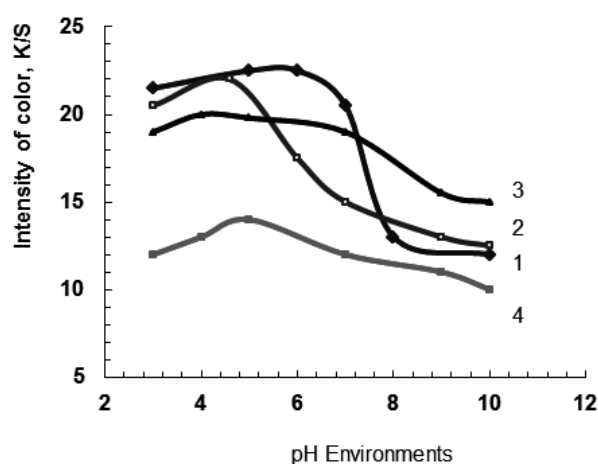
The figure shows that the maximum intensity of the color metals  $\text{Cu}^{2+}$ ,  $\text{Al}^{3+}$  and  $\text{Cr}^{6+}$  is achieved with a concentration of 2.5% by weight of silk, and for  $\text{Fe}^{3+}$  ions with 5%.



Colorants extract form complexes with metals, which are fixed by the metal on the fiber by means of a coordination bond. Complex formation (for a metal with a coordination number of 6) and the fixation of tannin on the fibroin can be represented as follows:

After determining the effect of the rational concentration of metals was studied in the complex of dyeing parameters: pH, T °C, pomegranate extract concentration peel and electrolyte on the in-

tensity of the color. The results for all the metals we investigated correspond to the mode selected in dyeing extract of pomegranate peel without the addition of salt (Fig. 3 (a, b)).



1- $\text{Fe}_2(\text{SO}_4)_3$ ; 2- $\text{CuSO}_4$ ; 3- $\text{Al}_2(\text{SO}_4)_3$ ; 4- $\text{K}_2\text{Cr}_2\text{O}_7$

Fig. 3. Influence of dyeing parameters (a – as well the pH; b – Temperature, °C) to the color intensity

From Fig. 3 shows that the electrolyte in a concentration of 2.5% by weight of silk has a positive effect on the sorption of the dye and forming a complex with metals (except chromium salt), a further increase in its concentration does not affect the amount of the colorant, but in all cases visually electrolyte improves color to be evenly covered.

**Recommendation:** On the basis of work performed, it is recommended to follow two stages technology of dyeing:

I. salts silk etched metal  $\text{Al}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Cr}^{6+}$  2,5%,  $\text{Fe}^{3+}$  — 5% by weight of silk; temperature 95°C time per 60 minutes;

II. Dyeing pomegranate extract in solution crusts at 5 g/l, NaCl — 2,5% by weight of silk; 95°C temperature, time per 60 minutes [4].

The results of the characteristics, the intensity of color, visual (subjective), hue and color strength are given in the Table. 1.

Table 1. – Features color silk colored broth pomegranate peels in the presence of various mordant's

Progresses	Concentration of a progress,%	Intensity of color, K/S	Color tone (visually)	Color tone, $\lambda$	Color purity,%	Brightness of color, $\kappa\delta/\text{m}^2$
Without progresses	–	18,5	The brown	583	58,9	9284
$\text{K}_2\text{Cr}_2\text{O}_7$	2,5	16,6	The Olive-brown	581	64,5	12567
$\text{Al}_2(\text{SO}_4)_3$	5,0	16,5	The yellow	584	70,2	18578
$\text{KAl}(\text{SO}_4)_2$	5,0	18,2	Brownish-yellow	582	68,8	15777
$\text{Ni}(\text{CH}_3\text{COO})_2$	3,5	16,8	Beige-brown	581	38,7	12636
$\text{Ni}(\text{NO}_3)_2$	4,0	19,0	Light brown	583	61,3	10791
$\text{CuSO}_4$	2,5	18,8	Dark brown	583	58,1	6312
$\text{CoCl}_2$	2,5	19,9	Light brown	584	59,4	11474
$\text{SnCl}_2$	2,5	18,0	The yellow	581	79,2	19944
$\text{Fe}_2(\text{SO}_4)_3$	5,0	19,4	Black-red	582	21,3	2732

From the results presented in the table shows that with the exception of sulphate mordant's  $Fe^{3+}$ ,  $Fe^{2+}$  remaining stains all have approximately the same value  $D_{max}$ ,  $D_{max}$  of iron sulfates value of about 9.5% higher. Depending on the nature mordants of broth pomegranate crusts yellow, brown and black colors with different shades are formed. When using dilute solutions of broth produced on silk bedding beautiful tone, and the effect of tissue crapy clearly emphasized.

Additionally, the most pure and bright colors form the metal salts  $Sn^{2+}$ ,  $Al^{3+}$ . Introduction to the dye bath mordant's, except  $Cu^{2+}$  salts and  $Fe^{3+}$ , increases the brightness of color, in the case of salts  $Sn^{2+}$ ,  $Al^{3+}$  more than 2 times as compared with the coloring obtained without stain. It is found that more efficient low salt mordant's are valences of metal ( $Fe^{2+}$ ,  $Cr^{3+}$ ) in comparison with the higher ( $Fe^{3+}$ ,  $Cr^{6+}$ ) influenced by the nature of the anion salts. The

concentrations of metal salts chosen 2.5–5.0% by weight of silk, in which the colors were obtained satisfactory of saturation. Quality and stability of color all colors obtained by wet processing is estimated highest score: 5/5/5, and resistance to dry friction is high, few inferior to wet friction, but estimated as good and satisfactory.

**Conclusion:** Thus, the possibility of getting rich and durable colors on silk using concoctions garnet crusts. Based on a study of various concentrations of salt used as a mordant in dyeing plants in the broth of the above, the possibility of reducing the salt concentration of 7–14% of the traditional silk –5 to 1.5 mass% of silk weight.

When dyeing silk with natural dyes found to increase the strength characteristics at 7.85 and 12.08% in warp and weft, respectively.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-176-178>

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## Development of yarn production technology of natural silk

**Abstract:** This article provides an overview of the spotted shell cocoon, sorting dry Cockney, single cocoon thread and physical and mechanical properties of raw silk obtained after sorting. Proposed ispolzovat in the preparation of surgical sutures from twisted generated raw silk. The proposed new method of process sokrasheno two transition. The structure and properties of surgical thread produced on the new method is given in table form.

**Keywords:** raw silk, cocoon, hybrid, unwinding, linear density, structure, surgical thread.

**Introduction:** The researchers of many countries still cannot understand how the protein in the salivary glands of the spider affects the reception of high-strength cobweb. No one knows how the spider manages to make a thread with strength greater than steel at the same thickness. As well as it manages to the silkworm.

For many years with varying degrees of success, scientists are trying to imitate the remarkable properties of natural silk, but all investigations have been unsuccessful yet.

**Analyses:** With the growth of population in the world, shortage of land to grow cultures for the textile industry, in the general balance of raw materials the share of natural fibers decreases from year to year, and the production of synthetic fibers and yarns is growing rapidly, it is seen from Table. 1.

Table 1. – World production of textile raw materials, mln. ton (%)

Year	Cotton	Synthetics	Cellulose	Wool	Silk	Total (100%)
1980	13,9 (47,3)	10,4 (35,9)	3,24 (11,1)	1,6 (5,5)	0,055 (0,20)	29,20
1990	20,83 (49,5)	16,4 (39,0)	2,9 (6,9)	1,9 (4,5)	0,075 (0,18)	42,1
2000	21,4 (40,7)	25,3 (48)	3,5 (6,7)	2,3 (4,4)	0,1050 (0,20)	52,6
2010	25,5 (30,0)	51,32 (60,3)	5,7 (6,7)	3,3 (3,8)	0,133 (0,15)	85,0
Prediction						
2020	25,0 (26,7)	60,0 (64,0)	5,3 (5,6)	2,8 (3,0)	0,150 (0,14)	93,3
2050	27,0 (19,4)	100,0 (72,0)	7,5 (5,4)	3,5 (2,5)	0,160 (0,12)	139,0



As is evident from Table 1 in general world balance of raw material the natural silk percentage is not more than 0,15–0,2%.

We know very well that natural silk by its strength characteristics, hygienic properties, has the highest rate among the natural fibers.

Therefore, natural silk is the most valuable textile raw materials of animal origin. It is a product of the selection of silk separator glands of animals, mainly silkworms of arthropods type of insects' class. Among them, the industrial importance has domesticated mulberry silkworm (*Bombyx mori* L), eating mulberry leaves, oaken silkworm, eating oak leaves and ailanthus silkworm, eating ailanthus leaves. In addition it should be noted, that only the mulberry silkworm is broadly cultural, rearing of its production and procurement of cocoons is carried out by human.

The researchers of many countries still cannot understand how the protein in the salivary glands of the spider affects the reception of high-strength cobweb. No one knows how the spider manages to make a thread with strength greater than steel at the same thickness. As well as it manages to the silkworm.

For many years with varying degrees of success, scientists are trying to imitate the remarkable properties of natural silk, but all investigations have been unsuccessful yet.

Scientist of Oxford University Fritz Vallarta is less optimistic and more cautious in the expectations. In his opinion, an important problem in the way of scientists to obtain artificial silk is an incomplete understanding of the molecular structure of natural silk, exactly this misunderstanding of the structure mechanism with the repeating sequences of amino acids in the environment of specific protein chains does not allow creating the strong silk-like synthetic fibers [1; 4; 5].

Natural silk, which has not only strength characteristics, but the low natural antibacterial and hygienic properties, is an ideal material for surgical sutures.

Taking into account these unique properties, we have developed technologies and methods for production of twisted and braided surgical sutures made of natural silk.

First of all, it should be noted, that the surgical suture material should have the following properties: smooth, fabric, which does not damage the surface, without knots and defects, good susceptibility to wet-heat treatment during sterilization and the ability to maintain the sterility during prolonged storage.

In order to produce a new range of surgical sutures conforming to these requirements, the raw material must be carefully prepared, when the selection of raw-silk it cannot allow the presence of lumps, mossiness, oil stains and other defects. So, it is necessary to use raw-silk, which meets the requirements of world standard, only class «A».

We have selected 30 kg of samples of dry cocoons of hybrid Uzbekistan 5-of crop 2014 of farming «Doniyorbek tutzori» of Markhamat district of Andizhan region.

Sorting performed by us showed that 70% of the cocoons were of high quality, with a clear, rigid and integral shell without any defects.

From the 30% of defective mainly were spotted — the cocoons, stained with liquid decomposed caterpillars or pupae, butterflies thymus fluid and excrement of silkworm, less than 0.5% were co-

coons — twinned (curled with two or more caterpillars), of irregular shape, spiky, ugly, etc [6].

Results of the single unwinding of cocoons showed that the presence of brown spots reduces raw silk yield with respect to the defect-free shell to 15–16% of black spots to 9–11%, brown to 16–17%, yellow 19–20% and when attempting to unwind the twinned, irregularly shaped, spiky, and the ugly of cocoons, very frequent breakage is not allowed to unwind the cocoon thread till the end of the.

The analysis shows if the output of raw silk, length, fineness, unevenness of cocoon thread as a whole depends on the genetic characteristics of the species and hybrids, the defectiveness of the shell is determined by the imperfection of farming rearing, primary processing technology, non-compliance with sanitation and hygienic conditions and feeding regimes, absence of cocoon cells and other factors.

From the selected cocoons of hybrid Uzbekistan-5 of a high-quality by a single unwinding the cocoons thread was received. Taking into account of quality indicators of the cocoon threads of the hybrid Uzbekistan-5, we worked out the raw-silk with linear density 2.33 and 3.23 tex.

Surgical seam materials — is the thread of different raw materials intended for the ligation of blood vessels or stapling of damaged tissue. There is written evidence that attempts to stitch fabric by various threads and cores of animals were made in 2000 BC. Over the centuries in the surgical operations there have been tried a large variety of materials — silk, linen, cotton, horsehair, gut and tendons of animals, wire of precious metal [2]. Some of these materials are widely used nowadays.

Long-term evolution of suture material led to such a variety of them, that nowadays surgeons are offered even specialized yarns targeted at specific surgical procedures. Thus, not only many of the difficulties, which surgeons had certain to meet, were overcome, but also the likelihood was significantly reduced after operational festering of wounds and other surgical complications.

Despite such a wide range of advanced materials and different methods of suturing the wounds, this procedure is now in effect repeats the procedures performed by doctors of Roman emperors. A doctor using a surgical needle conducts suture through tissue and tying a knot, leaving the thread in the tissue in the form of surgical suture.

In our opinion, based on the fact that natural silk is of animal origin and in its content were found all kinds of amino acids presented in the human organism and it has a natural antiseptic properties, it is the best material for the production of surgical sutures.

We have developed an advanced production process chain of twisted surgical threads made of raw-silk.

Use of modern Japanese machines with software control the process chain is reduced by two processes. Old equipment for doubling and twisting, all the spindles are rotating through a belt drive, so the number of twists per one meter is generally rejected by 10–20%. In the modern similar equipment of Japan production each spindle rotates by the individual program-controlled motor, so the setpoint of twist of yarns is attached 100%.

The new structure of surgical silk twisted yarns is given in Table 2.

Table 2. – The structure of the new surgical twisted silk threads

Nominal thread number	The average diameter, DH, mm	yarn length in 1 kg, m	Structural identification of thread
1	2	3	4
000	130–140	90000	2,33 × 2 S 1200 × 2 Z 1200
00	160–175	42000	2,33 × 3 S 1000 × 2 Z 1000
0	190–210	35000	2,33 × 4 S 800 × 2 Z 800
1	210–220	25000	2,33 × 5 S 700 × 2 Z 700
2	270–300	14000	2,33 × 6 S 650 × 2 Z 650

1	2	3	4
3	300–330	12000	3,23 × 8 S 550 × 3 Z 550
4	450–480	5900	3,23 × 16 S 500 × 3 Z 500
5	550–590	5200	3,23 × 24 S 450 × 3 Z 450
6	620–650	3700	3,23 × 30 S 450 × 3 Z 450
7	690–720	3200	3,23 × 34 S 400 × 3 Z 400
8	700–750	2500	3,23 × 36 S 350 × 3 Z 350

The next step is carried out theoretical and experimental research on the development of a method of surgical silk threads by weaving.

Weave — is a process accompanied by the interaction of at least three threads, which in tensioned position, are served in a common work area with packages moving in space. In the process of weaving the threads, intertwining, come interconnected in an increasingly close contact, causing their relative position in stable position.

Wum products, experiencing in the process of exploitation significant mechanical loads, are advisable to design based on preliminary calculations.

In the design of surgical braided threads important step is the selection of raw material. Raw-silk with low linear density requires preparation from it twisted threads of a certain thickness, suitable for refueling of braided machine.

To determine the theoretical breaking load of braided surgical thread you can use the formula of M. N. Belitsin [3] but with accounting of given weaving factor:

$$P_w = n \cdot p \cdot \eta \cdot K_a \cdot K_{pl} \quad (1)$$

where  $P_w$  – breaking load of wicker silk surgical suture, N;

$n$  – the amount of raw silk piece;

$p$  – breaking load of raw silk, N;

$\eta$  – breaking load utilization rate of raw silk twisted yarn (0,75);

$K_a$  – coefficient taking into account the impact on the breaking load of twisted yarn (0,89). Raw material for wicker surgical sutures is raw silk with a linear density of 2.33 Tex and 3.23 Tex. Estimated structure and physico-mechanical properties of threads is in Table. 3.

Table 3. – The structure and physico-mechanical properties of threads

№	Indicators of threads	Raw silk, tex (feed stock)		The structure of the braided surgical sutures									
				2,33 x 3 S 200 x 12	2,33 x 5 S 200 x 12	2,33 x 7 S 200 x 12	2,33 x 9 S 200 x 12	2,33 x 11 S 200 x 12	3,23 x 2 S 180 x 12	3,23 x 4 S 180 x 12	3,23 x 6 S 180 x 12	3,23 x 8 S 180 x 12	3,23 x 10 S 180 x 12
		2,33	3,23										
1	Linear density, tex	2,33	3,23	83,0	138,0	193,7	249,0	304,5	76,8	153,0	229,7	306,9	383,7
2	Diameter, mm	0,05	0,06	0,28	0,36	0,43	0,48	0,53	0,31	0,38	0,44	0,53	0,6
3	Breaking strength, N not less than	8,4	11,6	74,0	84,0	96,8	107,8	111,5	72,7	88,0	104,0	119,5	134,0
4	breaking elongation,%	18,7	18,2	20,7	21,6	22,4	23,2	24,0	20,0	21,0	23,4	25,0	26,3
5	Twist, kr/m	–	–	200	200	200	200	200	180	180	180	180	180
6	Weaving coefficient	–	–	4,4	3,0	2,47	2,14	1,94	4,7	2,85	2,24	1,93	1,73
7	Tensile strength, N/mm <sup>2</sup>	–	–	1,2	0,83	0,68	0,59	0,50	1,3	0,78	0,62	0,53	0,48

Table 4 shows that with the increase in diameter of wicker silk surgical sutures its breaking load and breaking elongation increases, and the weaving coefficient decreases. Technological scheme of production of wicker silk surgical sutures is shown: selection and preparation of raw materials for rewinding, rewinding on the machine MT-85 (Japan), addition and twist of raw silk on the machine, maturing of twisted yarns 72 hours, rewinding on spools of wicker machine, filling and making of surgical braided silk threads on the

machine of 12 class, decoction of threads in soap-soda solution, quality control, packaging and packing of finished products.

#### Conclusion:

The results of experimental research nearly matched data of analytical calculation (table. 4).

Thus, according to the results of theoretical and experimental researches designed workflows and new products will expand the range of silk twisted and braided surgical sutures.

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## Ways and technologies for making natural silk

**Abstract:** The present article is devoted to the ways and technology of making natural silk beginning from formation of cocoons to a yarn, raw silk, twisted yarn and before development of various fabrics on superficial density. There is given an assortment of silk fabrics dress-costume appointments and the new sample of a fabric with an outer effect of a multi-coloured cell.

**Keywords:** raw silk, cocoon, linear density, silk fabric, crepe, twisted.

**Introduction:** Silk fabrics are subdivided into groups depending on their appointment, raw structure, method of production and finishing (stuffed and one-colored) in a type of use of a thread or a yarn (raw silk, crepe-twisted, textured, etc.) and on others signs. In uniform qualifier of industrial output silk fabrics are divided depending on their appointment into the following groups: a) dress; dress and costume, vesting; b) shirt; c) corset; d) lining; e) pile clothe; e) decorative; g) cloak; h) technical appointment and other piece products.

**Analyses:** Natural silk represents allocation of a silkworm product by caterpillars (*Bombyx Mori*) of a special secret from silk glands.

At first silkworm eggs are kept in incubatory period at temperature 18,33°C and in 2–3 days gradually increase up to 25 °C, until larvae will not appear. They are fed for two times in an hour with young leaves of mulberry tree, preserved against draft, noise and foreign smells. Then within 4–6 weeks, there is carried out fattening of a silkworm, so far there is grows caterpillar from larvae reaching maximum size — about 7,5 cm, then there comes time to twist

the cocoons. Caterpillars begin to produce jellylike substance — proteinaceous threads which are tied together with sericin protein (allocated by other glands) and harden at contact with air in the form of a cocoon thread. In 3–4 days due to continuous rotation the silkworm is wrapped up with silk thread laid in the form of eight-figurative forms in bags, curling into cocoons [1].

In the nature, from a cocoon in 15–16 days there would hatch butterflies, destroying a cover of a cocoon and bringing to non-suitable state for unwinding, having spoiled a continuity of a silk thread.

For long storage of cover quality the cocoon are exposed to drying (necrosis of doll) by processing in hot air, steam, IR-beams, freezing, etc. By means of processing by steam, hot water and unwinding from 4–12 cocoons there are taken raw-silk with various linear density: 1,56; 1,89; 2,33; 3,23; 4,65 tex [2].

For production of beautiful silk fabrics of various range, it is necessary to prepare corresponding raw materials by giving of various twist. Range of some types of silk fabrics and ways of their development is given [3; 4; 5] in table.

Table 1. – Range and methods to make some silk fabrics for dress-costume appointments

№	name of fabric	Thread system	Raw		Thread density (to 10 cm)	surface density, g/m <sup>2</sup>	Method of inter-lacing
			name	thickness			
1	2	3	4	5	6	7	8
1.	Crepe-chiffon	B	Cr. r-s	1,56×2	370	28,87	linen weave
		S	Cr. r-s	1,56×2	380		
		W	Cr. r-s	1,56×2			
2.	Crepe-chiffon	B	Cr. r-s	2,33×2	380	43,10	linen weave
		S	Cr. r-s	2,33×2	380		
		W	Cr. r-s	2,33×2			
3.	Crepe-georgette	B	Cr. r-s	2,33×4	380	81,14	linen weave
		S	Cr. r-s	2,33×4	280		
		W	Cr. r-s	2,33×2			
4.	Crepe-de-shin	B	r-s	2,33	360	75,87	linen weave
		S	r-s	2,33	330		
		W	Cr. r-s	2,33×4			
5.	Crepe-de-shin	B	r-s	2,33	500	78,68	linen weave
		S	Pr. s.y.	5,0×2	350		
		W	Cr. r-s	2,33×4			
6.	Crepe-de-shin	B	r-s	2,33	440	87,55	linen weave
		S	r-s	2,33	300		
		W	Cr. r-s	2,33×5			
7.	Crepe-satin	B	r-s	2,33	900	98,9	Atlas 5/2
		S	r-s	1,56×2	–		
		W	Cr. r-s	2,33×4	460		

1	2	3	4	5	6	7	8
8.	Crepe-fie	B S W	r-s Cr. r-s Pr. s. y. Cr. r-s	2,33 2,33×4 5,0×2 2,33×4	360 360 440	133,37	Small figured Reps. weft 2/2
9.	Crepe-extra	B S W	Cr. r-s Cr. r-s Cr. r-s	2,33×4 2,33×4 2,33×3	870 – 600	153,82	multi-layer
10.	Crepe-flux	B S W	Cr. r-s Cr. r-s Cr. r-s	2,33×4 2,33×4 2,33×3	870 – 500	154,66	diagonal

Shortened designations of table.

B-basis; S-selvage; W-weft; Cr..r- – raw silk; Pr. – s. y. – silk yarn, received from fiber waste of natural silk.

Volume of raw silk in world balance of textile raw materials does not exceed 0,15–0,2%, and demand for silk products grows from year to year.

Reasons of popularity of silk fabrics and products throughout several millennia are covered in their unique properties:

– high hygroscopicity and large air permeability, silk perfectly absorbs moisture – to 30% of weight and at the same time remains dry to the touch. The secret is that thread just grows in a size, and due to air circulation there is a fast evaporation of excessive moisture unlike cotton;

– thermal control – silk is capable to maintain temperature, optimum for human body, – depending on environmental temperature as excellently adapts to body temperature and provides additional heat (if it is necessary in these conditions);

– hygiene and hypoallergenicity – silk does not collect a heat and reproduction of microbes and dust pincers in it is impossible;

– silk in its structure is similar to human skin, (contains all types of amino acids of human body), due to what it promotes regeneration and detains aging of organism;

– special durability and reliability – a silk thread with identical thickness of steel wire, has stronger durability, and fabric from it – is the most wearproof;

– consumer properties of silk fabrics – ease, gloss and excellent drape property – promote even more appeal of this material;

– silk it is a material which may serve till 20–25 years upon proper care.

All fabrics consist of two systems of threads intertwining among themselves in different ways. Arrangement of threads to fabrics and their characteristics is given in fig. 1.

From tab. and fig. 1. we may see the followings: in order to produce various best-selling fabrics it is necessary to prepare the bases corresponding to requirement of threads and weft.

Silk fabrics are subdivided into groups depending on their appointment, raw structure, method of production and finishing (stuffed and one-colored) in a type of use of a thread or a yarn (raw silk, crepe-twisted, textured, etc.) and on others signs. In uniform qualifier of industrial output silk fabrics are divided depending on their appointment into the following groups: a) dress; dress and costume, vesting; b) shirt; c) corset; d) lining; e) pile clothe; e) decorative; g) cloak; h) technical appointment and other piece products. Inside of each group division into subgroups on fiber: from natural silk or in mixture with other fibers in various combinations.

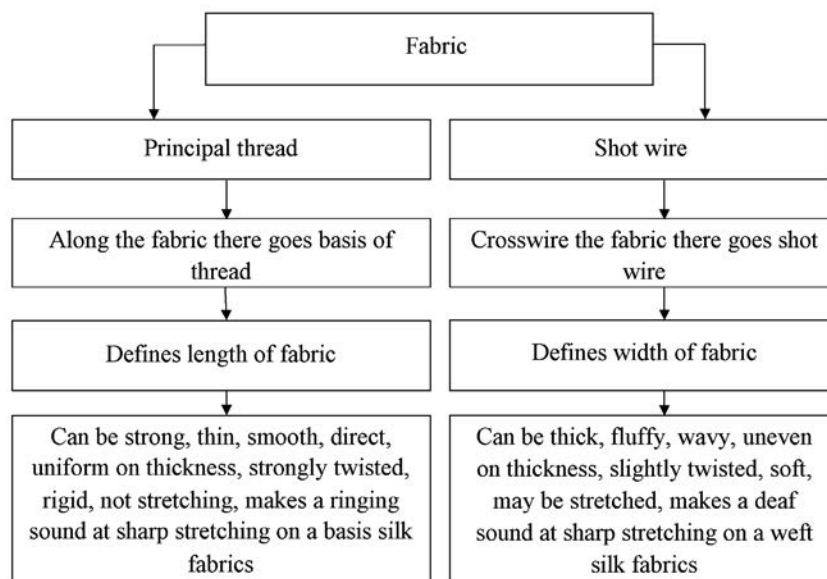


Figure 1. Arrangement of silk threads in fabrics and their characteristics

Researches have shown that range of classical silk fabric are generally developed from raw silk with a linear density of 2,33 tex. It should be noted that in connection with transition to market economy the only one silk complex in the republic Margilan silk combine, releasing crepe fabrics went out of business without having sustained competition.

Despite development of production of national silk and semi-silk fabrics like “Khan Atlas”, “Bekasab”, “Adras”, etc. now classical crepe silk fabrics in our Republic are almost not made.

We have developed a way for development of silk twisted thread for production of new range of silk fabric.

There is known a method of receiving twisted threads by addition of several threads of raw silk, preliminary reporting the right twist, then these threads are connected and reported into the left twist. Raw materials for production of silk fabrics with crepe effect re prepared in such method [3]. Deficiency for this method is that upon two phase method of prepared twisted threads — produced silk fabrics to some extent are confirmed to crease retention at tip of products. A new way for receiving twisted silk thread from raw silk, consisting in twisting torsion, differs with that fact that for receiving a thread of linear density 18–26 tex there is used raw silk of linear density of 2,33 and 3,23 tex by addition of two threads and torsion 800 kr/m in the left direction then additions of two threads and torsion 750-tw/m, in the right direction and the third time addition of both of these threads and torsion 700-tw/m in the left direction, then steam chamber is counterbalanced a three-phase twist of threads. On novelty of a method there is acquired IAP patent No. 20130325.

For receiving a new sample of silk fabric with linen weave on surface in the form of effect of a cell there were exposed threads to multi-colored dyeing.

In the result there is worked out dress and costume fabric with formation of effect of a multi-colored cell due to use of colored new twisted threads of increased linear density as on a basis and on weft, providing its high durability and crease-resistance, sample of fabric is given in fig. 2. (there is acquired SAP patent No. 01254)

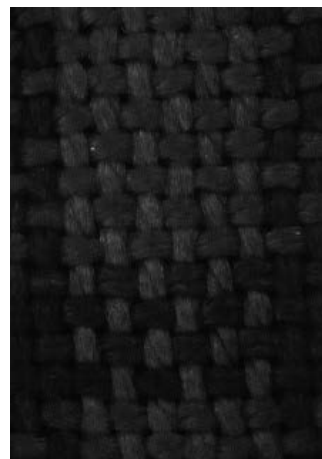


Figure 2. A new sample of silk fabric with cell effect

#### Conclusions:

1. With analytical research it is established that classical range of crepe silk fabrics generally with linen weave, are developed from raw silk from linear density of 2,33 tex in several additions and by giving various twist to threads.

2. There is worked out a way of development of new range for twisted silk thread and there is made fabric sample on surface in the form of multi-colored effect of a cell. (There is acquired IAP patents No. 20130325 and SAP No. 01254)

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-181-184>

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## Study of functioning of reservoirs in the form of cylindrical shells

**Abstract:** Research results of the functioning of steel reservoirs for liquid oil products storing are given in the paper; the reservoirs are produced in the form of cylindrical shells based on the models designed by “ANSYS” computer program (USA).

**Keywords:** cylindrical shell, steel reservoir, smooth walls, reinforced walls, reinforced cylindrical panel, rolled channel bar, C-section, G-section roll-formed shapes, strength, stability, stress.

The models of steel cylindrical reservoirs with smooth walls (without the reinforcement) and with reinforced vertical walls along the generatrix by the elements in the form of cylindrical panels of plate steel, rolled channel bars, C-section and G-section roll-formed shapes are considered here (Fig.1). Calculations have been conducted by «ANSYS» computer program (USA) [1].

The dimensions of reservoir models are taken as:  
The height of the reservoir  $H=2960$  mm;

The diameter of the reservoir:  $D=2800$  mm ( $r=1400$  mm);

Wall thickness:  $t=5$  mm.

The dimensions (parameters) of vertical reinforcing elements along the entire height of reservoir wall are:

1. Arc distance of cylindrical panel of plate steel:  $S=454$  mm,  $t=5$  mm,  $A=22,7$  cm<sup>2</sup>.

2. Rolled channels bars № 18 a:  $h=180$  mm,  $b=74$  mm,  $d=5,1$  mm,  $t=9,3$  mm,  $A=22,2$  cm<sup>2</sup>.

3. C-section equal-flange roll-formed channels (according to State Standards 8278 –83\*):  $h=200$  mm,  $b=100$  mm,  $t=6$  mm,  $A=22,4$  cm<sup>2</sup>

4. G-section equal-flange roll-formed shapes 400x160x50x3 mm (according to State Standards 8282 –83\*):  $A=24,01$  cm<sup>2</sup>

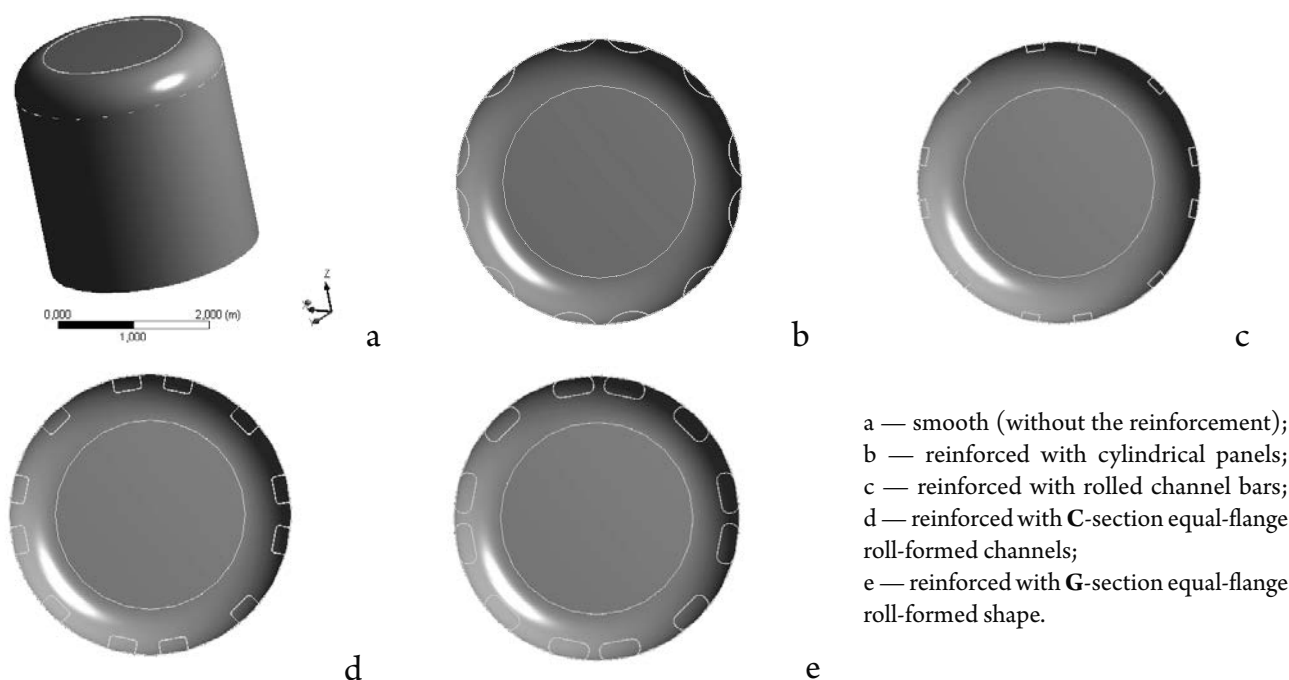


Figure 1. Models of studied reservoirs shells

The following reservoir functioning conditions were given: internal working pressure of stored product:  $P=10$  Pa; acceleration of foundation soil:  $\ddot{y}=4$  m/cm<sup>2</sup>; design seismicity: 9 points; proper weight of the structure was taken into consideration. Results of changes in strains, normal and tangent stresses in the elements of observed reservoirs are given in the Tables 1 and 2.

The strains in both basic shell of the reservoir and reinforcing panels were determined in X, Y, Z axes, as well as the normal and tangent stresses. The study of reservoir functioning has shown the following results.

Under given conditions of functioning in smooth reservoirs in X- and Y-axes there occur the strains equal to 0,0021 and 0,0020 m, respectively, and in Z-axis the strain is 0,0024. The values of normal stresses are: in X-axis  $3,05 \cdot 10^8$  Pa, in Y-axis  $3,1 \cdot 10^8$  Pa, and in Z-axis their values are three times less and equal to  $1,17 \cdot 10^8$  Pa. Tangent stresses also vary in this manner and their values are  $\tau_{XY} = 1,6 \cdot 10^8$ ,  $\tau_{XZ} = 1,6 \cdot 10^8$  and  $\tau_{YZ} = 4,9 \cdot 10^7$  Pa, respectively.

Table 1. – Strains and stresses in basic shell of the reservoirs

Indices		Smooth reservoir without reinforcement	Reservoir with reinforced vertical walls along the generatrix by the elements in the form of			
			Cylindrical panels of plate steel	Rolled channel bars	C-section roll-formed shapes	G-section roll-formed shapes
Strains in axes, m	X	0,0021	0,0019	0,0019	0,004	0,0064
	Y	0,0020	0,0019	0,0019	0,004	0,011
	Z	0,0024	0,00071	0,0006	0,006	0,00023
Normal stresses, Pa	$\sigma_x$	$3,05 \cdot 10^8$	$2,7 \cdot 10^8$	$3,41 \cdot 10^8$	$5,5 \cdot 10^8$	$1,03 \cdot 10^9$
	$\sigma_y$	$3,1 \cdot 10^8$	$2,9 \cdot 10^8$	$3,2 \cdot 10^8$	$5,27 \cdot 10^8$	$4,06 \cdot 10^8$
	$\sigma_z$	$1,17 \cdot 10^8$	$6,6 \cdot 10^7$	$8,6 \cdot 10^7$	$2,5 \cdot 10^8$	$6,3 \cdot 10^8$
Tangent stresses, Pa	$\tau_{xy}$	$1,6 \cdot 10^8$	$1,4 \cdot 10^8$	$1,5 \cdot 10^8$	$2,76 \cdot 10^8$	$2,7 \cdot 10^8$
	$\tau_{xz}$	$1,6 \cdot 10^8$	$4,57 \cdot 10^7$	$5,55 \cdot 10^7$	$3,2 \cdot 10^8$	$2,2 \cdot 10^8$
	$\tau_{yz}$	$4,9 \cdot 10^7$	$4,8 \cdot 10^6$	$2,66 \cdot 10^7$	$5,61 \cdot 10^8$	$2,5 \cdot 10^8$

Vertical wall reinforcement of reservoir models along the generatrix by the elements in the form of cylindrical panels of plate steel and rolled channel bars has led to the decrease in strains and stresses in the element. Stress-strain states of the models with reinforced vertical walls along the generatrix by the elements in the form of cylindrical panels of plate steel and rolled channel bars were almost identical and their values of strains and normal and tangent stresses were close. After the completion of above effects on the studied models there was observed a loss in stability of reinforcing panels; in the wall of basic shell there occur some minor local losses in stability in the form of small bulging-ins and bulging-outs.

Maximum and minimum tensile and compressive strains in X- and Y-axes are located diametrically opposite in the wall of the reservoir according to the gradient of seismic force effect; in transverse directions their values are much less.

Maximum and minimum tensile and compressive strains in Z-axis are located diametrically opposite in the bottom and upper cover of the reservoir, that is along the height of the structure.

Maximum and minimum normal stresses of tension and compression in X- and Y-axes are located diametrically opposite in the wall of the reservoir according to the gradient of seismic force effect; in transverse directions their values are much less.

Maximum and minimum normal stresses of tension and compression in Z-axis are located diametrically opposite in the bottom and the cover of the reservoir, and in the reinforcing panels; in the wall of the basic shell their values are much less.

Maximum and minimum tangent stresses in X- and Y-axes appear in mutual perpendicular planes of reservoir wall. The values of tangent stresses in the bottom and the cover are sufficiently less than the ones in the wall.

Table 2. – Strains and stresses in reinforcing panels of the reservoirs

Indices		Reservoir with reinforced vertical walls along the generatrix by the elements in the form of			
		Cylindrical panels of plate steel	Rolled channel bars	C-section roll-formed shapes	G-section roll-formed shapes
Strains in axes, m	X	0,0019	0,0019	0,004	0,053
	Y	0,0018	0,0019	0,004	0,027
	Z	0,0002	0,0006	0,0005	0,00127
Normal stresses, Pa	$\sigma_x$	$1,06 \cdot 10^8$	$1,34 \cdot 10^8$	$7,33 \cdot 10^8$	$1,03 \cdot 10^9$
	$\sigma_y$	$1,9 \cdot 10^7$	$1,67 \cdot 10^7$	$7,2 \cdot 10^8$	$1,5 \cdot 10^9$
	$\sigma_z$	$2,7 \cdot 10^7$	$2,33 \cdot 10^6$	$2,5 \cdot 10^8$	$8,9 \cdot 10^7$
Tangent stresses, Pa	$\tau_{xy}$	$1,07 \cdot 10^7$	$1,27 \cdot 10^7$	$3,9 \cdot 10^8$	$1,23 \cdot 10^9$
	$\tau_{xz}$	$4,88 \cdot 10^6$	$3,09 \cdot 10^7$	$3,2 \cdot 10^8$	$2,2 \cdot 10^8$
	$\tau_{yz}$	$4,7 \cdot 10^7$	$2,66 \cdot 10^8$	$1,61 \cdot 10^8$	$4,5 \cdot 10^8$

Tangent stresses in YZ- and XZ-axes in both the wall of the basic shell and in reinforcing panels have their maximum and minimum values in the points of wall joining with the bottom and the cover; at the same time they are located near the joining of the edges of reinforcing panels with the basic shell.

Stress-strain states of the models with reinforced vertical walls along the generatrix by the elements in the form of C-section and G-section roll-formed shapes are almost identical and their values of strains, normal and tangent stresses are close.

Absolute values of strains in X- and Y-axes in models with reinforced vertical walls along the generatrix by the elements in the form of C-section and G-section roll-formed shapes are greater than in other models; this is the results of the thinness (or wall thickness) of the sections. Maximum and minimum tensile and compressive strains in X- and Y-axes are located diametrically opposite in the walls reinforced by C-section and G-section roll-formed shapes according to the gradient of seismic force effect; in transverse directions their values are much less. Maximum tensile and compressive strains in Z-axis are located in the wall and reinforcing panels, and minimum ones — in the bottom and the upper cover of the reservoir.

Maximum and minimum normal stresses of tension and compression in X- and Y-axes are located diametrically opposite in the wall of the reservoir and reinforcing panels according to the gradient of seismic force effect; in transverse directions their values are much less. Here a complete loss of stability of all reinforcing panels is observed, and in the basic shell there occur some local losses of stability in the form of wall bulging-out in certain lengths approximately equal to the distances between the reinforcing panels. Here the local losses of stability of the wall of the basic shell are more pronounced and greater in size than in the models reinforced by cylindrical panels and rolled channel bars.

Similar pattern of stress-strain state is observed in Z-axis. Maximum and minimum normal stresses of tension and compression are located in the wall of the reservoir and reinforcing panels.

Maximum and minimum tangent stresses of tension and compression are located in the wall of the reservoir and reinforcing panels. A complete loss of stability of all reinforcing panels is observed, and some local losses of stability in the form of wall bulging-out occur in the basic shell.

The simplest calculations show that when reinforcing the shell with vertical discrete ridges, cylindrical panels of plate steel are the cheapest: 8–9% cheaper than channel bars, 12–13% cheaper than C-section, and 13–14% cheaper than G-section [2].

### Conclusions:

1. Reinforcement of the basic shell of the reservoir along the vertical generatrix with different panels leads to a considerable increase in stability and strength of the structure. Other conditions being equal the most effective are the reinforcing panels in the form of cylindrical panels and rolled channel bars.

2. Stress-strain states of the models with reinforced vertical walls along the generatrix by the elements in the form of cylindrical panels of plate steel and rolled channel bars are almost identical and their values of strains, normal and tangent stresses are very close.

3. Maximum and minimum tensile and compressive strains in X- and Y-axes are located diametrically opposite in the wall of the reservoir according to the gradient of seismic force effect; in transverse directions their values are much less.

Maximum and minimum tensile and compressive strains in Z-axis are located diametrically opposite in the bottom and the upper cover of the reservoir.

4. Maximum and minimum normal stresses of tension and compression in X- and Y-axes are located diametrically opposite in the wall of the reservoir according to the gradient of seismic force effect; in transverse directions their values are much less. Maximum and minimum normal stresses of tension and compression in Z-axes are located diametrically opposite in the bottom and the cover of the reservoir and in reinforcing panels; on the wall of the basic shell, their values is much less.

5. Maximum and minimum tangent stresses in X- and Y-axes appear in mutual perpendicular planes of reservoir wall. The values of tangent stresses in the bottom and the cover are sufficiently less than the ones in the wall.

Tangent stresses in YZ- and XZ-axes in both the wall of the basic shell and reinforcing panels have their maximum and minimum values in the points of wall joining with the bottom and the cover; at the same time they are located near the joining of the edges of reinforcing panels with the basic shell.

6. Absolute values of strains in X- and Y-axes in models with reinforced vertical walls along the generatrix by the elements in the form of C-section and G-section roll-formed shapes are greater than the ones in other models; this is the results of the thinness (or wall thickness) of the sections.

7. Maximum and minimum normal stresses of tension and compression in X- and Y-axes are located diametrically opposite in the wall of the reservoir and reinforcing panels according to the gradient of seismic force effect; in transverse directions their values are much less. A

complete loss of stability of all reinforcing panels is observed, and in the basic shell there occur some local losses of stability in the form of wall bulging-out in certain lengths approximately equal to the distances between the reinforcing panels. Here local losses of stability of the wall of the basic shell are more pronounced and greater in size than in the models reinforced by cylindrical panels and rolled channel bars.

Similar pattern of stress-strain state is observed in Z-axis. Maximum and minimum normal stresses of tension and compression are located in the wall of the reservoir and reinforcing panels.

8. Maximum and minimum tangent stresses of tension and compression are located in the wall of the reservoir and reinforcing panels. A complete loss of stability of all reinforcing panels is observed, and some local losses of stability in the form of wall bulging-out occur in the basic shell.

9. Taking into account the feasibility of manufacturing conditions, the “in-function” cost, it is recommended to use the reinforcing elements in the form of cylindrical panels.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-184-186>

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## Organizational and structural measures to improve the process of operation concrete span

**Abstract:** Ways of improving the structures of exploitation and practical ways of assessment of technical condition of the operated railway flying structures of bridges.

**Keywords:** bridge constructions, ferroconcrete, flying structures.

Analyzing the present situation of the bridge maintenance, it can be concluded that the Republican roads of JSC “Uzbekistan Railways” (“Uzbekiston Temir Yullari”) absolutely don’t meet the requirements of a durable and reliable operating structure. Service regular examinations and tests are not well organized and therefore Republican railway does not have a full picture of the technical condition and capacity of operated facilities.

Preservation and maintenance of normalized reliability of the operated bridges — standing problem, requiring for their solution wide variety of organizational activities.

In developing these measures should take into account that exploited the bridges built at different times for different regulations and loads and are in varying condition. Therefore, the collecting and study of the history of operation and organization of repair requires a systematic approach.

The observed reduction of operational reliability of bridge spans, in most cases, should be attributed to poor organization of work operations. However, as mentioned in [1] in the bulk of the work of these units includes repairs to the regulatory structures under overhead bed, track structure on bridges and other works, and repair of the superstructures practical is not given any attention.

Renovations to improve the reliability of a bridge span upon the occurrence of a failure on the basis of endurance of the concrete, require a large amount of restoration work [1], which forces the linear enterprises of the railroads impossible to master. Specialized units of the JSC “Uzbekistan Railways”, (Bridge building) where there is a strong mechanized equipment and machines, are not engaged in repair. As a result of solving many of the issues are time consuming, creating every year the danger of injuries, further development of which will restrict load capacity and premature structure failure.

It is unacceptable that many bridge organizations have the distraction of work, not associated with the repair of engineering structures. So, in General, JSC “Uzbekistan Railways” extraneous

load is 22% of the total. Despite the fact that annual allocations for capital repairs of bridges increased at an average rate of 7–8%, the situation does not change.

The way out is only possible with the creation of specialized mechanized units in ATIE (Association of track industry enterprises), organized by the Association of the track in the light of decisions on restructuring of work of railway transport. This does not require increase in staff, and the only restructuring of the production units. The existing small team in the production areas (in track) are combined into one unit headed by the Deputy chief ATIE on artificial structures. Created unit when equipping it with the necessary equipment to perform all repairs, including reinforcement of individual elements of the superstructure and replace them. This creates a separate, centralized, mechanized and industrial mobile base of operation. This allows you to increase the profitability of the repair of bridges [2].

In connection with the establishment of such enterprises should rebuild work bridge test stations at JSC “Uzbekistan Railways”. It is necessary to strengthen the link of their created units of the repair of bridges. The estimated structural organization of service operation is given in figure 1.

Part of a bridge-test station to a collection of information about the state operated bridges and control to streamline technical documentation management, headed by a qualified engineer, bridge-builders and technology. The task group is to prepare information on the status of bridges, identification of the need for test structures with defects and damages.

Inspection and testing of bridges produces a bridge-test station. Along with the traditional examinations and tests depends on the parameters for determining the residual life.

To obtain the most complete picture of the stress strain state of the exploited superstructures appropriate ordering of the data. In the future, these data can be processed and analyzed by computer.



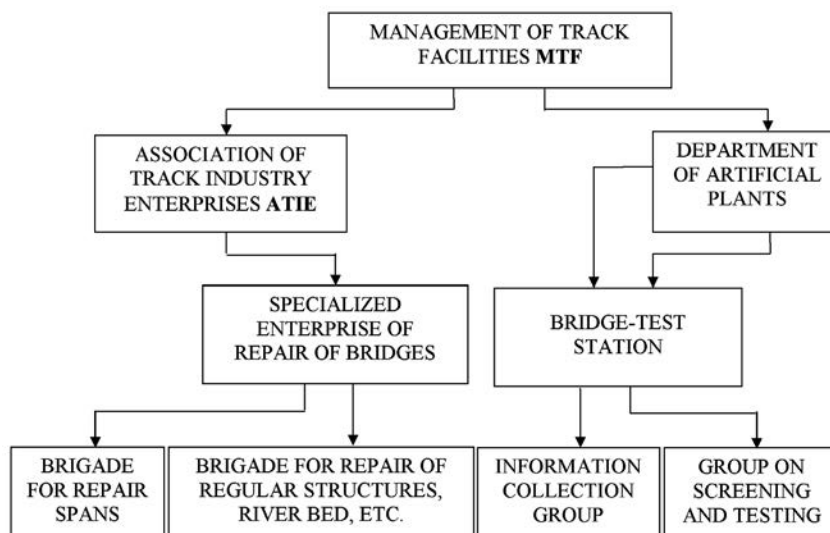


Figure 1. Proposed structure of service operation

The main objective definition of technical condition of the operated flying structures and constant observation of change of their key parameters.

In work the attempt to develop almost convenient for practice of a way behind observation of the general a condition of flying structures is made. At the same time for basic it is taken a technique [4; 5], applied earlier to assessment of bridge systems which allows to establish at the same time the level of the current maintenance of bridges and to determine by the mark scheme of their general technical condition.

All defects and damages, in the operated reinforced concrete flying structures, found as a result of their long-term inspections are broken into three categories and the mark assessment is appropriated to each category:

0 category — defects are absent or available insignificant defects do not influence the general technical condition of flying structures — perfectly (5);

1 category — defects worsen service conditions, do not influence loading capacity, but reduce durability — well (4);

2 category — the available defects need to be eliminated in due time as their further development can lead to restriction of the admission of trains — satisfactory (3);

3 category — loading capacity flying a structure are less than external loading, defects threaten traffic safety of trains — unsatisfactorily (2).

The category of defects is established as a result of technical diagnostics. As a matter of experience operation of flying structures all defects are systematized and mark estimates are appropriated to each of them and these data are entered in table 1.

Table 1. – Characteristic of defects of reinforced concrete flying structures

Category defects	Mark estimates on each defect		Description of defects
	1	2	
0			Defects are absent
			Superficial shrinkable cracks to 0,2 mm
			Insignificant prick out concrete up to 0,5 cm in depth
1			Leaching of concrete on a surface in flying structures
			The damaged drainage tubes, chips and sinks in concrete without stripping of fittings
			Begin to flow rusts because of the beginning of corrosion of fittings
			Shrinkable cracks disclosure more than 0,2 mm
2			Cracks in a sidewalk part of consoles
			Violation of a waterproofing of a ballast trough, begin to flow leaching of cement mortar from microcracks of a flying structure
			Peeling of a protective layer, chips of concrete, sink
			Corrosion (to 20% of the area) naked working fittings
			Break of one core of working fittings
			Longitudinal and cross cracks in consoles with solution 0,1 leaching
			Destruction of concrete in a zone of hinges of folding consoles, begin to flow dirt, leaching of cement mortar from the hinge
			Cross cracks disclosure more than 0,2 mm in preintense flying structures
			The closed-up cracks changing under loading disclosure more than 1 mm
			Destruction of concrete of sides, consoles of flying structures
			Insufficient width of deformation seams
			Building of boards of a ballast trough more than 20 cm
			Absence or malfunction of dimensional gate

1	2	3
3	The destroyed protective layer with the bared rusted fittings (more 20%ploshchadi)	2,0
	Break more than one core of working fittings	2,0
	Inclination of folding consoles, cracks in a root of consoles	2,0
	The cracks changing disclosure under loading	2,0
	Availability cross more 0,2mm in preliminary and intense flying structures	2,0
	The class of a flying structure is lower than a class of loading	2,0
	The through cracks separating a carriageway plate from the main beam	2,0

On end technical diagnostics and establishments of total, the appropriated mark estimates “” is accepted the following conditions:

- excellent (5) — B = 0;

- good (4) — at 0,02 B 0,1 (inclusive);
- satisfactory (3) — at 0,1 B 2,0
- unsatisfactory (2) — 2,0 B

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-186-188>

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## The control system of a single unit of the spatial field

**Abstract:** This paper deals with the development of control systems and the hardware of the device unified spatial field (DUSF), as well as identifying opportunities for its use of new functional materials. The control system provides an automatic feed control voltage and current, auto shut off circuit when the temperature rises in the coils.

**Keywords:** Frequency, thyristor, electric fields, magnetic fields, drivers, microcontroller, power management, transistors IGBT.

There are many methods and schemes of control technology grinding and extraction of bulk materials by means of a single unit of the spatial field. The easiest way to control — this control thyristors. Thyristors are the power devices of any technology of grinding and extraction. But most important in this technology is that the thyristors can be used at a low frequency of 2 Hz to 125 Hz. There thyristors frequency type PM, but they are designed to manage frequencies up to 10 kHz. For the grinding of minerals require very high currents of up to 300–450 A. The maximum current of thyristor frequency reaches 125 A — 250 A. It is therefore necessary to develop a universal management system that works with high currents and a wide frequency range from 2 Hz to 30 kHz. Therefore the choice of the theme of the article is relevant [1; 2–3].

The aim is to: the development of a universal management system that allows you to use it without an intermediary — thyristor converter. This system should possess a wide range of duty cycle adjustment is 5, 10, 20, 30, corresponding to frequencies of 5, 15, 18, and 25 Hz in the range of 3, 8, 17, 20, 25 kHz. Another disadvantage of the thyristor converter is that it is not included in the beginning of the line voltage half cycle and at arbitrary times which are separated from the half cycle beginning at a time not

exceeding the period of firing pulses, i. e. 50–100–200 microseconds. During this time the line voltage may increase to approximately 5–20 V. This results in a reduction of the input voltage. Another problem is that during the action of the trigger pulse current through the thyristor reaches the holding current, the thyristor is turned off after the end of the pulse. In developing the technology were used special methods based on the interaction of electric and magnetic fields and at different behavior of elements in the electric and magnetic fields. Particles with different electrical and magnetic properties become different trajectory. To manage these fields have developed special types of coil, an electromagnet and a copper rod. Block diagram of a single spatial field is shown in figure 1.

For grinding and extraction of bulk materials by means of a single unit of the spatial field, it requires a power supply of 220 V, the voltage step-down transformer to reduce the voltage of 120/80V. It is necessary to obtain a sufficiently large circuit current 8 pulsed mode (up to 300A) at low supply voltage (up to 80 V) and low frequency (5 Hz to 30 kHz on). For this purpose it is necessary to choose the management and implementation of hardware for guaranteed power switching devices [2, 1–3].

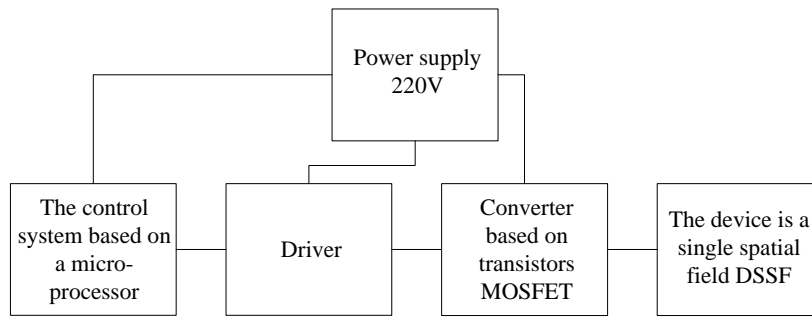


Figure 1. Block diagram of the converter unit

Depending on the control system output parameters, they are PWM (pulse — width modulation) with PFM (frequency — width modulation) and phase adjustment, and combinations of these three. PWM control circuit shown in figure 2. With the control system controls the range of frequencies to produce an output signal of a desired shape. The control system uses pulse-width modulation

(PWM), where the power switch is opened for a time proportional to the desired output voltage. This signal consists of pulses of different widths. The output of the PWM signal is obtained almost perfect desired shape. PWM control requires special care when installing the power circuits [3, 4–5].

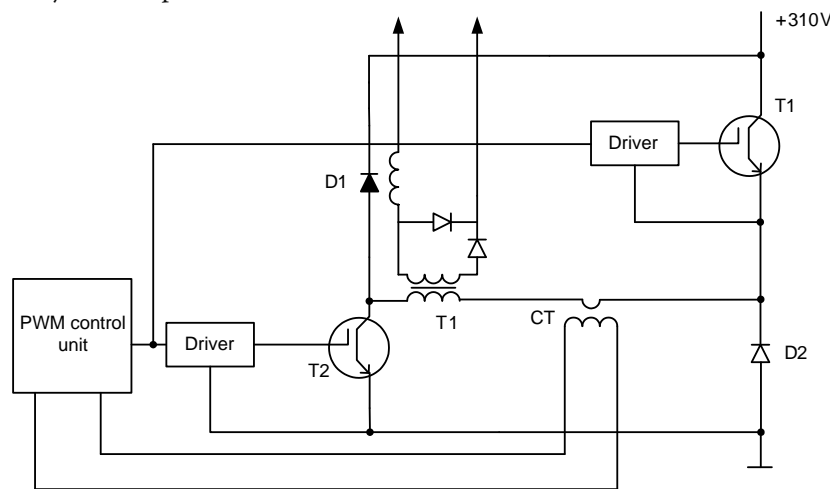


Figure 2. PWM control circuit

The control system is based on a microcontroller ATmega8. We all know that a microprocessor controlled by software.

The control system provides:

- automatic feeding of the control voltage and current;
- automatic shutdown when the temperature rises in the coils;

— automatic control of flow in the pipe materials.

Schematic diagram of the microcontroller, modeled in the program Proteus, is shown in figure 3. The circuit is equipped with a plug connection, the programmer to reprogram the microcontroller [4, 1–3].

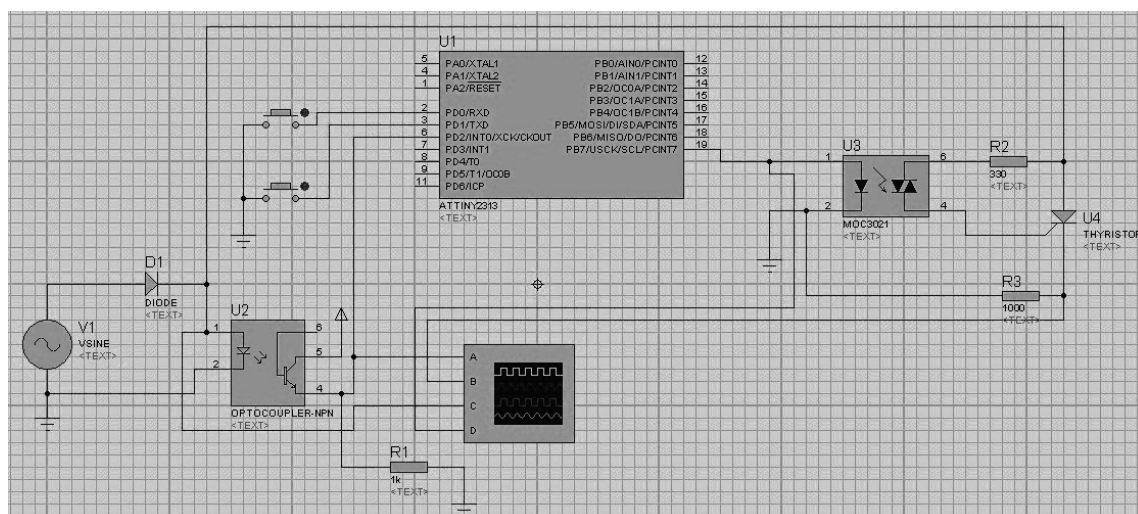


Figure 3. Schematic diagram of the controller

Technical parameters of the controller as follows:

- 16K loaded flash memory;
- 512 bytes EEPROM;
- 32 of I/O pins;
- configurable timer/counter with the regime coincidence;
- internal and external interrupts;

- programmable universal serial port;
- built-in generator;
- three-channel PWM;
- built-in analog comparator;
- 8 — channel 10 — bit ADC;
- watchdog.

The microcontroller used quartz resonator 8 MHz. The appearance of the controller board is shown in figure 4. On the basis of the «C++Builder» program is recorded on the microcontroller to control a single device spatial field. Through the program «C ++ Builder», we get an accurate signal to the range of 5 Hz to 30 kHz.

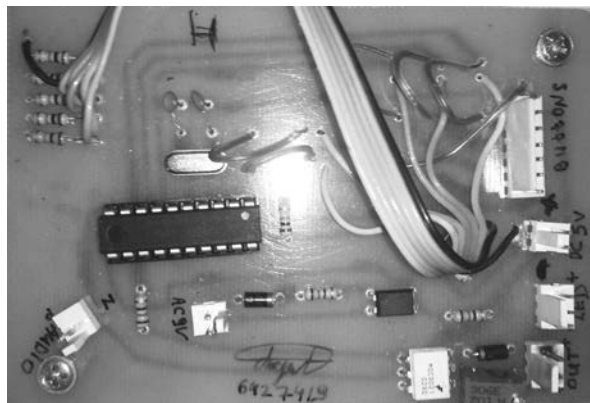


Figure 4. The appearance of the controller board

Production of bulk materials requires a fairly large UEPP induction in the order of 6 T. To create a large induction in pulsed mode is selected insulated-gate bipolar transistor

(IGBT) brand SEMIKRON SKM800GA126D and the driver. At the gates of power switches form the signal to be purely rectangular shape in figure 5 and figure 6 on the key signals.

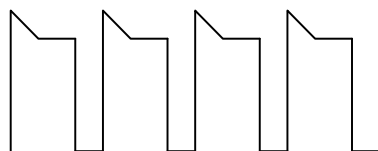


Figure 5. Form signals to the gate of power switches.

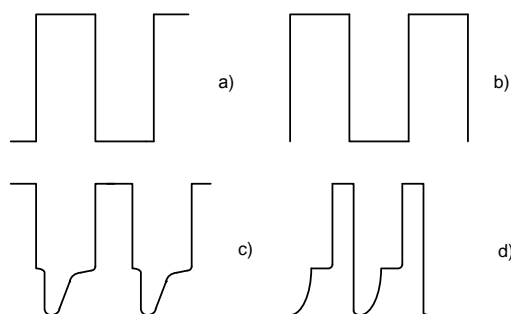


Figure 6. Form of key signals by adjusting the pulse duration

In its internal structure IGBT is a cascade connection of two electronic switches: Enter key FET controls the powerful terminal key bipolar transistor. The gate electrode is called a gate electrode is the other two — the emitter and collector of the bipolar like. This allows the inclusion compound to combine in one device the advantages of both types of semiconductor devices.

IGBT driver control device is a middleware between the CPU (control circuit) and the security keys. The driver is designed to per-

form two main functions: formation of the control signal on the gate of IGBT in accordance with the commands of the processor, and diagnoses the status (presence or absence of a current overload). With timely turn off the power transistor signal is sent to the accident IGBT processor.

The developed control system allows to obtain a positive pulse output signal and adjust its amplitude, phase and duration.

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## The effect of changes in mating elements on the bearing capacity of Nodes

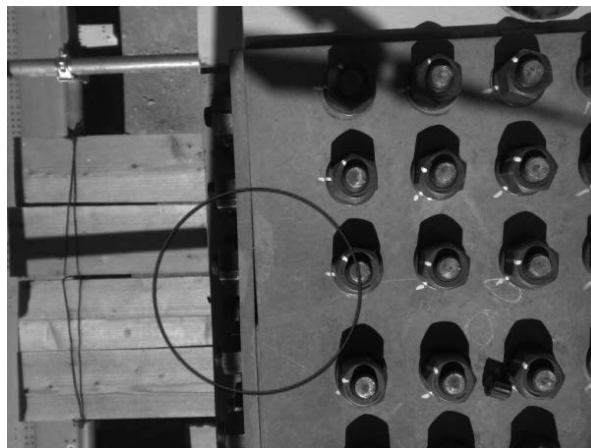
**Abstract:** This paper presents the results of tests of natural fragments of metal trusses nodes. It is established that, at a differential element in the compounds up to 3.0 mm is practically no effect on the coefficient of friction.

**Keywords:** assembly, clearance, test, fragment, metal farm differences, friction, shear bearing capacity.

A series of metal bridges have been built for the railways of the Republic of Uzbekistan in recent years. All of the superstructure of railway bridges kept in constant operation, meet the modern requirements of normative documents and ensure the safety and uninterrupted movement of trains. However, a survey of wiring nodes through some metal trusses showed that a perfect seal contact surfaces are not provided. Here, local leakages detected with gaps of 1.0 to 2.0 mm (see. Photos) at their allowable values norms — 0.3 mm.

Existing gaps arranged randomly and any dependence of these values and the number of leaks from the connected elements form not found.

As a result of the inspection nodes after 3–5 years of operation superstructures determined that despite the contraction of the dense high-strength bolts, water still gets in the gaps. After the rain it was possible to detect moisture drips from under fostonok on vertical edges and moisture under the luminaire contributes to the development of surface corrosion.



There were also one-sided visible gaps between the nut and washer or the washer and plate. In some cases these gaps width reached 2.0 mm.

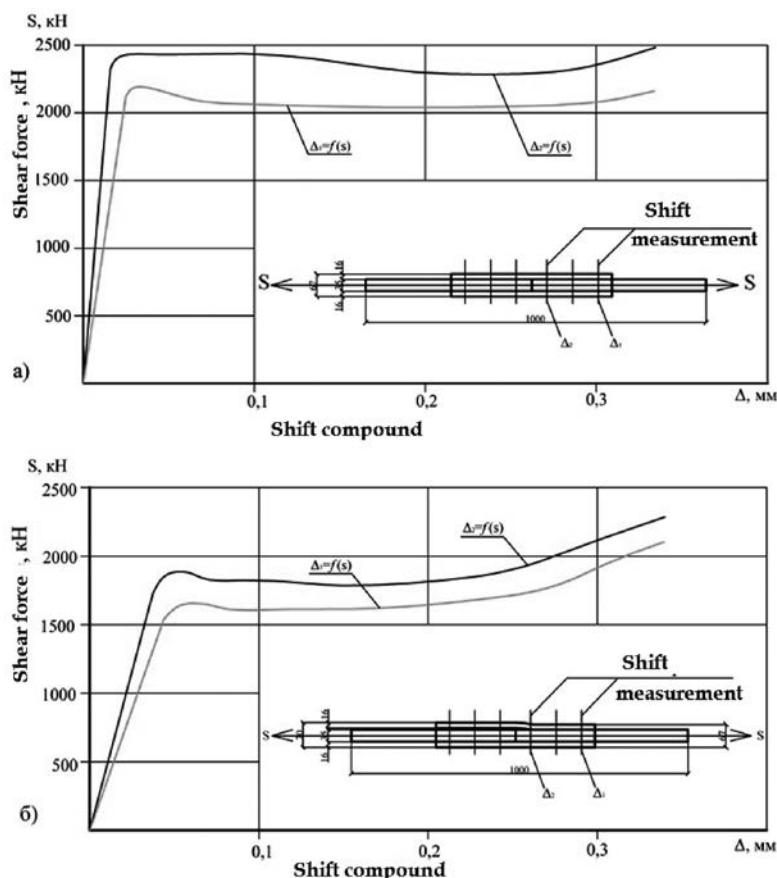


Figure 1. Diagram of the work connection during testing of full-scale fragments

a) — without a drop of connected elements

b) — with 4.5 mm difference of connected elements

To assess the impact of structural defects noted on the carrying capacity of joints special experimental studies have been conducted.

It was produced 3 series of samples, fragments of field units through farms. Each series consisted of 4 samples with differences connected elements 3 and 4.5 mm. Simultaneously, the same samples had been made without differential.

Testing of fragments of the nodes held in the research laboratory of Subaku of company Nippon steel Engineering Co. Ltd under the leadership of engineer Kiuchi. The author participated in the development of test methods, and materials processing.

Tests were carried out on the hydraulic lift with capacity of 4000 kN. To measure the value of sliding established brand. Strain measuring accuracy — 0.01 mm.

The geometric dimensions of the experimental fragments correspond to the actual used on the Railways of Japan for farms up to a length of 130 m.

As a result of test of these pieces obtained compound operation diagrams (Fig. 1).

As can be seen from Fig. 1 compounds include loading chart plots preliminary displacement, the total shear zone and showing the inclusion of the bolts for shear and crushing.

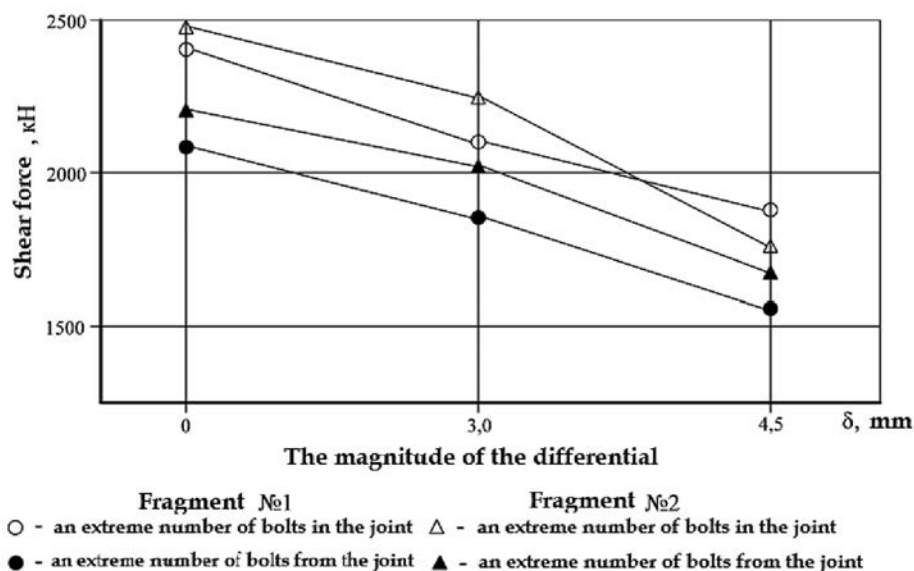


Figure 2. – Dependence of shearing force P of the magnitude of the differential connecting elements  $\Delta$

In practice, due to the existing black individual bolts are included in the work of the shear and crushing the initial stage compounds. In experimental studies [2-4] noted that this phenomenon is a pronounced increase in shear strength and deflection line of a general shift from the horizontal. It is found that movement of a total shift difference depends on the diameters of holes and bolts. According to experimental data [2], these movements make up this difference of 0.3-0.4. As a result of the inclusion of bolts in the connection work there is a gradual transition from the area of general shift to the site cut and creasing.

When the hole diameter difference and bolts 1.0 - 1.6 mm displacement reaches 2–4 mm and this point characterizes the onset of flow connection. Further increase in load leads to intensive development deforming wall holes and bolts. By the time of the destruction of the connection offset values reach up to 30 mm and a breaking load of up to 4 times higher than the load at a total shift [2, 4].

In the table are listed the value of the friction coefficient  $\mu$  obtained from testing of experimental pieces. The table shows that the

Strike-slip movements in the range of 0.035–0.05 mm correspond to overcome the total friction force, and the lower value of these values correspond to samples without differences of connected elements. Shifts in the compounds increased from the middle to the edges. Pre offset corresponding to the straight line correspond to shear strain of 0.035–0.05 mm. General deformation structures are determined by precisely this value. Further increase in all fragments shift occurs without increasing the shearing force. The above-mentioned section of the site called a general shift [1; 2].

Figure 2 shows the shear force P corresponding to the beginning of the preliminary displacement differential values in experimental samples.

From Figure 2, we can see that the P value of shearing forces greatly depends on the differential bolt and the connected elements of the location of the joint. The low-est value of shear corresponds to the extreme number of bolts from the joint with a difference of 4.5 mm connected elements. This shows that by increasing the reduced differences in the contact plane of the connecting member and the bolts on the transmission of forces is uneven rows.

The nature of the general shift of development depends on many factors-black, inaccurate installation bolts, fluctuations in the connecting member, etc. The process of enabling operation of the bolts in shear and bearing strength occurs at this period.

coefficient of friction  $\mu$  in the compounds decreases with increasing differences of elements in the joints. At the drop of connections to 3.0 mm experimental values of the coefficient of friction is almost equal to the normative values. A further increase in the differential value leads to a marked decrease in  $\mu$ . Clearances at differences of up to 3.0 mm is recommended to fill sealants to prevent moisture from entering the compound.

Table 1. – The change in the coefficient of friction  $\mu$  in dependence on the differential of elements in compounds

Changes in the joints, mm	№ samples	The values of the coefficient of friction $\mu$
0,0	1	0,62
	2	0,63
3,0	3	0,49
	4	0,53
4,5	5	0,50
	6	0,43

The following conclusions can be drawn on the basis of the research:

With the increase in the differential of connected elements of friction coefficient decreases. When a drop of 3.0 mm revealed a marked decrease in coefficient of friction.

Gaps, with a difference of elements in compounds to 3.0 mm practically don't influence the coefficient of friction and these gaps can be sealed to prevent the ingress of moisture. Gaps greater than 3.0 mm is unacceptable. When you see these gaps it is recommended to fill them with additional plates, the thickness of which is equal to the value of the differential.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-191-193>

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## Evaluation of the influence of meteorological factors on the aeration zone and the groundwater regime using Gis and Mike Sheimitating models

**Abstract:** As is known in the groundwater regime is influenced by precipitation, surface runoff and evaporation of soil moisture. In the arid climate for crop production in the initial phase of the plant the determining factor is the condition of aeration zone, which is determined by the level of groundwater. And in areas prone to soil salinity, groundwater regime is determined by the state of irrigated lands: the rise of level or increasing salinity pose a risk to soil salinity, soil salinity reduces the productivity of irrigated lands and irrigation water. Along with this assessment of groundwater regime, especially its state level under the influence of precipitation and runoff are difficult scientific problem. The solution of this important agricultural production is the subject of this Article.

**Keywords:** runoff, groundwater, aeration zone, ground water level, groundwater regime, atmospheric condensation, soil salinization.

**Introduction.** In areas with an arid climate with ground-water runoff determine the main conditions of crop production. In establishing mode of an irrigation plants, especially cotton, the state of groundwater determines the amount of water-supply via irrigation canals. And for soils affected by salt and in the presence of groundwater toxic salts, state groundwater determine the main conditions of plant life: a small distance from the ground surface leads to salinization and soil degradation, and causes a deep state of increased demand for irrigation water. Prediction of ground water regime is a scientific challenge. The challenge is caused by the presence of a variety of factors that affect the groundwater regime, the most influential of them are precipitation and runoff. At the same time on the groundwater regime has a significant impact the area where it is located, if the territory is located on the river valley, the factors which have an impact on the groundwater regime, more than the areas in the steppe zone, etc. In this regard, as the object of research established Chirchik river basin area in the Tashkent region of Uzbekistan [1]. As a subject of research determined primarily influence of precipitation in conjunction with other components of the water balance of a river basin in ground water areas.

**Materials and methods.** Object of research is the area of Chirchik river basin, where crop productions are carried out exclusively by irrigation. Therefore, prediction of the state of groundwater enhances the effectiveness of water management in the production of crops, especially of cotton [1; 2].

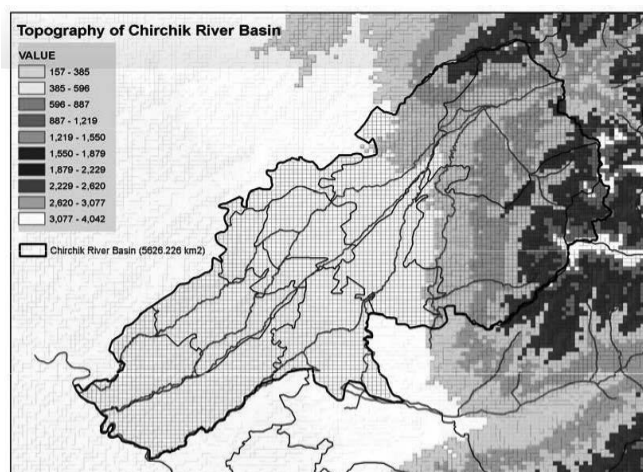


Figure 1. Topography of Chirchik River Basin (DEM by GIS)

Cotton for the mentioned area is the main crop and occupies more than 60% of the irrigated area of Syrdarya river basin. As the research methods defined the water-balance method of river basin, the method of unspecified filtering and interpolation method of climatic factors, developed by the authors of this article.

Water balance equation of Chirchik river basin:

$$Q_{gw} = W - Q_{Char+Ugam} + Q_{Ohan} + P - Q_{Chinoz} - Q_{use} - ET - E Q_{char+Ugam}$$

– Water Inflow to Chirchik River Basin from Ugam River and Charvak reservoir

$Q_{Ohan}$  – Water Inflow to Chirchik River Basin from Akhangaran river.

$P$  – Precipitation

$Q_{Chinoz}$  – Water discharge in Chinaz station

$Q_{use}$  – Water use of Chirchik River Basin

$ET$  – Total amount of evatranspiration

$E$  – Total amount of soil evaporation

$Q_{gw}$  – Ground water discharge and expenditure

The Richard's equation of unsteady filtration of water:

$$\frac{\partial \theta}{\partial t} = - \frac{\partial \left[ K(h) \left( \frac{\partial h}{\partial z} + 1 \right) \right]}{\partial z} - S(h)$$

Where  $\theta$  – volumetric soil moisture;  $t$  – time, day;  $S(h)$  – the rate of extraction of water by plant roots (evapo-transpiration),  $sm^3/sm^3$  day.  $q$  – the flow of soil moisture,  $sm/day$ ;  $h$  – pressure soil moisture  $cm$  of water;  $z$  – vertical coordinate pointing upwards;  $K$  – coefficient of hydraulic conductivity (hydraulic conductivity)  $sm/day$ .

Interpolation method of the climatic factors:

Values of the coordinates of hydro-meteorological stations positioned relative origin to Tashkent weather station in meters.

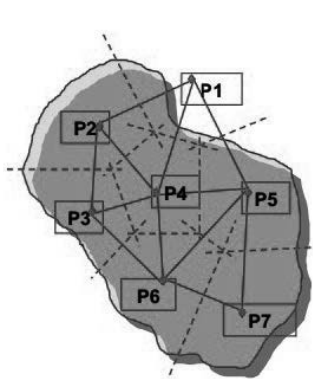


Figure 2

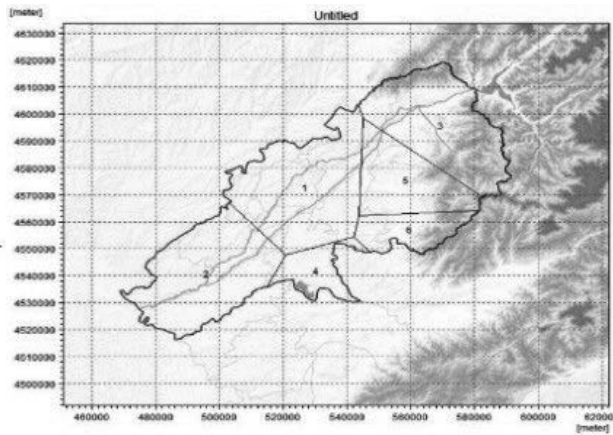


Figure 3

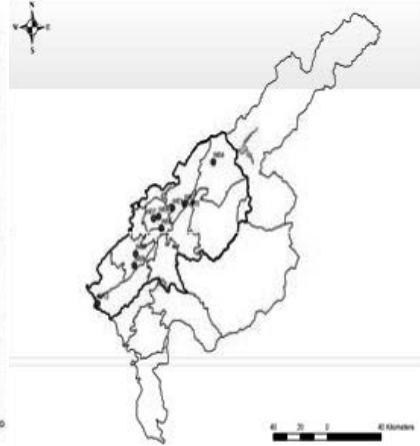


Figure 4

Figure 3. Thiessen Polygon Method in Scheme of creating an interpolation method for establishing climatic factors of Chirchik river basin, Figure 4. Layout stations in the Chirchik river basin by using Thiessen Polygon Method in ArcGIS. Data network of observation wells Figure 5 by means of which monitored the status of groundwater.

**The main part of the research.** Using the parameters of the water balance Chirchik river basin, topographic maps using the program MIKESHE simulation model to get a map of seasonal changes in groundwater levels throughout the basin of Chirchik river (Figure 4).

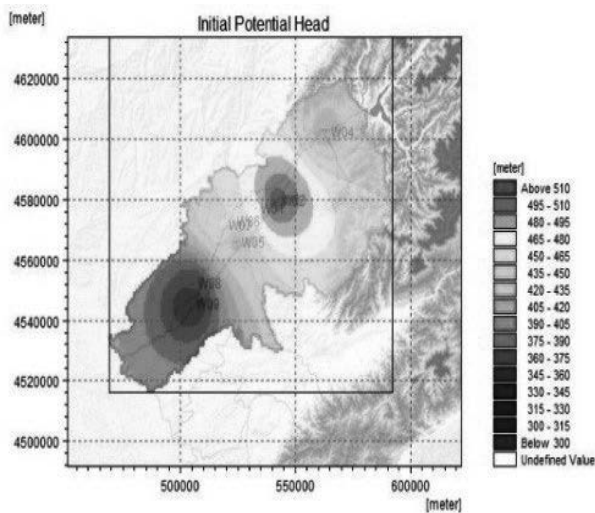


Figure 5

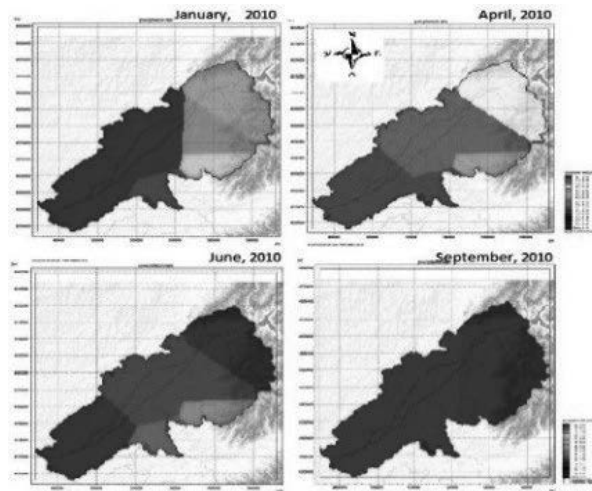


Figure 6

Figure 5. Seasonal changes and distribution of rainfall in the catchment area of the river Chirchik in 2010 and Figure 6. Initial Ground water horizon, by using interpolation of the each ground water well.

ability of the data on changes in groundwater levels calibrate the measured values of the groundwater level according to observation wells in the basin with the results obtained by the simulation model.

Simulated results of the level of groundwater by using MIKESHE simulation model of river basin balance. To establish the reli-

Calibration and comparison of the results obtained by natural observation and calculation method of feature points in the basin are shown in Fig. 7.



Table 1. – Initial data for the assessment of groundwater monitoring wells according and simulated results of the level of groundwater by using MIKE SHE simulation model of river basin balance

wells	W03	W06	W09	W03	W06	W09
X/Y Coordinates	69.50517 41.36778	69.26844 41.30378	69.05472 41.05992	69.50517 41.36778	69.26844 41.30378	69.05472 41.05992
Altitude	519	461	244	519	461	244
GWL	Ground Water level from the point of altitude (observed data)			Ground Water level from the point of altitude (Simulated results)		
JAN	515.7	451.3	320.6	515.7	451.3	320.6
FEB	515.4	451	320.5	515.829	450.963	321.143
MARCH	516.1	451.1	320.6	515.821	450.936	321.289
APRIL	516.7	451.3	320.6	515.818	450.912	321.432
MAY	516.8	451.6	320.8	515.911	450.896	321.409
JUNE	516.9	451.7	320.8	516.012	450.961	321.362
JULY	517	452	320.8	516.06	451.039	321.311
AUG	517.1	452.1	320.7	516.076	451.082	321.267
SEPT	517	452.1	320.7	516.073	451.085	321.228
OCT	516.9	452.1	320.6	516.067	451.068	321.198
NOV	516.8	452	320.5	516.05	451.045	321.181
DEC	516.7	451.9	320.4	516.039	451.021	321.173

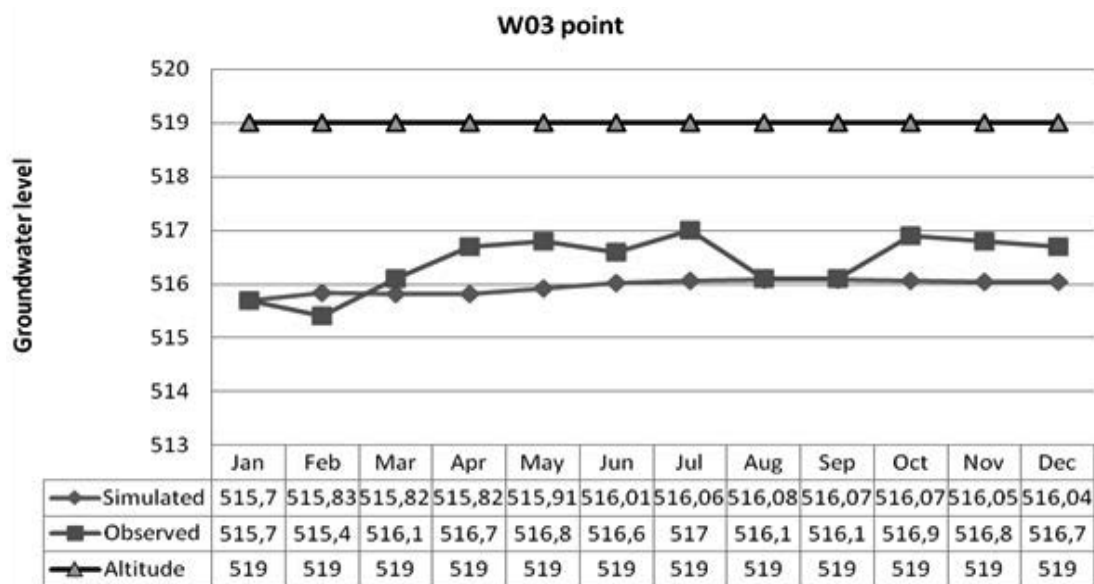


Figure 7. Calibration results of calculation methods with the results of measurements on the well 03

Fig. 7 the upper dark lines show the earth's surface, and the red and blue lines- groundwater levels, determined by different methods. As the graph shows the similarity values between forecast and actual values of groundwater level fluctuations within acceptable RMSE for W03 point is 0.65943, which makes permitted by applicable predictive calculation method for establishing groundwater level at any point in the river basin.

**Conclusions.** Developed earlier interpolation method of climatic parameters, contributed research to develop a method of

predicting the state and dynamics of changes in groundwater levels, the river basin. As a result, developed a model that allows you reliably to predict the state of the ground water level, the river basin.

Taking into consideration that groundwater together with irrigation water are sources of water use plants, prediction method can effectively manage water resources for irrigation of crops, especially cotton. Forecast for the groundwater level contributes to the adoption of scientific and technical measures to protect the irrigated land from waterlogging and salinity.

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## Assessment of energy efficiency of the work of pneumatic transport at raw cotton transportation

**Abstract:** Results of studies on effective functioning of pneumatic transport at raw cotton transportation in operating ginning factories of the Republic of Uzbekistan are considered in the paper.

**Keywords:** cotton, of transportation, reliability, method of creating, pneumatic-transport, power consumption, efficiency of ventilator.

Raw cotton transportation from warehouses to the production factories is carried out by pneumatic transport. This is facilitated by a number of advantages in comparison with the other forms of transportation: work reliability, simplicity of designs, simplicity of maintenance and repair, compactness and minimal material loss at transportation. In addition, raw cotton transportation by air flow contributes to the loosening of cotton and its moisture removal, as well as to the pre-cleaning from small-size impurities when it passes through the separator.

The principle of operation is based on the ability of air to transport material in suspension at its motion through the operating pipeline.

Air motion is ensured by the pressure difference at the beginning and the end of pneumatic-transport unit. According to the method of creating the pressure difference at the beginning of operating pipeline (excess pressure) or at its end (depression) one could distinguish pneumatic-transport units of suction, pressure and suction-pressure types [1; 2; 3].

Pneumatic-transport units of suction-type are used for raw cotton transportation on the ginning factories. An essential advantage of suction type unit is the fact that it allows without any troubles to change the location scheme of operating pipelines, depending on the location of warehouses and bale sites on the territory of factory pre-machining centers.

An efficiency of pneumatic-transport systems varies depending on the capacity of ginning factory. For the modern one-battery ginning plant it amounts up to 12 tons of raw cotton per hour.

Determining the actual parameters of power consumption of pneumatic-transport units in real conditions of operation is one of the main objectives of effective use of this equipment.

Total consumption of electricity as the main source of energy for ventilation systems may be represented in the following form:

$$\sum P = P_{n.s} + P_{a.c}, \quad kW \quad (1)$$

where:  $P_{n.s}$  – is an installed capacity of the fan drives;  $P_{a.c}$  – a capacity of additional (auxiliary) equipment used in ventilation systems (lighting, automation, etc.).

In general terms, for all electric motors of pneumatic air-blowers (fans, smoke exhausters, pumps, compressors) an installed capacity is given by:

$$P_{n.s} = \frac{L \cdot H_n}{3600 \cdot 102 \cdot \eta_n \cdot \eta_s \cdot \eta_e} \cdot K, \quad kW \quad (2)$$

where:  $L$  – is an efficiency of air-blower,  $m^3/h$ ;  $\eta_s$  – fan efficiency (according to the ratings);  $\eta_n$  – transmission efficiency ( $\eta_n = 1$  – under direct setting of electric motor on a shaft; at sleeve joint  $\eta_n = 0,98$ ; at V-belt transmission  $\eta_n = 0,95$ );  $\eta_e$  – electric motor efficiency ( $\eta_e = 0,97 \div 0,99$ );  $K$  – power reserve factor, which takes into account a starting torque;  $H_n$  – total developing pressure,  $kg/m^2$ , defined by working characteristic of an air-blower;  $\frac{1}{102 \cdot 10^{-3}}$  – free fall acceleration,  $H/kg$ .

If  $H_n$  – is a total developed pressure, then (2) has the form:

$$P_{n.s} = \frac{L \cdot H_n}{3600 \cdot 1000 \cdot \eta_n \cdot \eta_s \cdot \eta_e} \cdot K, \quad kW \quad (3)$$

The value  $P_{a.c}$  practically does not depend on ventilator characteristics, being the constant and considerably less than  $P_{n.s}$ .

To reveal the real characteristics of ventilation system it is necessary to determine:

- efficiency of ventilator (air-blower),  $L$  in  $m^3/s$  or in  $m^3/h$ ;
- static and dynamic pressure developed by a ventilator,  $H_c, H_d$ ,  $kg/m^2$  or in millimeters of water column;
- ventilator wheel speed,  $n$ ,  $rev/min$ ;
- power consumption on ventilator shaft,  $kW$ ;
- density of air,  $\rho$ ,  $kg/m^3$

To determine an actual efficiency of ventilator it is necessary to know the cross-section of air pipe and air speed.

$$Q = S \cdot V, \quad m^3/c \quad (4)$$

To determine air speed  $m/s$ , depending on assumed range, at  $V = 0,4 \div 15$  – wing-gauge anemometers are used; at  $V = 1 \div 35$  – cup ones are used as well as micro-manometers with pneumatic pipes.

The measurements should be performed on straight portions of the channels with diameter length  $l = 5 \div 8$ , with constant cross-section and smooth walls.

Static pressure is measured by micro-manometer:

$$H_c = \rho \cdot q \cdot (h - h_0) \cdot \sin \alpha \cdot 10^{-2}, \quad Pa \quad (5)$$

where:  $\rho$  – is a density of fluid in micro-manometer,  $kg/m^3$  (for alcohol it equals to  $800 \div 820$   $kg/m^3$ );  $q = 9,81$  – free fall acceleration,

$m/s^2$ ;  $h$  – scale reading at measuring;  $h_0$  – starting scale reading,  $mm$ ;  
 $\alpha$  – tilt angle of the pipe relative to the horizon, *degree*.

Dynamic pressure is determined by the formula:

$$H_0 = \frac{W^2}{2} \cdot \rho, \quad Pa \quad (6)$$

Hence air speed is:

$$V = \sqrt{\frac{2H_0}{\rho}}, \quad m/c \quad (7)$$

And average speed along the route is

$$V_p = \frac{\sum V}{n}, \quad m/c \quad (8)$$

where:  $n$  – is a number of measurements.

In case of the deviation from standard conditions it is necessary to introduce a correction factor.

In fact, the power consumption  $P$  can be determined by a direct measurement:

$$P = \frac{\sqrt{3} \cdot U \cdot I \cdot \cos \phi}{1000}, \quad (9)$$

where  $U$  – is a mains voltage,  $B$ ;  $I$  – an actual current in ventilator electric motor,  $A$ .

Then, rated power use is compared with actual one:

$$\Delta W = W_{np} - W_p, \quad (10)$$

where  $W_{np}$  – is an actual power consumption at project capacity of electric motor;  $W_p$  – power use at rated power consumption of electric motor.

In case of overstating the power capacity of electric motor, excess expenditure may be determined without the readings along the route. The procedure for calculation is as follows:

– the definition of actually required power of electric motor;

– the definition by the formula (2) of annual energy consumption taking into account the use factor;

– the determination of the demand factor of power  $K_{cn}$ :

$$K_{cn} = \frac{P_{pacu}}{P_{\phi akm}}, \quad (11)$$

where  $P_{pacu}$  – is a design (required) power of electric motor,  $kW$ ;  
 $P_{\phi akm}$  – actual (installed) power of electric motor,  $kW$ .

Excess expenditure may be determined using the notion of “specific consumption” – an amount of energy consumed from the circuit referred to each  $kW/h$  of effective work:

$$\Delta W = \frac{K_{cn} + \alpha(1 - \eta_{nep}) / K_T}{K_{cn} \cdot \eta_{nep}}, \quad (12)$$

where  $\alpha = 0,7 \div 0,9$  – is a factor depending on the design of electric motor;  $\eta_{nep}$  – efficiency of ventilator with account of efficiency of transmission and electric motor:

$$\eta_{nep} = \eta_a \cdot \eta_n \cdot \eta_s; \quad K_T - \text{a rate of working hours use.}$$

In case of machine maximum use:

$$\Delta W_o = \frac{1 + \alpha(1 - \eta_{nep}) / K_T}{1 \cdot \eta_{nep}} \quad (13)$$

Relationship  $\beta = \frac{\Delta W}{\Delta W_o}$  determines the value of power loss.

According to:

$$\Delta W_n = P_{\phi} \cdot \tau \cdot (\beta - 1) \quad (14)$$

where  $\tau$  – is an operating time of ventilator during the year,  $h$ .

Thus, according to above expressions the energy-saving parameters of operated pneumatic transport units at raw cotton transportation to ginning factories are defined.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-195-198>

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## The substantiation of energy-saving technology and field tests of universal machines for tilling the soil in interrows of gardens

**Abstract:** In the article there are analysed the technologies of tilling the soil in interrows of gardens. Studying the existing constructions of machines, the authors proposed a new construction of the machine, which carries out all the operations on tilling the soil in interrows of gardens.

There were carried out experimental works under field conditions, determined the optimum depth of loosening the soil at the unit speed of 1,48 ... 1,60 m/s, there was revealed the parabolic dependence of the change of the traction resistance.

**Keywords:** garden, row, device, flatcutler, cultivation.

The ploughing of the soil in a main agrotechnical method, which creates favourable conditions for the growth of fruit trees, forms and loosens the layer of the soil, contribute to the retention thaw waters, accumulation of moisture in the soil, the destruction of weeds. During the ploughing organic and mineral fertilizers are sealed, and a part of pests is destroyed [1; 2; 3].

The soils in the gardens of the Republic are mainly greysoils, low-powered, chiefly stony and in some places-pebblesto-

ny. As a result of repeated watering under conditions of mountain gardening the precipitations lead to formation of cemented layer in the depth of 20–60 sm, which the roots of trees can hardly force. Besides, the crust, formed on the surface of the arable layer negatively influences water-air and food regime of the soil [4; 5; 6].

The main task of tilling the soil in interrows of gardens and vineyards is to supply a good fruit-bearing of trees, ovaring and normal

growth of fruits, yearly development of daughter shoots with taking garden buds, and also a good preparing the plants for the winter.

Proceeding from this, the system of upkeeping the soil in interrows is composed on the base of black fallow, a possible summer planting of cyderates on green fertilizer, introduction of fertilizers, snow retention and many other operations.

A proper cultivation of the soil in interrows of garden plants achieves the accumulation and conservation the moisture in the soil during all the vegetation period, creation of favourable thermal and air regimes, intensification of activity of soil microorganisms, the improvement of nutritive regime and liquidation of weeds, pests and plant diseases, nowadays the technology of tilling the soil, traditional for the majority of countries, engaged in horticulture and viticulture includes such basic operations as:

- autumn ploughing of interrows on the depth of 25–30 sm
- spring loosening of interrows and tree trunk circles
- spring-summer cultivation 6–8 times during the vegetation period, along with loosening of tree trunk circles on the depth of 6–12 sm.

The main autumn ploughing of the soil in interrows contribute to the accumulation of moisture, sealing of fertilizers and extermination of pests, inhabiting in the arable layer.

The ploughing is carried out up to the depth of the occurrence of main mass of roots for every garden area depending on the soil-climatic conditions of the region, the variety composition etc.

The determining factor in carrying out of any operation in the interrows of the garden on tilling the soil or taking care of plants is a closed space, characterized by the width of the interrow.

In the concept of development of mechanization of agricultural production in the Republic of Uzbekistan till 2020 there is foreseen the creation of broad capturing machines with combined working organs.

As a result of the researches, there was ascertained that at creation of soilcultivating machine, combining the basic tilling with auxiliary methods such as: intrasoil local introduction of fertilizers and tree trunk tilling, which gives energy-saving, resource-saving and moisture-accumulation effects [8; 9]

We propose the improvement of new technology of the construction technical devices for tilling the soil in interrows and rows of gardens, which ensures the reduction of energy consumption, material and labour and increase the moisture-accumulation in comparison with basic technology.

In the countries engaged in the cultivation of fruit crops, the particular differences in methods of planting trees are not observed. The gardens are located on the scheme, in which the row spacing varies from 5.0 to 10.0 m, 3.0 to 8.0 m.

In the vineyards historically is formed the way of planting trees with the space of interrows from 1,5 to 3,0 m and the distance between the bushes in rows is 0,8–2,0 m. But for the past time there is observed the tendency to wide row culture of grapes with the width of interrows 3,0–3,5, rarely up to 4,0–4,5. the distance between bushes varies in the norm of 0,8–2,5, rarely up to 3,0 m.

The ploughing with turnover the layer is one of the most energy-intensive operations in cultivation of various crops, and its application in horticulture and viticulture is complicated by many factors and specific conditions, connected with limited space, the physiology of the growth and development of plants. In spite of the fact, that serious investigations in our country and abroad showed, that the mould-board ploughing with turnover of the layer is more effective, than long-term used mould boardless loosening.

The latter contributes to clogging of the fields, increases the dispersion of the upper horizons and reduces water-resistance of the

structural units of the soil, leads to an increase in its volumetric mass density.

Particularly ineffective tilling of the soil without turnover of the layer namely in the gardens and vineyards, where the soil, under the influence of spring-summer operations on taking care of seedlings by autumn, considerably compresses: in the points of passageways of travelling unit system on the same track, the density of dry soil increases up to  $1,8 \text{ g/sm}^3$  (optimum figure of  $1,12\text{--}1,24 \text{ g/sm}^3$ ) in the layer 0–22 sm and up to  $12,6 \text{ g/sm}^3$  in the layer 22–29 sm. This soil will water inflow is almost fully air and waterproof;

For considering the matter on application of the technology of smooth ploughing in interrows of a garden, we should analyze the shortcomings of existing technology. In the first place we shall consider the agrotechnical standarts upon the ploughing the soil in interrows of gardens and vineyards;

- the ensuring the qualitative turnover of the layer and its crumbling with sealing of plants remains (the number of lumps are larger than 10 sm at ploughing the soil with optimum moisture must not exceed 20%);
- the levelling interrows (without formation of combs and furrows);
- the possibility of carrying out various depth tilling of the soil on the width of interrows (for orchards, where the minimum depth in the root zone of trees is required);
- the absence of damages of trees and bushes, providing the protective zone no less than 30–50 sm from each of the row;
- ensuring the solidity (without faults and fractures) adjacent passes of the unit width (the deviation shouldn't exceed 10% of the width of the plough.);
- the establishment of the required depth of tilling in the course of motion of the unit (the deviation of the average depth shouldn't exceed 2 sm);
- carrying out the ploughing in the required terms.

**Materials and methods.** Taking into consideration mentioned above statements we proposed the scheme of a machine with combined working organs, which carries out a number of operations in orchards such as: a smooth ploughing, deep loosening and discing, cutting irrigation furrows, cultivates the soil in intertrunk and interbush strips (Figure 1).

The machine is meant for works in orchards and other zones, having similar soil-climatic conditions and agrotechnics of cultivation orchards and vineyards.

The universality of the machine is provided by a set of removable working organs and the possibility of different variants of their assembly on a single frame.

The machine can be used for carrying out the following processes of tilling the soil in orchards and vineyards:

- the cultivation of interrows and interbush strips;
- the loosening of interrows;
- the cutting irrigation furrows;
- the renewal of plantage (deep loosening);
- the introduction of fertilizers;
- the smooth ploughing of interrows.

The machine is mounted on caterpillar tractors of 30 ... 40 KH class at the width of band 4,0 m and a device for tilling the soil of tree trunk strips with width of band 0,5 m.

For tilling the soil in interrows of gardens there was produced an experimental sample of the machine, which carries out different-depth (15–20–25 sm) smooth furrowless tilling with the help of removable working organs once 2–3 years the deep loosening is carried out together with introduction, formation of furrows for water-

ing and surface tilling the soil in interrows and tree-trunks strips (Figure 2).

There were conducted field tests of the universal machines in orchards of Samarkand branch of Uz Sh I of V and H named after R. R. Shreder.

**The results and analysis of data.** The working organs are installed depending on the operation being carried out. For example, for loosening interrows a short ploughshare is fixed on the working organ. For the first motion the working organs are regulated to the width of band of 300 sm and the depth of tilling-16sm.

At the cultivation with simultaneous intertrunk tilling in is required to regulate working organs properly. The flat-cutting working organs with the width band 0,45 m are installed in such way so that they must cultivate a half of the protective zone. The working organ is

operated with hydroobserving system. (Patent of the Republic of Uzbekistan № IAP 04654) (Figure2).

The cultivation of the soil with flatcutting working organs takes place in such way.under the influence of blade the soil layer at first is compressed and then is cut. At cutting and displacing the soil is in tense state, which is discarded by turning over and throwing down and the crumbling takes place.

The researchers on qualitative indexes of solid loosening of the soil in interrows was carried out with the help central and side universal working organs on which ploughshares.

At the motion of a tractor unit chisel, assembled on all the working organs, deepened into the soil and loosened it on the target depth of 16–17 sm along all the interrow, and the ploughshares simultaneously were cutting weeds and crumbling the soil.



Figure 1. The universal soil tilling machine



Figure 2. The working organ for tilling the soils of tree-trunk strips

The increase of the angle of the raise to more than  $30^\circ$  is not desirable, because on the loamy soil it will cause the sharp increase of its resistance and worsen the quality of crumbling the soil. Besides, it is possible heaving the soil in front of the working organ. It is also confirmed by indexes of combness, correspondingly increasing from 5,66 to 8,08 at the angle of the raise of the chisel to more than  $30^\circ$  the number of fractions of optimum size i. e. less than 25 mm-reduced from 70,84 to 48,99%.

The best indexes of stable width of band and protective zone were got for the angle of the raise of the chisel of working organs  $28^\circ$  correspondingly 3,408 m and 29,58 sm at admissible meanings

of average-squared deviation, the coefficient of variations and the mistake of experiments.

The analysis of qualitative indexes of the work of loosening working organs of soil-tilling machine under concrete soil conditions confirms the theoretical premises about the optimum angle of the installation of the chisel of loosener equals to  $28-30^\circ$ . In addition it insures high agrotechnical quality of loosening the soil, the steadiness of the depth of tilling and stability of the width band of working organs.

The technological process of cultivation of interrows is in principle similar to the process of solid loosening and differs from it only

that cutting weeds and loosening the soil is realized along all the interrow by working organs, provided with prolonged chisels and on the less depth 10–12 sm.

Owing to little depth of loosening at cultivation there appears the question whether there is the necessity of installation working organs of chisel on the side stanchions with the purpose of the better deepening of flatcutting chisels.

It should be marked, however, that at complete destruction of weeds with flat cutting chisels there are observed: some lowering of the crumbling the soil into optimum fractions: less than 10 mm from 68,6% to 53,64%; from 10 to 20 mm from 11,08% to 9,08% decrease of the working width of band from 3,453 to 3,399m; the raise of combines from 5,21 to 7,58 sm and increase of protective zone from 27,27 to 30,05 sm.

It is clearly seen in pic.4, where there is shown the profile of the surface of cultivation of interrows and also the sight of the surface of the soil after the motion of the unit and is confirmed by quite permissible meanings of deviation and mistakes of experiments. At

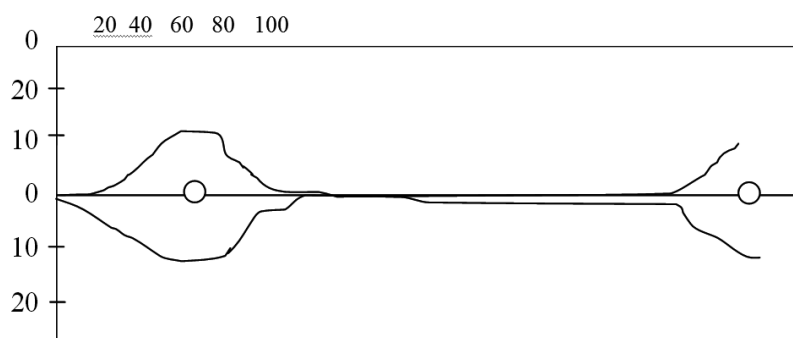


Figure 3. The scheme of untilled protective zone a round the punch after two motions of device for cultivation of inter trunk strips

These lines in their turn, characterize the existence of active zone of root-punch in the tilled layer of the soil in the row. The rest untilled zone around the punch is very small and almost does not require the manual additional work.

#### Conclusion.

1. At assembling combined soil tilling machine the tractor must shift strictly in the middle of the inter row, the permissible deviation from the centre-no more than 0,2..0,25 m.

the same time the worsening of these indexes is not considerable at raising the angle of the raise of chisel up to 32 ° and it is obviously appreciable at 35° index.

The analysis of the results of experimental researches allows to make a conclusion, that for the surface cultivation of the soil on the depth of 10–12 sm the angle of the raise of chisel of cultivating working organs with prolonged flat cutting ploughshare must be in limits of 28–32°.

At cultivation inter trunk strips short flat cutting ploughshares are installed on the central loosener, and long ones are installed on the side universal working organs.

The greatest fullness of tilling the soil in orchards was achieved at the speed of inter-trunk tillage 1,48m/s totalled 98,75%. Besides (see table 1) the ratio of protective zone totalled 92,50%.

In pic.3 there is quoted the scheme of untilled protective zone of a punch after two motions of the unit in adjacent inter rows, showing the characteristic trajectory of motion of turning universal working organ –in the form of winging line.

2. On the base of agro technical indexes there was ascertained, that optimum angle of the raise of chisel of loosening working organ of combined soil tilling machine must be in limits of 28–30°. In this meaning of the angle of the raise of the chisel there is ensured a high quality of tilling at a solid loosening the uniformity of the motion depth and the stability of band width of working organs. The increase of the angle of the raise to more than 30° leads to self deepening of the chisel and worsens the quality of tilling owing to heaping the soil in front of working organs.

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## Draught resistance of supporting-soil crumbles destructing device

**Abstract:** Design schemes and theoretical bases on determination of draught resistance of the supporting-soil crumbles destructing device are specified in the article.

**Keywords:** elastic rods, disc, resistance, soil, roller, diameter, coefficient, the bed surface.

One of the main tasks of working elements of digging down potato harvesting machines is destruction of the soil formation with tubers of potato beds to sizes smaller than the minimum dimensions of economically suitable tubers, in effort to ensure complete separation of it from the soil. The number of mechanical damages to the tubers should not exceed the limits prescribed by the agro technical requirements. The solution for this problem is very complex, as many of the physical and mechanical properties of the tuber are overlapped with the physical and mechanical properties of soil crumbles. Due to the soil and climatic peculiarities (high summer times temperatures, low relative humidity, soil compaction after irrigation) in the course of harvesting the potato the soil of tuber-carrier reservoir crumbles worse and split into large soil crumbles, having greater hardness than the tubers, thus, makes difficult to selection process from the tubers at crashing machine and elevator. This case complicates, especially on clay and heavy loamy soils that are prone to the formation of lumps when it is processes, which is characteristic of Uzbekistan [1].

In this regard, based on the analysis of frontier part design of the potato digging machines, supporting-soil crumbles destructing operating element of the potato diggers have been developed (figure 1, a) by our side. When the unit is moving the supporting-soil crumbles destructing roller 1 provides a predetermined depth of excavation and destructs soil lumps of potato beds. Roller 1 is provided with wheels 3 and in running process they cut-over lateral sides of beds and thus reduce the incoming flow of soil to the separating operational elements. Furthermore plowshares dig the remaining part of potato beds, out coming into that operating elements load is decreased. Between the discs 3 flexible rods 2 are installed and in this case they are fixed throughout the perimeter of each disc 3 and are laid out between them. Length of each elastic rod 2 is greater than the distance between the discs 3.

In operation process the wheels 3 with elastic rods 2 copy the surface row-space and in contact with tuber formation reservoir destruct the surface soil crumbles.

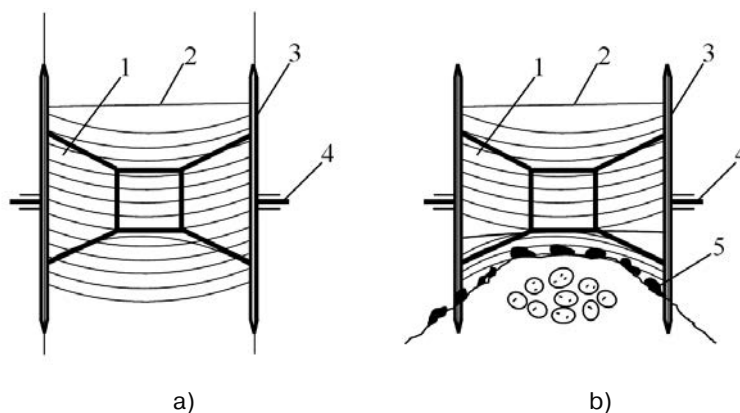


Fig. 1. Supporting-soil crumbles destructing operational element with elastic rods: a — structural design scheme; b — the working body interaction scheme tuber formation; 1—soil crumbles destructing roller; 2 — elastic rods; 3 — disc; 4 — axis; 5 — the bed surface

Draught resistance of supporting-soil crumbles destructing device in common background can be expressed base on formula as in the following:

$$R = 2R_1 + R_2 + R_3, \tag{1}$$

where  $R$  – general draught resistance of the supporting-soil crumbles destructing operating device;

$R_1$  – disc resistance;

$R_2$  – rolling resistance of roller;

$R_3$  – resistance arising from the effects of elastic rods in the bed of potato.

$R_1$  We determine, using the circuit shown in Figure 2. To do this, select interacting with the soil of the potato beds disc elementary area  $ds$ . In this area it operates an elementary normal force

$$dN = qds, \tag{2}$$

where  $q$  — soil specific pressure to elementary land area, Pa.

It is known [2], that

$$q = q_0 h_n, \tag{3}$$

where  $q_0$  – coefficient of extensional soil crumpling,  $N/m^3$ ;

$h_n$  — variable of soil crumpling (deformation) at vertical direction, m.

Base on scheme on the fig.2 considering formulas (2) and (3), we all obtain

$$dN = \frac{q_0 \left( 0,5D_d - \frac{t_d}{4} ctg\gamma_s \right)^2 t_d}{2 \sin^2 \gamma_s \cos \alpha} (\cos \alpha - \cos \alpha_0) d\alpha \tag{4}$$

Taking into consideration of the following formula

$$R_1 = 2 \int_0^{\alpha_0} dN \sin \alpha (\sin \gamma + f \cos \gamma_s) d\alpha =$$

$$= 2q_0 \frac{\left(0,5D_\delta - \frac{t_\delta}{4} \operatorname{tg} \gamma_s\right)^2}{2 \sin^2 \gamma_s} t_\delta (\sin \gamma_s + f \cos \gamma_s) \times$$

$$\times \left[1 - \cos \alpha_0 (1 - \ln |\cos \alpha_0 - 1|)\right],$$

where  $D_\delta$  – disc diameter;

$t_\delta$  – disc thickness;  
 $\gamma_{sh}$  – angle of disc sharpening;  
 $\alpha_0$  – soil girth angle of a disc;  
 $f$  – coefficient of soil friction over a disc material.

By getting  $\cos \alpha_0$  through  $D_\delta$  and  $h_n$ , we all obtain the following:

$$\cos \alpha_0 = \frac{0,5D_\delta - h_n}{0,5D_\delta - \frac{t_\delta}{4} \operatorname{ctg} \gamma_s}, \quad (6)$$

where  $h_n$  – depth of disc immersion into a soil.

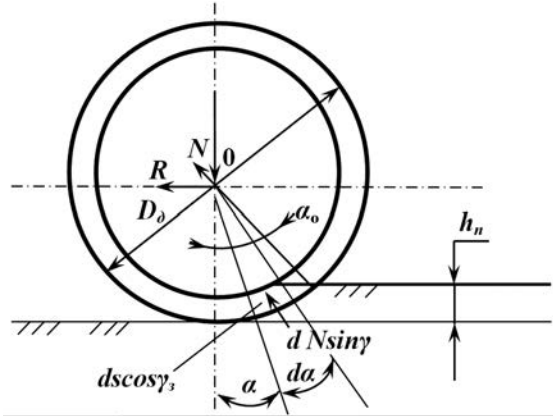


Figure 2. Scheme for determining a draught resistance of the supporting-soil crumbles destructing device

Considering the formulas (6) the formula (5) will be as in the following:

$$R_1 = q_0 \frac{\left(0,5D_\delta - \frac{t_\delta}{4} \operatorname{tg} \gamma_s\right)^2}{\sin^2 \gamma_s} t_\delta (\sin \gamma_s + f \cos \gamma_s) \times$$

$$\times \left[1 - \frac{0,5D_\delta - h_n}{0,5D_\delta - \frac{t_\delta}{4} \operatorname{ctg} \gamma_s} \left(1 - \ln \left| \frac{0,5D_\delta - h_n}{0,5D_\delta - \frac{t_\delta}{4} \operatorname{ctg} \gamma_s} \right| \right)\right]. \quad (7)$$

From the implemented analysis on above formula it is obvious that the draught resistance of a disc of the supporting-soil crumbles destructing device depends on its diameter, thickness, sharpening angle and depth of immersion into the potato bed, as well as physical and mechanical properties of the soil ( $f, q_0$ ).

In effort to determine  $R_2$ , the formula Grandvuane-Goryachkin [2, 3] will be used

$$R_2 = 0,86 \cdot \sqrt[3]{\frac{Q_v^4}{B_0 q_0 D_r^2}}, \quad (8)$$

where  $Q_v$  – vertical load onto the supporting-soil crumbles destructing device;

$D_r$  – roller diameter;

$B_0$  – width of the supporting-soil crumbles destructing device.

Width  $B_0$  of supporting-soil crumbles destructing device is selected out of exclusion term on cutting-over of potato tuber by its discs.

This is ensured in case if

$$B_0 = b_{avr} + 3\sigma + 2c + t_\delta, \quad (9)$$

where  $b_{avr}$  – average value of tuber nests width;

$\sigma$  – average quadratic deviation of tuber nests width;

$c$  – allowance for machine horizontal oscillations.

Taking into consideration of formulas (9) the formula (8) will be as in the following:

$$R_2 = 0,86 \cdot \sqrt[3]{\frac{Q_v^4}{(b_{avr} + 3\sigma + 2c + t_\delta) q_0 D_r^2}}. \quad (10)$$

Resistance  $R_3$  arising from the interaction of potato layer with elastic rods is determined by the applying of the formula (10) of  $k_n$  coefficient that considers auxiliary resistance arising from the interaction of the potato layer with elastic rods, that is,

$$R_3 = k_n R_2, \quad (11)$$

By putting into the obtained values of  $R_1, R_2, R_3$  forces at (1), we will obtain the formula for determining the general draught resistance of the supporting-soil crumbles destructing device.

$$R = 2q_0 \frac{\left(0,5D_\delta - \frac{t_\delta}{4} \operatorname{ctg} \gamma_s\right)^2}{\sin^2 \gamma_s} t_\delta (\sin \gamma_s + f \cos \gamma_s) \times$$

$$\left[1 - \frac{0,5D_\delta - h_n}{0,5D_\delta - \frac{t_\delta}{4} \operatorname{ctg} \gamma_s} \left(1 - \ln \left| \frac{0,5D_\delta - h_n}{0,5D_\delta - \frac{t_\delta}{4} \operatorname{ctg} \gamma_s} \right| \right)\right] +$$

$$+ 0,86 \cdot \sqrt[3]{\frac{Q_s^4}{(b_{cp} + 3\sigma + 2c + t_\delta) q_0 D_r^2}} (1 + k_n). \quad (12)$$

From the implemented analysis on above formula it is obvious that draught resistance of the supporting-soil crumbles destructing device depends on its parameters ( $D_\delta, D_r, t_\delta, B_0$ ), as well as the soil physical and mechanical properties ( $q_0, f$ ). By accepting  $\gamma_s = 30^\circ$ ,  $D_\delta = 0,50 \div 0,55 \text{ m}$ ,  $D_k = 0,30 \text{ m}$ ,  $t_\delta = 0,005 \text{ m}$ ,  $b_{avr} = 0,21 \text{ m}$ ,  $c = 0,05 \text{ m}$ ,  $\sigma = 0,03 \text{ m}$ ,

$q_0 = 1,2 \cdot 10^6 \frac{\text{N}}{\text{m}^3}$  and  $f = 0,5774$  base on the formula (12) we will obtain, that draught

resistance of the supporting-soil crumbles destructing device of potato digging machine varies within the range of  $0,33 \div 0,35 \text{ kN}$ .



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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-201-203>

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## The main ways to reduce energy costs at the enterprises of the cement industry of Uzbekistan

**Abstract:** At the article are presented the results of research on more efficient use of fuel and energy resources in cement production. There are defined objectives and main ways of reducing energy consumption in the cement industry.

**Keywords:** energy expenses, energy-saving, energy consumption, energy efficiency, optimal allocation of energy resources.

One of the strategic directions of the economy of the Republic of Uzbekistan is a more efficient use of energy resources in the industry. According to the Presidential Decree of the Republic of Uzbekistan May 5, 2015 PP-2343 “About the program to reduce the energy intensity of the measures, the introduction of energy saving technologies in the fields of economy and social sphere for 2015–2019” [1], provides for significantly reduced energy use in large industrial enterprises. In this regard, the reduction of energy consumption and improving energy efficiency in the industry while maintaining the quality of products today has become an urgent task of the republic.

At present time in Uzbekistan there are four major cement producing enterprises. Cement production increased from 3.28 million tons in 2000 to 7.4 million tons in 2015. It is projected that cement production in Uzbekistan will grow annually by an average of 3.5% in 2019 to reach 8.9 million tons. These parameters are defined in the program of measures to ensure structural reforms, modernization and diversification of production in the years 2015–2019. [2] Table 1 shows the volume of production of cement plants of Uzbekistan for 2011–2015.

Table 1.

№	Name Company	Capacity, (thousand tons)	The volume of cement production by years (thousand tons)				
			2011 year	2012 year	2013 year	2014 year	2015 year
1.	Joint-stock company JSC “Ahangarancement (Wet process)	1736	1651	1534	1620	1701	1730
2.	Joint-stock company JSC “Kuvasaycement” (Wet process)	1001	1065	1042	1030	1039	1080
3.	Joint-stock company JSC “Bekabadcement” including:	1714	817	925	1006	1018	1130
	– Wet method	714	817	925	695	585	490
	– Dry process (from 2013)	1000	–	–	323	413	640
4.	Joint-stock company JSC “Kizilqumcement” (Dry process)	3080	3165	3282	3334	3450	3460
	<b>Total:</b>	<b>7531</b>	<b>6698</b>	<b>6783</b>	<b>6990</b>	<b>7208</b>	<b>7400</b>
	Growth rate	×	101,08	101,27	103,05	103,1	102,7

In Uzbekistan, cement is produced through «wet» technology and the «dry» method. According to the technology of «wet» method cement plants consume about 90% of fuel and 10% of electricity, and the technology of «dry» way is to consume about 60% of fuel and 40% of electricity.

According to preliminary studies of consumption of fuel and energy resources at the enterprises of the cement industry it is determined that the main consumer of fuel (natural gas) is burning and the main consumers of electricity are grinding plant, raw plant, roasting plant and the compressor plant. To improve the efficiency

of fuel and energy resources in cement production is necessary to investigate the following tasks:

1. To reduce the fuel consumption of clinker burning is necessary to examine the methodology to minimize fuel consumption process by calculating the thermodynamic sound volumes of fuel consumption and approaching them by optimizing heat transfer between the processes, methods and characteristics of fuel supply processes.

2. It is necessary to develop methods and means of control of physical and chemical process of combustion of fuel in the kilns, and automation of the optimum combustion control.

3. In order to reduce energy consumption in energy-intensive departments it is needed to conduct theoretical and experimental studies of energy-efficient process of degeneration of cement clinker in a ball mill.

4. Development of a feasibility study on the replacement of obsolete equipment with modern energy-saving equipment in the process of cement production.

5. For the efficient use of fuel and energy resources in cement production, also it is needed to streamline the consumption of energy and to transfer power to the regulatory framework. Proper organization of rationing of energy consumption is crucial to the implementation of their saving mode. One important factor is the availability of norms of fuel and energy resources for industrial enterprises manufactured products.

The study of best practices shows that the research, development and implementation of the above tasks will enable the reduction of fuel and energy resources in cement production while maintaining product quality.

The real effect of saving fuel and energy resources can only be obtained in the implementation of the above tasks in the cement industry, including the development of technically and economically feasible standards at all levels and a range of products through an integrated approach and modern optimization model, as well as a systematic review of the rules based on the analysis of their performance, keeping the conditions of production, energy surveys

According to a study [3] projects to improve energy efficiency in the cement industry have been introduced. For example JSC "Kizilqumcement" implemented the following measures to improve the energy efficiency of the enterprise:

1. To improve the performance and optimization of the mill cement grinding process in order to produce high-quality cement using local raw materials in place of a closed cement grinding cycle by installing a high-efficiency separator to cement mill plant. Installing high-efficiency separator should provide:

— Issue with no additional PC 400D0 cements with a specific surface according to Blaine of 3000 cm<sup>2</sup>/g;

— The release of high-quality cement without additional PC 500D0 with a specific surface according to Blaine of 4500 cm<sup>2</sup>/g;

— The specific energy consumption for grinding: 30 kW·h/t of cement production PC 400D0 to 48 kW·h/t of cement production PC 500D0.

— Localization and improvement of the quality of products by using local raw materials;

— Control output data and archiving, both the operator and the controller;

— Monitoring and diagnostics of equipment, electric drives and control systems;

— The availability of built-in hardware diagnostics system and self-test software and hardware complex control systems;

— Displays information on print on demand operator;

— The conclusion of the emergency communications;

— Performance monitoring system.

2. Implemented automated flue gas composition analysis system at the rotary kiln in the clinker burning process with the installation of modern gas analyzers for the determination of CH<sub>4</sub>, CO, CO<sub>2</sub>, NO, SO<sub>2</sub>, O<sub>2</sub> in order to maintain the feedback and active influence on the course of the clinker burning process when you reject it from specified process parameters.

The automated system should ensure:

— Monitoring process parameters of clinker burning process in real time;

— Compliance with the technological instructions for temperature regimes clinker burning;

— The choice of a rational mode of fuel combustion;

— Control of combustion efficiency;

— To change the settings for the operator of the gas meter to the oven with a workstation, depending on the value of the coefficient of excess air;

— Indication and control data received CH<sub>4</sub>, CO, CO<sub>2</sub>, NO, SO<sub>2</sub>, O<sub>2</sub> and archiving as an operator workstation, and a panel controller;

— The conclusion of the emergency communications;

— Transparency and provide further integration of the hierarchical scheme with an automated system of technical accounting and certification cement.

According to technical and economic calculations [3], the introduction of new highly advanced technologies will allow for:

first — improving the quality of products;

second — reducing gas consumption by 11.7%;

thirdly — increase the furnace capacity by 6.4%;

fourth — lining life increase of 1.5%;

fifth — reducing emissions of harmful substances in the exhaust gases of 1.0%.

The second enterprise for the production volume of products is JSC "Bekabadcement" — the only company in the country, which combines the two cement production technology — wet and dry methods. On March 23, 2013 there was launched construction of a new production line for the production of cement clinker through dry process has been completed. The design capacity of the new line — 2500 tons per day or 750 000 tons of clinker per year, which makes it possible to produce more than 1 million tons of cement per year.

In order to modernize and improve the efficiency of production, the factory introduced and implemented numerous projects for the decommissioning of obsolete equipment and mechanisms, developed new technological solutions aiming improved energy efficiency.

1. Modernization of the silo farm will provide electricity consumption reduction of about 23% compressor shop; increase the number of points of shipment and their location, as well as speed of loading, increase productivity of cement shipment systems in railway carriages and motor vehicles for the transport of cement.

2. By upgrading the milling department with the installation of a new cement mill, capacity up to 150 tons per hour. Modernizations of the existing system of grinding mill № 3 will increase the average daily performance of the mill installation to 2015,7 tons, and will reduce the energy consumption at a daily capacity 2,400 tons to 54,240 kWh.

3. Modernization of the component dispensing system for cement grinding cement mills, installing of automated belt weighed 3 pieces.

Replacement of disc feeders on energy-saving automated weightier will accelerate the process of compounding, increase the efficiency of the production process, reduce maintenance costs, and will achieve maximum accuracy of weighing and batching. Reducing the consumption of electricity per day to 134.65 kW·h.

Increasing energy efficiency and reducing energy consumption in the production as a whole will increase the competitiveness of the industry in Uzbekistan and release part of the limited gas resources and reduce carbon dioxide emissions.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-203-205>

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## Physical principles of dry vegetables fruit products under the influence of Infrared

**Abstract:** This article analyzes the physical nature of drying vegetable-fruit products under the influence of infrared radiation, the mechanisms of interaction of infrared radiation with the products. It is shown selecting effective paths ceramic infrared radiation sources.

**Keywords:** electromagnetic wave, infrared wave spectra, drying, heat exchange, ceramics, thermal radiation, convection, the motion of atoms and molecules, the radiation range.

As is known, in the Republic of Uzbekistan ovoschoplodovye products matures in the short flying time, three to four months of the year. To ensure the needs of the population for these products throughout the year, there is a storage problem. Traditionally, this problem can be solved in two ways; First, the product is stored in the refrigerator, it requires huge holodylnye area and great energy. Second, the products initially osushivaetsya, then stored in special places. The second method is more efficient than the first, but the process of drying the products is different.

Before and currently drying products carried on the areas under the rays of sunlight. This process is done in two ways; under the direct rays of sunlight in open areas, or drying of the products is carried out under the eaves, that is, in a shady area of the canopy. In contrast to the first, in the second case the drained products have high quality, preserving the natural biological primary structural parameters, ie, It is environmentally friendly. However, here as in the first case for large drying space drying required.

In recent years, to accomplish this task, dryers are used, so-called ovens. In these devices ovoschoplodovye osushivaetsya products under the influence of infrared radiation. Operation is that the products for drying is subjected to an intense irradiation of infrared radiation. To do this, stir the food in a special case, where the radiation source is installed. For the production of source is a quartz tube, inside which posted electric spiral from the outside of the tube are applied to a layer of special ceramics. When a current is passed through a spiral tube is heated, and the ceramic layer emits infrared rays.

The collection of articles [1], the economic and technical characteristics of the dryers of various designs manufactured in the country and abroad. And in the monograph [2], describes the effect of infrared radiation on biological organisms, medical applications, and the basics of drying ovoshoplodovyyh products. In these studies focuses on the improvement and optimization of the technical characteristics dryers. But the physical mechanisms of interaction of radiation with the products and the spectral characteristics of the radiation is not discussed.

The purpose of this article is to analyze the spectral characteristics of the source and absorbing infrared radiation environments,

as well as mechanisms for the process of drying ovoschoplodovyyh products.

You can put a primitive question why when irradiated with infrared rays wet bodies drainage occurs, ie, It evaporates. In the academic literature on the physics of the process is due to evaporation from the viewpoint of molecular — kinetic theory. According to this theory, when heated liquids or gases molecules get heat energy. In the molecules initially excited by the internal rotational and vibrational motion, and then increases the energy of translational motion. The molecules get enough required kinetic energy of the surface tension of the fluid overcoming the forces leave. Such a process in wet bodies, lead to their drainage.

For drying wet bodies require a continuous heat transfer. In nature, there are three types of heat, conduction, convection and radiation through electromagnetic [3]. In the first case the heat transfer medium fills the required space between the heat source and the heating body. In the latter case, great masses of gas and liquid is carried in the space and cause it to heat exchange. In the third case, the energy is transferred in form of electromagnetic radiation, and is not required medium for transfer of heat. Infrared radiation is a carrier of thermal energy in the literature and are often referred to as infrared thermal radiation.

In the absorption of infrared radiation bodies in the molecules forming the body, the internal excited rotational, vibrational and translational motion of the molecule as a whole. If the molecule is in an excited state, the molecule within the complex movement occurs and this leads to a change in the overall dipole moment of the molecule and is observed in the infrared radiation range. The spectral composition of the radiation depends on the internal structure and the symmetry of the molecule.

The drying process is associated with the evaporation of water molecules from the surface of the product for this reason, first analyze water absorption and emission spectra. A molecule of water ( $H_2O$ ) is a triatomic molecules and vibration theory has three vibration (vibration) and three rotational (rotary) movement. Figure 1 shows schematic representations of six independent movement of the water molecule [4].

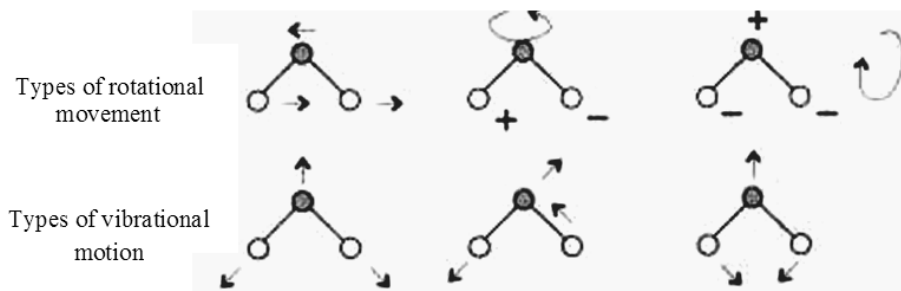


Figure 1. Types of movement of water molecules

In a first approximation, these movements can be described as a model of the three harmonic oscillators and rotators. Their energy is determined by the following formulas.

$$E_{ocq} = \hbar\omega_0\left(n + \frac{1}{2}\right), E_{pom} = \frac{\hbar^2 J(J+1)}{2I}. \quad (1)$$

Here,  $n, J$ -quantum numbers.  $I$ -moment of inertia of the oscillator frequency of  $\omega_0 = \sqrt{k/m}$  – private. 6 These movements form of vibration and rotational energy spectrum of the molecule as a whole.

$$E(n) = E_{zn}(n_0) + E_{me\sigma}(n_1, n_2, n_3) + E_{ai\alpha}(J_1, J_2, J_3), \quad (2)$$

$$(n_0, n_1, n_2, n_3, J_1, J_2, J_3 = 1, 2, 3, \dots).$$

From formula (2) that the molecule has an energy spectrum over a wide range. If the molecule moves from one state to another, it changes leads to the emission or absorption of electromagnetic radiation, whose frequency is determined by the formula

$$\hbar\omega = E^{(1)} - E^{(2)} = (E_{zn}^{(1)} - E_{zn}^{(2)}) + (E_{me\sigma}^{(1)} - E_{me\sigma}^{(2)}) + (E_{ai\alpha}^{(1)} - E_{ai\alpha}^{(2)}) = \quad (3)$$

$$= (\Delta E_{zn} + \Delta E_{me\sigma} + \Delta E_{ai\alpha}) = \hbar(\omega_{zn} + \omega_{me\sigma} + \omega_{ai\alpha}),$$

Experimental and theoretical calculations show that the energy spectrum defined by the formula (3) corresponds to the infrared range. The table shows the results of a numerical calculation of the formula (3) and experimental measurements of the absorption spectra of water vapor molecules [4].

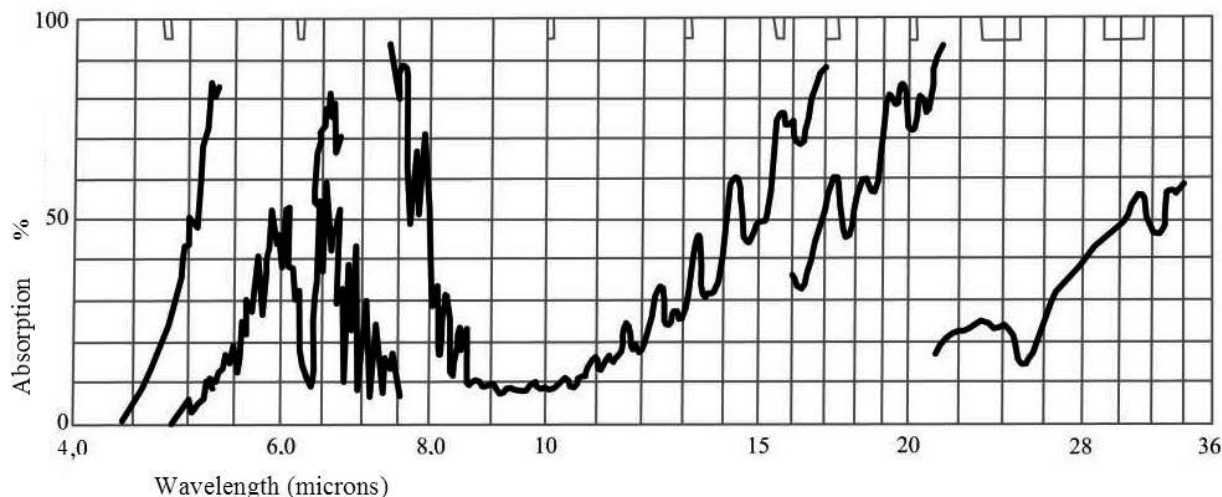
Rotational spectra (rotational) movements							
$\lambda(\text{exp})$	$\lambda_1(\text{theor})$	$\lambda_2(\text{theor})$	$\lambda_3(\text{theor})$	$\lambda(\text{exp})$	$\lambda_1(\text{theor})$	$\lambda_2(\text{theor})$	$\lambda_3(\text{theor})$
267 (mic)	278	208	–	35.7	39.0	36,8	–
175.6	182	–	–	–	37.0	34,8	35,0
167	–	–	175	32	32.7	32	–
132	139	137	–	30.6	30.9	29,7	–
116.8	111.2	–	–	29.0	29.3	–	–
108.9	–	104	–	28.9	27.8	27,7	–
105.8	–	–	–	26.6	26.6	26,0	29,2
90.9	91.7	–	87,5	25.0	25.3	24,5	–
83	–	83	–	23,0	–	23,1	25,0
79.3	79.4	–	–	22.9	–	–	–
78	–	–	–	21.6	–	21,9	–
74.5	–	–	–	20.5	–	20,8	21,9
72.2	–	–	–	19.7	–	–	–
69.9	68.3	69,3	–	19.2	–	–	19,4
63.7	–	–	–	17.5	–	–	–
65.8	61.7	–	–	15.7	–	–	17,5
57	–	59,4	58,1	14.3	–	–	15,9
52.6	55.6	52,0	–	13.4	–	–	14,6
50	50.1	–	–	12.4	–	–	13,5
49	–	–	–	11.6	–	–	12,4
44.1	45.6	46,2	43,8	10.9	–	–	11,7
40.0	42.2	41,6	–	–	–	–	10,9
The spectra of normal (vibration) fluctuations							
$\lambda(\text{exp})$	$\lambda_1(\text{theor})$	$\lambda_2(\text{theor})$	$\lambda_3(\text{theor})$	$\lambda(\text{exp})$	$\lambda_1(\text{theor})$	$\lambda_2(\text{theor})$	$\lambda_3(\text{theor})$
6.1	–	–	–	0.98	1.02	0.97	0.98
4.7	–	–	–	0.85	0.88	–	0.85
2.29	3.05	–	–	0.75	0.77	0.73	0.75
1.98	2.03	–	1.96	0.63	0.68	–	–
1.46	1.52	1.45	1.48	–	–	–	–
1.18	1.22	–	1.17	0.55	0.55	0.58	–

The table shows that the short-wave ( $\lambda_i \approx 6\text{--}0.55$  mic), corresponding to the vibrational motion, and the long-wavelength part ( $\lambda_i \approx 278\text{--}6$  mic), to the rotary motion. Also, the short-wave part of

the spectrum corresponds to the long-wave part of the optical range. It is not difficult to understand that for this reason, under the influence of solar radiation, there is an intense evaporation of water.

According to theoretical calculations by the formula (3) in a range of water must observed ruled individual spectral lines, corresponding to the values  $\lambda_i$  (or  $\omega_i$ ). In the experimental measure-

ments in place there is always some strip lines  $\lambda\omega_i(\Delta\omega_i)$ , which corresponds to the natural broadening of the width of the lines. This shows that the intra molecular motion of molecules is complex.



For clarity, the graph of experimental absorption spectrum attestation portion of water vapor in the range of 4–35 microns [4]. For wavelengths of 5,2 mic and 6 mic, 6,25 mic, 6,75 mic in the table on the graph corresponds to only one resonance line in the range of 5–8 mic ( $\Delta\lambda \approx 3\text{mic}$ ). The peak of the resonance corresponds to a wavelength of  $\lambda_i = 6,1$  mic, shown in the table. The following experimental peaks correspond roughly to  $\lambda_i = 17\text{mic}$ ,  $\lambda_i = 21\text{mic}$ ,  $\lambda_i = 33\text{mic}$  associated with three different types of rotational motion of the molecules, as shown in the figure.

The ovens for drying ovoshoplodovyh offered products, the infrared radiation source is a ceramic compound specially produced for this purpose. In [1], as the source of radiation is a ceramic material proposed so-called “mullahs” emitting radiation up to 25 mic. In other devices, it offers ceramic materials based on quartz emits radiation to 3–5 mic, but in the majority of the works of the spectral characteristics of the source of radiation is not discussed.

From above resulted analysis it can be concluded that used for drying special ceramic material must have a wide range of emission within the spectral range of water absorption. Those material should emit radiation of different frequencies coating weight of the absorption spectrum of water molecules. This leads to an improvement in the economic efficiency of the device.

The question arises, what qualities distinguished drying ovoshoplodovyh products than drying by solar radiation. The climatic conditions of our country for drying ovoshoplodovyh under solar radiation enough. It is known that in the solar radiation spectrum besides the infrared ray and have ultraviolet optical radiation and partially rays with

energies higher [5]. Optical and ultraviolet rays are produced in the optical transitions of external electrons, electron shells of atoms. This radiation has higher energy than infrared rays, when they get into a hydrocarbon, the molecular structure of foods destroys their chains. And this leads to a change in biological structure ovoshoplodovyh product. In other words, when drying products completely or partially lose initial, natural quality. The infrared radiation acts mainly water molecules and their interaction with hydrocarbon molecules, the first drying stage can be ignored. So, how their energy is not sufficient for the active destruction of hydrocarbons.

As we mentioned earlier in this article, for the above mentioned reason, the drained products in the solar shade have higher natural qualities. But this method of drying time longer than drying in open areas. This can be called the drying temperature drying, as in this case, a thermal evaporation of water from the product, and drying time depend on the temperature of the shadow area.

It should be noted that the optical beams and also ultraviolet involved during evaporation of water molecules. Thus there is a Raman scattering radiation hydrocarbon molecules. In such processes, the energy of the primary radiation changed slightly, and the contribution of the infrared radiation is produced as a result of the Stokes process is much less than in the optical range. Recently, before the product manufacturers ovoshoplodovyh task, when drying the product as much as possible to maintain their original natural appearance. Despite the surplus energy, drying under the influence of infrared radiation is responding to these requirements, as well as a drying can be performed at any time of the year.

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## Selecting of the shape and structural design of the device for loading and distribution of raw cotton into the closed storage

**Abstract:** A new shape and structural design of the device for loading and distribution of raw cotton based on the analysis of raw cotton storage process into open bundles and private storages as well as used for this mechanization is proposed in this article. Layout and installation of devices for loading and distribution of raw cotton into the closed storage are shown. With the proposed devices a reduction of heavy manual labor in the process of cotton bundling, as well as an increasing of revenue load factor in storages is provided.

**Keywords:** raw cotton, closed storage, belt conveyor, feeder-distributor, chute, screw conveyor, kicker, loading gates.

Cotton storage is the initial link of operating procedure in ginneries. Ginneries during harvesting season recycle about 20% of harvested cotton. The basic mass of raw cotton are placed in open and closed storages to long-term storing for its processing in the following months, as a rule, before the start of new cotton harvest. One of the most labor-intensive work for the storage of raw cotton is to ensure uniformity of distribution of it inside an enclosed storage.

There are closed storage for raw cotton [1], carried out in the form of placement equipped with loading gates and mechanical system of feed through loading gates and switchgear inside the storage.

The disadvantage of such storages is the complication of storage warehousing process and low revenue load factor of the storage.

Raw cotton storage [2], made in the form provided with loading gates, closed room with a set of fixed mechanical means including a receiving-feeder, discharge conveyor, distribution sleeve and inclined conveyors with throwers can be considered as the most optimum alternative. Throwers are placed with angular displacement in a horizontal plane at 120°.

Its disadvantages include the uneven distribution of cotton around the storage content and low load factor due to the formation of seed cotton weight cones as raw cotton in its structure belongs to the category of poorly flowing fibrous bodies. In recent years, for long-term, as well as online storage of raw cotton construction of covered warehouses modern designs on standard projects with a capacity of up to 1500 tons has being spread widely. The walls and roof of the warehouses of this type are made of asbestos cement sheets reinforced profile for precast concrete frame. Roofing structure are reinforced concrete beams and purlins. It is also not widely used in the industry version of the modular storage of raw cotton in the closed storage due to lack of reliability in structures and uneconomical, since the storage of raw cotton uses only 50–75% of the volume of the warehouse. It should be noted regarding the loading and unloading means of mechanization, which, despite the availability of certain constructions are used in the industry, they also have significant drawbacks:

- access to thrower of such devices in the event of repair and replacement of the tape during operation is difficult;
- low coefficient of utilization of the total area of the warehouse with the canopy (of about 55%);

- uneven cotton density at its storage;
- high fire risk;
- a high degree of dust level in warehouses while loading of raw cotton;
- high probability of damage to the cotton seeds because of mechanical impact on raw cotton headset of picket drums.

Continuing to develop the direction for improving the loading technology and distribution of raw cotton in sealed storage, our new design of the device has been developed, which is presented in Figure 1.

The aim of this design loading devices and distribution of raw cotton is to increase the efficiency of use of useful storage areas by providing a uniform distribution of compressed cotton inside the warehouse throughout its volume. Storage of raw cotton is a set of stationary means of mechanization in the volume of enclosed space to loading gates. The internal space is divided by means of vertical support elements, at least two interconnected compartments where a feeder-valve with the possibility of reciprocating movement along the storage is placed. Equipped with unloading hatches horizontal conveyor belts with kickers placed on them to supply raw cotton from the surface of the conveyor belts to the download device and cotton distribution are installed on the opposite longitudinal sides under the loading gates.

Feeders-distributor are placed under horizontal conveyor belts across each compartment and are provided with a roller supports to move on longitudinal guides formed, for example, in the form of rails mounted along the entire length of the opposite longitudinal sides of each of the storage compartments. Loading gates are installed to cooperate, for example with inclined conveyor of send-receiver device placed outside the storage.

Offered technology of raw cotton loading and distribution and the structure of feeder-distributor is illustrated by a drawing in which Figure 1 schematically shows a general view of repository.

Closed type storage is made of reinforced concrete in the form of prefabricated buildings of rectangular form. The internal storage space consists of two adjacent interconnected compartments 1 and 2 (Fig. 1) formed through along the central axis of the vertical support members repository 3. Each of the compartments is provided with a loading gate 4 located at the top of the longitudinal walls of storage 5.

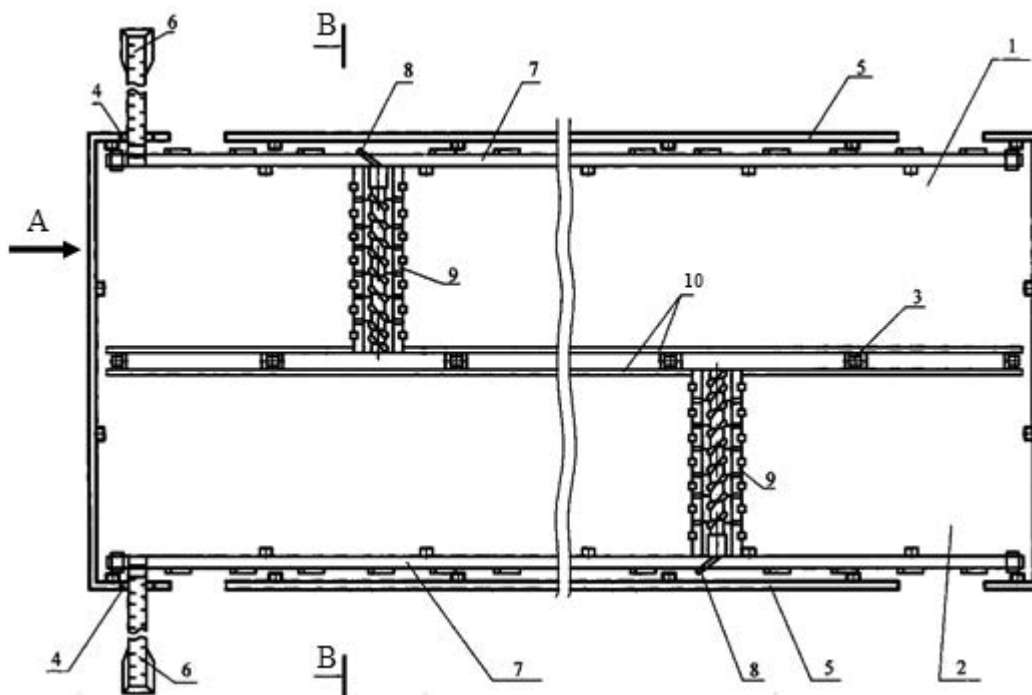


Figure 1. General view of the storage device

1, 2 – compartment; 3-vertically supporting element of central repository axis; 4 – loading gate; 5 – longitudinal wall of storage; 6 – inclined conveyor; 7 – horizontal belt conveyor; 8 – ejector; 9 – feeder-distributor; 10 – profile corners.

Each loading gate communicates with an inclined conveyor 6 of send-receiver device installed outside the storage.

Under each loading gate in the storage are placed horizontal conveyor belts 7, consisting of a stationary fixed bed, at the ends of which the drive and tension drums set. These drums are swept with the belt which strands support trunnion.

The kickers 8 for feeding of raw cotton from the surface of the belt conveyor on the feeder-distributors 9 through the unloading gates are gimbal mounted with rated corner on the belt to the longitudinal axis of the conveyor (Fig. 2).

Feeders-disributors are placed at the horizontal conveyor belts across each of the storage compartments with the possibility of reciprocating movement along the fitted compartment.

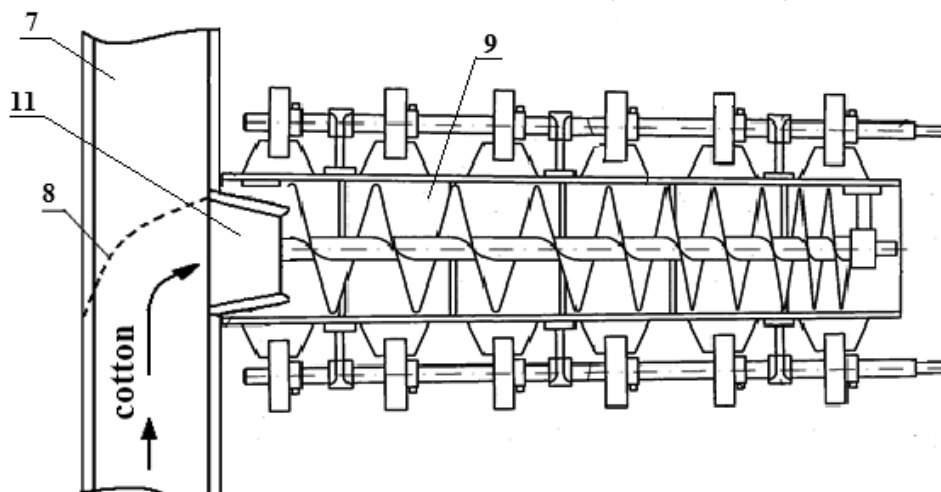


Figure 2. Supply of raw cotton on a screw conveyor (top view)

7 – horizontal belt conveyor; 8 – ejector; 9 – feeder-distributor; 11 – unloading gate

While loading storage raw cotton with the help of inclined conveyor 6 is fed from the outside through the loading gates 4 on the horizontal conveyor belts 7. With kickers 8, raw cotton is fed to the feeder-distributor 9 through the unloading gates 11 (Fig. 2).

Because feeders-distributors 9 are mounted across each of the compartments 1 and 2 with the possibility of moving along them, raw cotton loading is made layer-by-layer at its uniform distribution and while producing a uniform distribution and compaction.

The track rollers sliding along guide rails moved feeders-distributors 9 along each of the compartments 1 and 2 that promotes efficient use of the useful area around the storage.

Loading of raw cotton of both compartments 1 and 2 may be performed by turns and simultaneously.

In the course of studying of the technological and constructive parameters of the above described device it was found that for the optimal operation of the device as a part of the storage the following factors are interacted: a uniform supply of cotton

to the feeder-distributor, a uniform distribution of raw cotton along the length of the screw conveyor and the uniform distribution of raw cotton during loading and unloading in the volume of the chute. These factors relate to the capacity of the installation.

Taking into consideration the above mentioned conditions, we proposed a feeder-distributor with new structure, which conveyor

screw is tapered with variable pitch, decreasing the length of the feeder-distributor.

Tapering and changing of the step of the screw conveyor is selected so that a decrease of cotton intensity along the length of the screw conveyor decreases proportionally to the diameter and pitch that provides uniform distribution of cotton to the sections of the device to keep natural properties of raw cotton.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-208-210>

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## Development of the device for loading and distribution of raw cotton into the closed storage

**Abstract:** Based on the results of the study of the loading and distribution of raw cotton into the closed storage an improved cotton feeder-distributor for closed type storages is introduced in this article. The proposed feeder-distributor is based on a conical screw with variable pitch to ensure uniform supply and distribution of feed raw cotton over the entire length of the screw and the volume of the closed stores. The results of its testing at production conditions showed that using of this setting can increase the duty cycle of raw cotton closed storage, to ensure the complete mechanization of the loading process and a uniform distribution of raw cotton into the closed store, as well as the automation of these processes.

**Keywords:** loading process, screw, conical shape, uniform supply, load factor, uniform distribution, efficiency, natural properties.

In order to develop the structure of raw cotton distribution device into the closed storage the following mandatory conditions are necessary to provide:

- High performance of cotton loading to 25–30 m/h, which must match the capability of combined devices (XPP and the CLP-650);
- Uniform supply of raw cotton for the entire length of the closed storage.

Considering the above conditions, we have developed a screw feeder-distributor with periodically opening groove [1; 2].

This device provides a uniform raw cotton distribution by conveyor length and raw cotton natural features keeping.

Conveyor's screw is performed by conic variable step, reduced with screw's length. The conicity and changing of screw is selected in such way when raw cotton weight is minimized proportional diameter and step which provides uniform allocation to the sections of the device.

The device is clarified by drawing: picture 1 demonstrates general type of the device, picture 2 shows type "A" and profile of "B-B" cam.

The device 1 comprises a shute formed in the lower part of the movable sections 2, 3, and mounted in the upper part of the shute

4 taper screw with decreasing pitch, the difference of diameters of the screw 4 is selected equal to the bases of the cone is not more than 100 mm.

The value between the maximum and minimum diameters of the screw and the steps is selected from the condition of the size of the average value of the diameter of a lump of cotton (not more than 100 mm) in the device.

The screw 4 is connected with the shute 1 by brackets 5. On both sides of the chute 1 driving shafts 6 are mounted by brackets 7, 8 on the top of the chute 1, and the driving shafts 6 are forced on with component cams made of bases 9, 10 and worn they rubber rings 11 and 12 and fixed on the profile bases 9, 10 with a special glue, all of which interacts with the cantilever arm 13, 14 of one section of section 2, 3 of shute 1, mounted on hinges 15, 16.

The device operates as following. Raw cotton located in the chute 1 is moved around along the shute 1 with revolutes transitional moving of the shute 4. The lower part of the shute 1 is designed as a movable sections 2 and 3. Each section consists of two hinged parts having overhanging arms 13, 14, which cooperate with the rubber rings 11 and 12, the cams 9 and 10 and in accordance of the condition of the profile rubber rings 11 and 12 change relative positions



concerning to the screw 4, for example, are opened or closed. Profiles of rubber rings 11, 12 and cams 9,10 are chosen so that while opening of one section of the chute 1 others are closed. It supplies raw cotton in a given place at a given time.

During the opening of the corresponding pair of sections 2, 3 is unloaded from cotton device. Thus, in all sections of the screw conveyor according to a certain law occurs alternately opening and closing sections, and thus the discharge of the device. To ensure the uniformity along the length of raw cotton of the screw 4, the latter is conical with decreasing lead.

In the beginning of the movement of raw cotton by screw 4 seed cotton fallout from the first section, and further, raw cotton is compacted both vertically due to reducing of the diameter of the screw 4 and the screw along the length of the reduction step. In the following sections of cotton fallout will be the same (by volume and weight) as in the previous sections.

The proposed design is achieved by multiple repetition of the distribution process, which significantly increases the uniformity of the paved layer. This ensures uniform distribution of the raw cotton within the repository throughout its volume.

The proposed plant has a working length of 6 meters with the possibility of adjusting the geometric parameters of links and gaps.

The chute consists of a two-arm arcuate funnel. The first arm length is  $L_1 = 25$  mm, the second arm —  $L_2 = 45$  mm, the

width is 70 cm. To ensure a smooth and timely raw cotton fallout from the chute the inside parts of the crater made of smooth metal steel. The number of chutes in the construction consists of 6 pieces. Screw conveyor chute to the carriage 15 attached via mm steel wire. From the top of the chute it contacts with the cam. Upon contact with the cam portion cut tipping occurs that leads to opening of the chute and unloading cotton located inside. For a simultaneous opening of chutes contacting cams are located in opposite directions in the same positions. The diameter of the cam is 250 mm. Right side is trimmed with metal, resistant to abrasion. There is a cut with an angle of  $60^\circ$  opening. Cams are headed on separate shafts. The shaft supporting a cam mechanism is made from steel with diameter of 45 mm and the length of 6,2 m.

To secure the cam gear while cornering, and unwanted shift in the shaft the key way is provided.

The selected design features of the developed device for loading and distribution of raw cotton provide optimal conditions for the supply and distribution of cotton across the length and volume of the closed store, which in turn provide the download complete, uniform layer.

Testing of the new device performance for downloading and distribution of raw cotton in the closed storage was carried out in Kagan JSC "Oltin tola", Bukhara region.

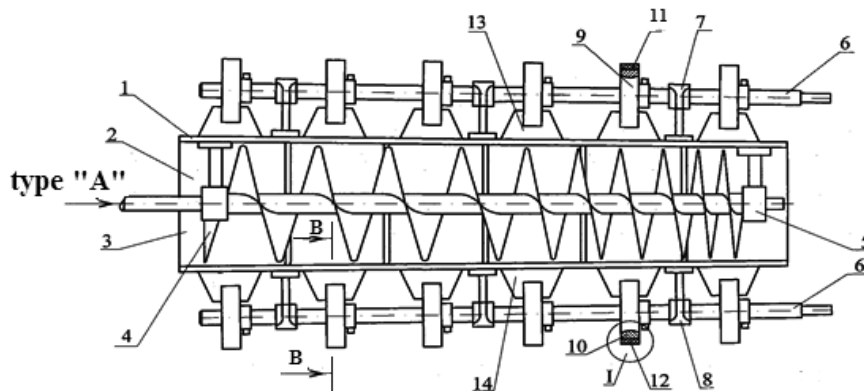


Figure 1. General view of the feeder-distributor

- 1 – the chute; 2.3 – section of the device; 4 – the screw; 5, 7, 8 – arms; 6 – driven shaft of cam; 9, 10 – cams;
- 11, 12 – rubber rings; 13, 14 – cantilevered arms; 15, 16 – hinges

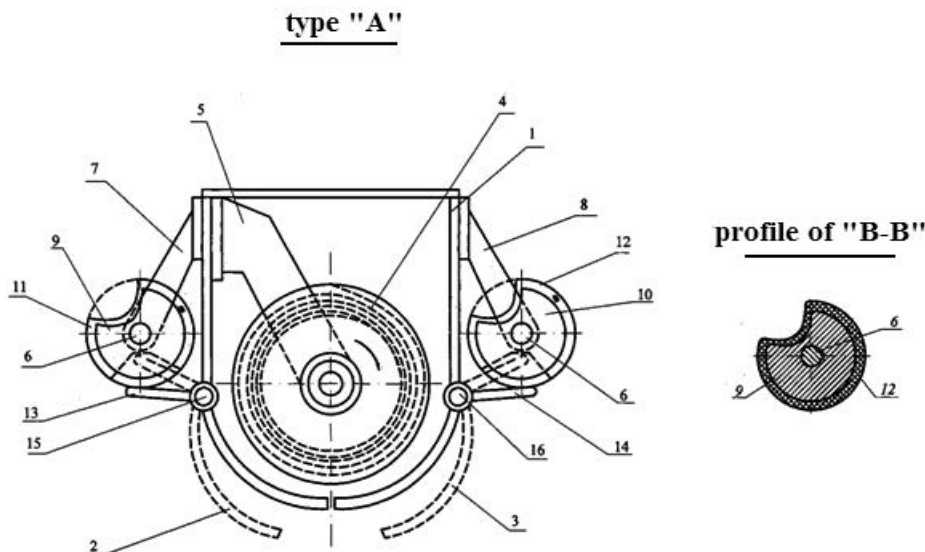


Figure 2. View on the "A" feeder-distributor and the cut of "B-B" cam

When the device was placed into the closed storage their basic dimensions were accounted. So, taking into account the size of a typical warehouse of 54 to 24 meters 2 sets of devices were placed there. Developed storage scheme with new devices for loading of raw cotton in comparison with existing analogues has a positive effect on the following parameters:

1. Factor of storage loading is 0,90–0,96.
2. The high level of mechanization of the processes associated with the downloading and distribution of raw cotton for the entire volume of the closed stores.
3. Ability to automate processes and manage the download and delivery of raw cotton in the distribution area.

This scheme of loading into the storage and the device for its implementation is recommended for widespread use in the cotton industry to ensure the preservation of the natural properties of raw cotton.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-210-212>

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## Dependencies to determine the measure of damage and calculation of residual life of reinforced concrete superstructure, exposed to salt corrosion

**Abstract:** In this paper we consider the current method of determining the measure of damage of concrete and reinforcement. The proposed dependence measures of damage, convenient for use in predicting the life of structures superstructures. The practical method of calculation determination of residual resource of the exploited superstructures developed. The main source of data for calculating the residual life are the parameters defined by the technical diagnosis.

**Keywords:** measures the damage, resource forecasting, exhaustion bearing capacity of the structure, corrosion of concrete and reinforcement, the remaining service life, load-bearing capacity.

Forecasting resource of intense machine elements and structures [1; 2], reinforced concrete and steel bridge spans [3; 4; 5; 6] are now used the main provisions of the theory of linear damage accumulation [7; 8].

In [10–12] considered a practical way of determining the degree of salt corrosion in the concrete, the use of which will be possible to establish the actual thickness of the concrete, exposed to salt corrosion; It developed a method of estimation of influence of salt corrosion of the concrete work and valves; calculation method for determining the measure of damage of concrete and reinforcement. The proposed permit depending on the results of the survey to determine reliably the load span structures, suitable for use in predicting the resource superstructure.

Thus damage caused by external impact during the considered time independent of the load history, and they can be summed with previous injuries. The value of the degree of damage is estimated as  $0 \leq \Psi \leq 1$ , at the beginning of loading  $\Psi=0$ ; at the moment of exhaustion bearing capacity of the structure  $\Psi=1$ .

The accumulation of damage over time is described by

$$\sum_{i=1}^T \frac{t_i}{T_i} = 1 \quad (1)$$

For structures operating under cyclic downloaded

$$\sum_{i=1}^K \frac{n_i}{N_i} = 1 \quad (2)$$

where  $n_i$  – number of cycles at a uniform loading;  $N_i$  – number of cycles to failure.

$\Psi$  – measure damage to any point in time

$$\Psi_i = \sum_{i=0}^T \frac{t_i}{T_i} \quad (3)$$

In the case of non-linear voltage uploading  $\sigma$

$$\Psi_i = \int_0^T \frac{dt}{T(\sigma)} \quad (4)$$

On the basis of (3) in [5; 6] proposed to determine the dependence of the resource elements of metal bridges.

V. P. Chirkov [9] proposed a mathematical model for resource prediction of reinforced concrete bridge spans on the basis of these provisions. As a measure of concrete damaged by exposure to multiple repeated loads accepted the change of the transverse deformation coefficient Vand with this in mind, the dependences for determining resource superstructures.

In the work of R. Mamajanov is described the degradation process and development of cracking in the concrete of the compression zone spans used basic parameter fracture mechanics – stress intensity factor “K”. The dependences for the description of the “K” in time, when repeatedly re-loading.

In the works of the above story loading is taken into account, the characteristics of loads and their statistical dispersion.

However, it should be noted that the use of measures to assess the damage for practical calculations are complex and require the presence of large statistical data.

Based on the analysis of the above studies, it can be concluded that the more promising as a measure of damage to receive actual performance concrete strength reinforcement corrosion degree [10; 11; 12]. Knowing the actual values of these parameters, it is possible to determine the value of the measure of damage and determine resource superstructures on the strength of concrete in the case of salt corrosion and corrosion of the reinforcement.

Considering the above measure of concrete damage, accept as

$$\Psi = \frac{R_b - R_{texp}}{R_b - R_{cr}} \quad (5)$$

where  $R_b$  – design value of the concrete strength;

$R_{texp}$  – the value of the concrete strength at the time of technical diagnostics;

$R_{cr}$  – the maximum allowable value, the strength reduction in the salt corrosion.

For (5) the condition

$$R_b = R_{texp}; \Psi = 0 \quad (6)$$

$$R_{texp} = R_{cr}; \Psi = 1 \quad (7)$$

Thus,  $\Psi=0$  corresponds to the case when there is no salt corrosion and the strength is not reduced, and  $\Psi=1$  – the time of the ultimate state.

From (5) we have

$$\Psi_b = a - bR_{texp}; \quad (8)$$

$$a = \frac{R_b}{R_b - R_{cr}} \quad (9)$$

$$b = \frac{1}{R_b - R_{cr}} \quad (10)$$

Substituting  $R_{bt} = 0,9R_b e^{-0,01t}$ ; in (8) we obtain

$$\Psi_b = a - 0,9bR_b e^{-0,01t}; \quad (11)$$

By (11) it is possible to determine the value of the measure concrete damage at any time  $t$  of technical diagnostics based on actual measurements of the strength of concrete.

Similarly, reduction of cross-sectional area of reinforcement can also be expressed in terms of the measure of damages

$$\Psi_s = a_s - b_s A_{st}; \quad (12)$$

$$a = \frac{A_s}{A_s - A_{cr}}; \quad (13)$$

$$b_s = \frac{1}{A_s - A_{cr}} \quad (14)$$

where  $A_s$  – sectional area of the project of reinforcement;

$A_{st}$  – sectional area of the valve after the corrosion;

$A_{cr}$  – the maximum allowable value, reducing the cross-sectional area of reinforcement.

Given  $A_{st} = A_{s0} e^{-0,015t}$  expression (12) is written as

$$\Psi_s = a_s - 0,7b_s A_{s0} e^{-0,015t}; \quad (15)$$

**Example of calculation of residual life of reinforced concrete spans, susceptible to salt corrosion**

The dependences obtained in [10] to describe the damage in time measures allow us to determine the remaining service life of span structures as a result of technical diagnostics.

Initial data.

Reinforced concrete span structure with a length of 16.76 m of the overpass. Year of construction of the overpass — 1967. The project developed by the beam under the load L30 and wheel load WL80.

The scheme of the span of the bridge is shown in Figure 1. Main beam reinforced fittings periodic profile Ø14 mm Class A-II. Stove roadway reinforcement has Ø12 mm Class A-II in increments of 10 cm. The distance between the main beams 56 cm. Design concrete class — B25 (M300).

The examination found that due to salt corrosion original diameter rebar fell to 5.9 mm. Salts penetration depth, determined as described in [11; 12] is up to 12–17 mm. The actual strength of the concrete slab layer, susceptible to corrosion,  $R_b = 12,0$  MPa.

Required to determine the residual life of the superstructure on the strength of the board.

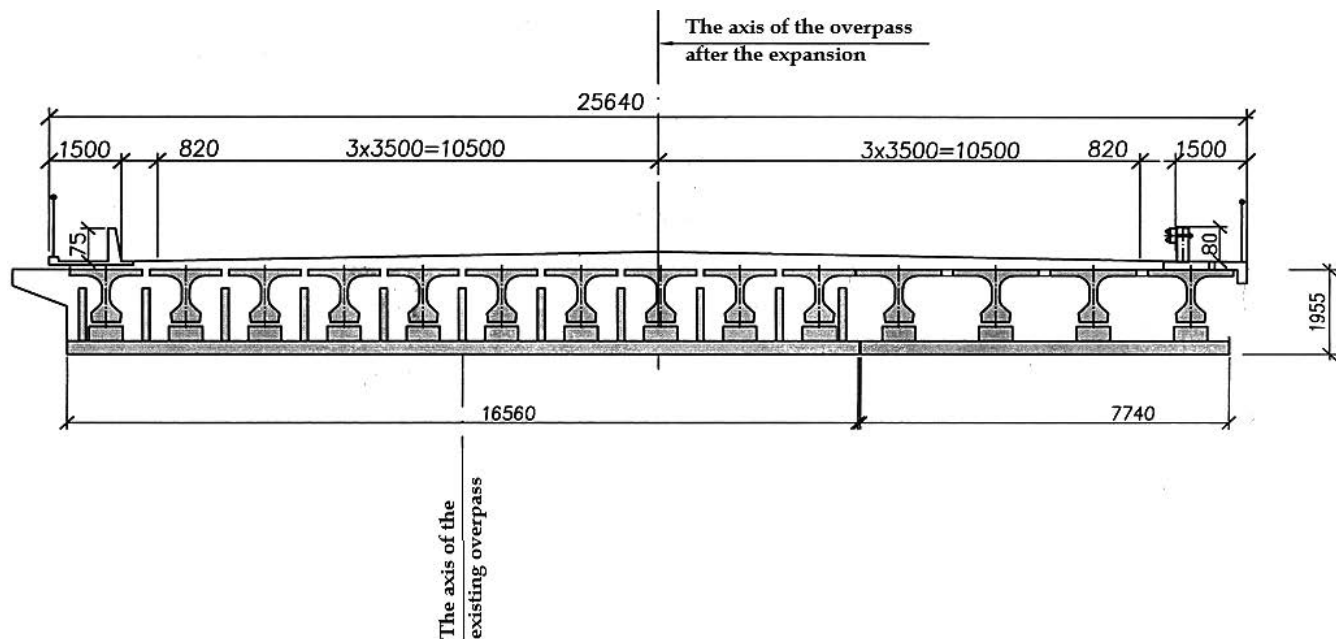
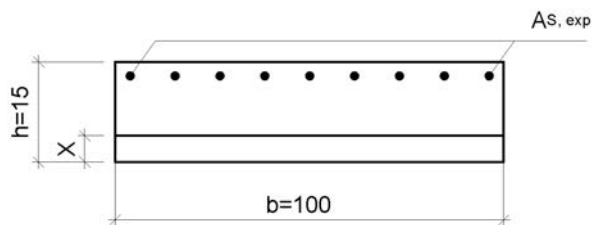


Figure 1. The cross-section of the span

**Calculation of bearing capacity of the slab at the time of technical diagnostics**

Estimated circuit boards external console

$h_1$  — the height of the compressed zone, impervious to salt corrosion.



The height of the compressed zone of concrete in view of the actual state of the plate is determined by the expression:

$$x = \frac{R_s A_{s,exp}}{R_{b,exp}} = \frac{240 \cdot 5,9}{12 \cdot 100} = 2,36 \text{ sm}$$

where  $A_{s,exp}$  – actual sectional area of the valve;

$R_{b,exp}$  – the actual design of concrete resistance.

Check bearing section capacity:

$$R_{b,exp} b x \left[ h_0 - \frac{x}{2} \right] = 12 \cdot 100 \cdot 2,36 \left[ 12 - \frac{2,36}{2} \right] = 15,3 \text{ kNm} > M = 14,1 \text{ kNm}$$

where  $M$  — bending moment calculated in this section, the moment of diagnosis section carrying capacity is provided with a small margin. Exhaustion of the resource may occur at lower strength concrete to  $R_{crb} = 8,0$  MPa and a decrease in the actual area of reinforcement to  $A_{scr} = 5,5 \text{ sm}^2$ .

Determine the measure of damage accumulation in the concrete and reinforcement at the time of diagnosis by technical formulas

$$\Psi_{1b} = \frac{R_b - R_{b,exp}}{R_b - R_{cr}} = \frac{35 - 12}{35 - 8} = 0,85$$

$$\Delta T_{resb} = \frac{\ln \left[ \frac{\Psi_{cr} - \Psi_{1b}}{c} \right]}{\alpha} = \frac{\ln \left[ \frac{1,92 - 0,85}{1,18} \right]}{0,01} = 9,8 \text{ year}$$

$$C = 0,9 R b b = 0,9 \frac{35}{35 - 8,5} = 1,18$$

$$\Psi_{cr} = \frac{1}{[\Psi_{cr}]} = \frac{1}{0,52} = 1,92$$

where  $[\Psi_{cr}] = 0,5$  for the reliability level of 0.95 on the scale.

Table 1. – Scale

Changes $\Psi_{cr}$	0,35	0,4	0,45	0,5	0,55	0,6	0,65
The probability of non-destruction	0,999	0,996	0,989	0,971	0,934	0,864	0,722

$$\Psi_{1s} = \frac{A_s - A_{s,exp}}{A_s - A_{cr}} = \frac{11,3 - 5,9}{11,3 - 5,5} = 0,93$$

$$\Delta T_{ress} = \frac{\ln \left[ \frac{c_3 - \Psi_{1s}}{c_3} \right]}{2} = \frac{\ln \left[ \frac{1,923 - 0,93}{1,42} \right]}{0,015} = 25,2 \text{ year}$$

$$C_3 = 0,7 b_s A_{s0} = 0,7 \frac{1}{11,3 - 5,5} 11,3 = 1,42$$

Thus, the residual life of the superstructure slabs

$\Delta T_{res} = 9,8 \approx 10$  years on the basis of concrete corrosion bearing capacity.

ing capacity.

### Conclusions

The proposed calculation method and according to the definition of concrete measures damage in concrete structures suitable for use in predicting the resource superstructure.

A practical way to determine the estimated residual life of the exploited superstructures. It is shown that the main source of data for calculating the residual life are the parameters defined by the technical diagnosis. It was found that the residual life span structures exposed to salt corrosion, up to 3 times less than the residual life of the structures that are in normal operating conditions.

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## Review of strengthening reinforced concrete beams using cfrp Laminate

**Abstract:** This paper presents the Literature Review of carbon fiber reinforced polymer (CFRP) strips to reinforced concrete (RC) as a strengthening solution for T-beams. Although a great deal of research has been carried out on Rectangular beams strengthened with Fibre-Reinforced Polymer composites (FRP), Fiber reinforced polymer (FRP) composites have been increasingly studied for their application in the flexural or shear strengthening of reinforced concrete (RC) members. A detailed discussion of the shear strengthening repair with FRP is undertaken.

**Keywords:** Shear, Strengthening, Concrete, Flexural, carbon fiber reinforced polymer (CFRP), fiber reinforced polymer (FRP).

The growing interest in fiber-reinforced polymer (FRP) composite in strengthening and retrofit is becoming apparent in recent years because of the special properties of these composite materials.

The most efficient technique for improving the shear strength of deteriorated RC members is to externally bond fiber-reinforced polymer (FRP) plates or sheets [1]. FRP composite materials have experienced a continuous increase of use in structural strengthening and repair applications around the world in the last decade [2]. In addition, the FRP when compared with steel materials found and provided unique opportunities to develop the shapes and forms to facilitate their use in construction.

In addition, the FRP when compared with steel materials found and provided unique opportunities to develop the shapes and forms to facilitate their use in construction.

Strengthening of beams and slabs in flexure and confinement of circular columns have been well documented. A review of research studies on shear strengthening, however, revealed that experimental investigations are still needed [3; 4].

There are many methods for shear strengthening option such as: Bonded surface configurations, end anchor, shear reinforcement spacing and fiber orientation. While many methods of strengthening structures are available, strengthening structures via external bonding of advanced fibre-reinforced polymer composite (FRP) has become very popular worldwide.

Although the materials used in FRP for example, fiber and resins are relatively expensive when compared with traditional materials, noting that the crises of equipment for the installation of FRP systems are lower in cost. FRP systems can also be used in areas with limited access where traditional techniques would be impractical. Commercially available FRP reinforcing materials are made of continuous aramid (AFRP), carbon (CFRP), and glass (GFRP) fibers. Possible failure modes of FRP strengthened beams are classified into two types:

The first type of failure includes the common failure modes such as concrete crushing and FRP rupture based on complete composite action. The second type of failure is a premature failure without reaching full composite action at failure. This type of failure includes: end cover separation, end interfacial delamination, flexural crack induced

debonding and shear crack induced debonding. Different failure mechanisms in experimental tests were reported by [5; 6].

For the first time great volume of work on research of possibilities FRP for strengthening of ferro-concrete designs has been spent in Switzerland with 1982 [7] (Meier, 2000). Sheet FRP wrapped up a design, pasting it epoxide pitch to a concrete surface, providing good coupling. Various experimental and theoretical researches according to strengthening of ferro-concrete beams FRP from glass — and carbon and their comparison with the identical beams strengthened by steel plates are reflected in [8, 9]. As a result of these researches questions of rigidity and durability of coupling of concrete with FRP, possible forms flacky have been studied, and also is shown that ferro-concrete beams with strengthening from FRP possessed considerably bigger bearing ability, than beams with steel strengthening. In work [9] simple analytical dependences for an estimation of limiting bearing ability of bent elements with strengthening from FRP, received of the equations of balance and compatibility of deformations, applicable to rectangular and t-beams are offered sections with single and double reinforcing. In overwhelming majority these researches are devoted strengthening of ferro-concrete beams in operative ranges of the bending moments, and only the few have concentrated on the sections testing action of cross-section forces [10].

At the same time the wide inspections of ferro-concrete designs spent in the various countries, speak about extensive damages to operative ranges of cross-section forces which can lead to destruction [11; 15] because of inefficient cross-section reinforcing, corrosion of armature, excess of design loadings while in service and many other factors which are not considered at designing under operating standard documents. Almost all ferro-concrete designs of buildings and constructions to some extent work on perception the cross-section forces. For example, the basic and most dangerous defects in most flying structures of maintained ferro-concrete bridges and overpasses are the inclined cracks arising and developing in at the basic to a zone of flight. Their uncontrolled development can lead to sharp decrease in bearing ability of designs and terms of their service, and sometimes and to destruction even in the absence of normal cracks. For the majority of ferro-concrete designs calculation on cross-section force is

defining at appointment of the sizes of section and the cross-section reinforcing which, for example, in beams of flying structures of bridges and overpasses sometimes makes over 50% from the general expense of armature on an element. The considerable share (to 20%) reinforcings of such beams can be replaced by effective external reinforcing in the form of high-strength fabric polymeric materials from carbon, widespread abroad (in the USA, Europe, Japan and Russia).

For the first time questions of designing and an estimation of bearing ability of the ferro-concrete elements strengthened FRP have appeared for last decade in standard documents of the USA, Switzerland, Japan, Germany and Australia. They reflect sufficient understanding of a problem with reference to normal sections of bent ferro-concrete elements though some questions connected with infringements of anchoring and flacky coverings from FRP are still studied insufficiently. However questions of development of methods of calculation of the strengthened ferro-concrete beams on inclined sections in many respects still are insufficiently clear. It first of all is connected by that used in national and foreign standard documents methods of calculation of durability on cross-section force are far from perfect on a level of development, to accuracy and reliability and considerably concede to methods of calculation of durability at action of the bending moments and longitudinal forces.

It is quite obvious that for the ferro-concrete beams strengthened FRP, the mechanism of resistance to action of cross-section forces even more becomes complicated and demands additional experimental and theoretical studying [12]. In works [8, 16] resistance researches to a cross-section bend ferro-concrete t-beams strengthened by fibres from glass and aramid which were pasted to an edge of beams by two-componental mastic from epoxide pitches are executed. Thus, their shift resistance raised by wrap up the beams fibres focused under corners  $0^\circ/90^\circ$  and  $45^\circ/135^\circ$ . Tests have shown that orientation at an angle  $0^\circ/90^\circ$  increased durability of beams by shift much more, than orientation at an angle  $45^\circ/135^\circ$ .

Influence of orientation of a fibre ( $0^\circ$ ,  $90^\circ$  and  $45^\circ$ ) on behaviour damaged rectangular and t-beams strengthened unidirectional continuous fabric and sheet FRP on the basis of thin carbon of fibres has been investigated in [12; 13; 16] where it has been noticed that increase in shift durability of beams and the form of their destruction are essentially connected with orientation of fibres. Also it was noticed that the strengthened beams collapsed basically because of flacky FRP from a concrete surface.

Extensive researches to strengthening of ferro-concrete beams in a cut zone have spent [8; 13; 16; 11; 18] having used unidirectional sheets CFRP. Influence of the relation of flight of a cut to working height of section, quantity of layers CFRP, U-shaped fixing CFRP in the form of sheets and strips on lateral surfaces of edges of beams was investigated. Results show that infringement of coupling of layers FRP with a concrete surface was a principal view of destruction of beams. If to prevent coupling infringement the strengthening material is used more effectively and, hence, it is

possible to increase even more bearing ability of a ferro-concrete beam in a cut zone. In 2003 Imran and others also have conducted tests for studying of bearing ability at a cut of the small-scale rectangular beams strengthened by gluing of external reinforcing from aramide FRP. The thickness and width of strip AFRP (20 мм and 40 мм) were the basic variables. For revealing of influence of type of fixing AFRP two schemes — U-shaped strip and full обертывание were used by sheets. The reached increase in durability at a cut was within 7–19%. In works [10; 11; 18] it is noticed that the further experimental work is necessary for revealing of influence of orientation of fibres, quantity of longitudinal working armature and the relation of flight of a cut to working height of section.

The majority of the spent researches on strengthening of a zone of a cut of ferro-concrete beams have been made with use unidirectional carbonaceous sheet AFRP. Strengthening two-forked carbonaceous sheet AFRP practically has not been considered [14]. In particular all researches have concentrated on systems with external reinforcing in the form of continuous wrap up though the method of strip reinforcing FRP is more economic. Some works by a technique of external strengthening are spent by separate strips FRP in [11; 18]. In works [15] it is specified in obvious insufficiency of researches of behaviour of partially damaged beams strengthened FRP.

In work [13] the simple equation for definition of bearing ability of the strengthened beams is offered at a cut taking into account rupture of fibres FRP. In work [16] it is offered two equations for orientation of fibres at an angle  $0/90$  and  $45/135$  of degrees with restriction of deformations. In works [17; 19] the equations for calculation of bearing ability of the strengthened samples are presented at a cut in the assumption that paste on layers of external strengthening from FRP work the same as also internal steel armature. This model has been developed for external strengthening of sides of edges by a strip and U-shaped covering from FRP and can be applicable and for cases of rupture or infringement of coupling FRP with a concrete surface. In works [18] three lowering factors, based on character of destruction and connected with rupture FRP, infringement of its coupling with concrete and the crack disclosing, leading to decrease in it of forces of gearing are entered. The models describing possible forms of destruction of beams, resulted in works [18; 19], will well be coordinated with experimental results.

**Conclusion:** This paper reviewed the research works on shear of RC beams strengthening by CFRP. The review given in this research is based on CFRP composite and has been covered extensively but not exhaustively. The importance to study the strengthening of the T-beams is due more practical in the site compare with rectangular beams. A working knowledge of how material properties change as a function of climate, time and loading will also be of great value to the engineering and design communities. In addition FRP in concrete and allows engineers to increase or decrease margins of safety depending on environmental and stress conditions, generic FRP type and required design life.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-215-217>

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## Study of energy indicators of power-consuming equipment at in-plant procurement centers of cotton-cleaning plants

**Abstract:** The problems of formation of energy indicators of power-consuming equipment at in-plant procuring centers are considered in the paper, as well as the method of calculation of electrical loads, which improves the accuracy of planning and the prediction of electricity consumption.

**Keywords:** cotton, energy, electric power, equipment, consumption, increase, design.

The mode so drive gear operation and other energy-consuming devices of the enterprises are the bases for formation of electric-power indicators in industrial production, consumption levels and the character of electric loads change. The study and exact assessment of the indicators of power-consumption of these units with consideration of their technical state, physical-chemical and physical- technological features of the technological process allow us to correctly analyze the dynamics of electrical loads of an enterprise, to reveal the reserves of electric energy, to increase the accuracy of planning and prediction of energy-consumption.

Knowing that the mode so electrical loads in individual machines determine the level of energy indicators, we have studied

the principal regularities of the change in electrical loads, specific electric power consumption of these machines. Calculations are carried out and energy characteristics of machines and mechanisms are built.

To build energy characteristics of consumed power and specific electrical consumption depending on productivity and other indicators, experiments on currently operating equipment have been carried out. Data processing was conducted with the use of mathematical statistics and probability theory.

Since the machines have different shut-off capacity due to different regulation and lubrication, the studies have been conducted on machines with average values of shut-off capacity.

Raw cotton in procurement center sand cotton-cleaning plants is received and stored separately according to its selection variety, industrial growth and the type of harvesting. Raw cotton acceptance in procurement centers is done according to ripeness coefficient, its color, outward appearance of the fiber in accordance with norms and appearance descriptions in the Standards of the Republic of Uzbekistan.

About 100 in-plant procurement centers and more than 500 procurement centers are operating in the republic.

See draw cotton is accepted and batched separately from technical growths.

Raw cotton is stores in indoors warehouses, in open storage facilities (sheds) and open specially built areas where raw cotton is piled up on rammed down and asphalt sites.

Mobile belt conveyors TLX-18, TL, KLP-650 and pneumo-

feeding units PLA and XPP are used for the acceptance of raw cotton from lorrybaskets and tractor carts and feeding to the bales in procurement centers. Electrical power in cotton procurement centers are consumed by belt conveyors, pneumo-feeding units and lighting of territory and service premises.

Consumption evaluation of electrical power in the enterprises is fulfilled by the counters (meters) of active and reactive energy; at the absence of meters in procurements center or in equipment units, energy consumption is determined by the measurements of consumed capacity of all energy consuming objects with account of their operation mode, utilization factor and actual working time.

Experimental data on consumed capacity and power consumption per equipment unit at in-plant procurement centers are shown in Table 1.

Table 1.

No	Name of technological equipment	Number	Fixed capacity per 1 equipment, kw	Designed consumed capacity per 1 equipment, kw	Operation time of technological equip., h	Designed consumption of elect power per 1 equipment, kw	Total consumption of power, kwh
1	Mobile belt cotton conveyor TLX-18	7	9,7	4	450	1800	12600
2	Belt conveyor TL	4	11,5	4,8	45	2160	8640
3	Mobile belt conveyor KLP-650	2	9,7	4	450	1800	3600
4	Receipting-feeding unit — feeder PLA	11	3	1,3	450	585	6435
5	Receipting-feeding unit mobile XPP	4	4,75	2	450	900	3600
6	Batch packer BX	2	35	14,7	480	7056	14112
7	Tunnel digging machine OBT	2	13,2	5,5	240	1320	2640
8	Ventilator for air suction through the tunnels UVP (VC-10) at efficiency up to 0,7	4	22	14	720	10080	40320

Energy consumption at in-plant cotton procurement center is evaluated by the following way:

$$W_{3.n} = n(P_{TLX}t_{TLX}) + n(P_{TL}t_{TL}) + n(P_{KLP}t_{KLP}) + n(P_{PLA}t_{PLA}) + n(P_{XPP}t_{XPP}) + n(P_{BX}t_{BX}) + n(P_{OBT}t_{OBT}) + n(P_{UVP}t_{UVP}) + n(P_{OSV}t_{OSV}), kw.h$$

where,  $P_{TLX}$  – is a consumed energy of belt cotton conveyor, kw;  $P_{TL}$  – a consumed capacity of belt conveyor, kw;  $P_{KLP}$  – a consumed capacity of belt mobile conveyor, kw;  $P_{PLA}$  – a consumed capacity of receipting-feeding unit — feeder, kw;  $P_{XPP}$  – a consumed capacity of receipting-feeding mobile unit, kw;  $P_{BX}$  – a consumed capacity of batch packer, kw;  $P_{OBT}$  – a consumed capacity of tunnel machine, kw;  $P_{UVP}$  – a consumed capacity of ventilator for air suction through the tunnels, kw;  $P_{OSV}$  – a consumed capacity of lighting devices, kw;  $n$  – a number of equipment in operation, pieces;  $t$  – operation time of equipment,  $h$ .

Aggregate specific consumption of electric power for equipment at in-plant procurement center is:

— mobile belt cotton conveyor TLX-18:

$$d_{TLX} = \frac{P_{TLX}}{A_{TLX}} = \frac{9,7}{20} \approx 0,49, kw.h / m$$

— belt conveyor TL:

$$d_{TL} = \frac{11,5}{35} \approx 0,33, kw.h / m$$

— belt mobile conveyor KLP-650:

$$d_{KLP} = \frac{9,7}{38} \approx 0,26, kw.h / m$$

— receipting — feeding unit — feeder PLA:

$$d_{PLA} = \frac{3}{24} \approx 0,13, kw.h / m$$

— receipting-feeding unit, mobile XPP:

$$d_{XPP} = \frac{4,75}{30} \approx 0,16, kw.h / m$$

— batch packer BX

$$d_{BX} = \frac{35}{35} \approx 1, kw.h / m$$

— tunnel digging machine OBT:

$$d_{OBT} = \frac{13,2}{3} \approx 4,4, kw.h / m$$

— ventilator for air suction through the tunnels UVP:

$$d_{UVP} = \frac{22}{2,5} \approx 8,8, kw.h / m^3 .cek$$

Design and experimental energy indicators of equipment, obtained at operating in-plant procurement center are given below in Table 2.

Experimental energy indicators obtained by measurement so noperating equipment, allow us to analyze and predict energy consumption.

Predicted amount of energy consumption per design period is determined from the expression:



$$W_{3.n.} = d_{TLX} \Pi_{TLX} + d_{TL} \Pi_{TL} + d_{KLP} \Pi_{KLP} + d_{PLA} \Pi_{PLA} + d_{XPP} \Pi_{XPP} + d_{BX} \Pi_{BX} + d_{OBT} \Pi_{OBT} + (P_{UVP} t_{UVP} + P_{OSV} t_{OSV})$$

kw.h/design period

where  $\Pi$ -is an amount for put production by principal technological equipment at in-plant procurement center,  $t$ .

Table 2.

№	Name of mechanization facility	Type	Design indicators			Experimental indicators		
			Efficiency, t/s	Specified capacity, kw	Specific consumption of energy, kw/t	Actual efficiency, t/h	Consumed capacity, kw	Actual specific energy consumption, kw.h/t
1	Mobile belt cotton conveyor	TXL-18	20	9,7	0,49	12	4	0,3
2	Belt conveyor	TL	35	11,5	0,33	21	4,8	0,2
3	Belt mobile conveyor	KLP-650	38	9,7	0,26	22,8	4	0,2
4	Receiving-feeding unit-feeder	PLA	24	3	0,13	14,4	1,3	0,09
5	Receiving-feeding unit	XPP	30	4,75	0,16	18	2	0,1
6	Batch packer	BX	35	35	1	21	14,7	0,7
7	Tunnel digging machine	OBT	3	13,2	4,4	1,8	5,5	3
8	Ventilator for air suction through tunnel at efficiency up to 0,7	UVP	2,5 m <sup>3</sup> /s	22	8,8 kw. h/m <sup>3</sup> s	2,5 m <sup>3</sup> /s	14	5,6 kw. h/m <sup>3</sup> s

So, it is recommended to use experimentally obtained data to analyze and predict energy indicators; they increase design accuracy

of specific norms of energy consumption and absolute consumption of electric power.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-217-220>

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**Environmental monitoring to get special data from observation points (based on ecological factors)**

**Abstract:** For defining ecological factor’s status, there is one of the useful methods that to get special data from observation points and analyses it without human factors. As well as, GIS modeling illustrates this collected data from observation points with environmental parameters.

**Keywords:** stations, observation points, ecological factors, digital data, big data, geoprocessing, environmental monitoring, EDMS.

**Introduction:** Our environment is constantly changing and there is no denying that. However, as our environment changes, so does the need to become increasingly aware of the problems that surround it. With a massive influx of natural disasters, warming and cooling periods, different types of weather patterns and much more, people need to be aware of what types of environmental problems our planet is facing. Environmental problems contain pollution, global warming and climate; improve grand soiling, changing water, changing air quality and other problems in ecological stress area.

These areas need making environmental monitoring to define status of ecology.

Environmental monitoring describes the processes and activities that need to take place to characterize and monitor the quality of the environment. Environmental monitoring is used in the preparation of environmental impact assessments, as well as in many circumstances in which human activities carry a risk of harmful effects on the natural environment. All monitoring strategies and programs have reasons and justifications, which are often designed to establish

the status of an environment or to establish trends in environmental parameters. In all cases, the results of monitoring will be reviewed, analyzed statistically, intellectualized and published. In addition, collected data from observation points with environmental parameters are illustrated by GIS technology.

The purpose of the task: Actually, through ecological stress areas that a large number of distributed applications requires continuous and timely processing of information and data as it flows from the periphery to the center of the system.

Examples are that kind of systems, which analyze network traffic in real-time to identify possible attacks, environmental monitoring applications, which process raw data coming from sensor networks

to identify critical situations, or applications performing on-line analysis of stock prices to identify trends and forecast future values. To define ecological factor's value, we need sensor network to get special data from observation points in ecological stress areas.

A sensor network is a computer accessible network of many spatially distributed devices, which uses sensors to monitor conditions at different locations. In addition, it captures real-time information about environmental features. However, these networks of sensors are not connected to each other. This means that users cannot access the data from one convenient location; consequently, making an effective decision in a critical situation would be a challenging issue in the case of environmental monitoring (figure 1).

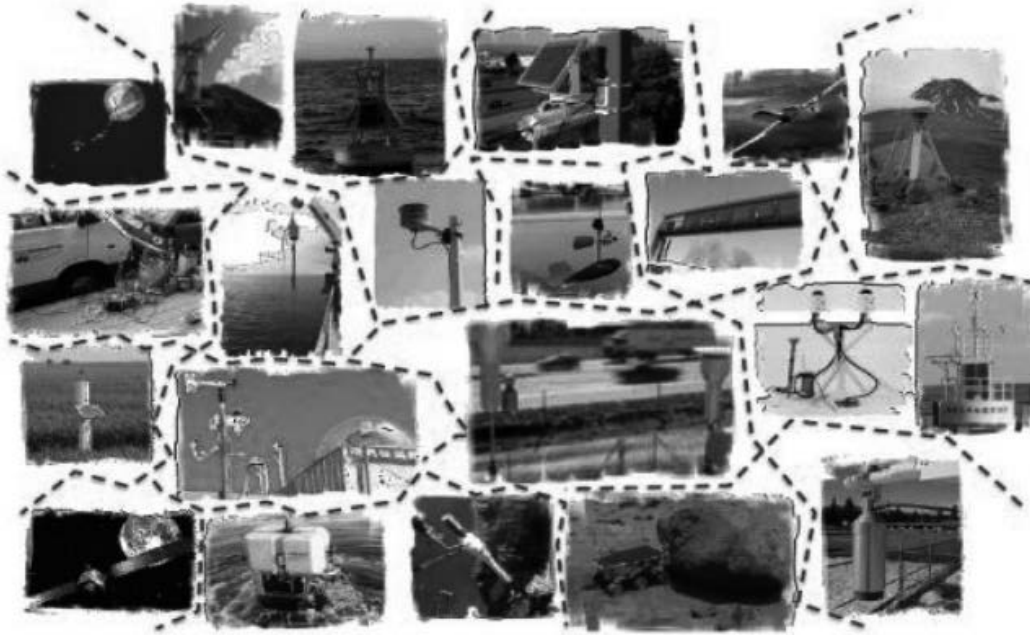


Figure 1. Sensor network

Actually, traditional DBMSs, which need to store and index data before processing it, can hardly fulfill the requirements of timeliness coming from such domains. Accordingly, during the last decade different research communities developed a number of tools, which we collectively special data from observation points in ecological stress areas. However, in this case Flow Processing (IFP) Systems, to support these scenarios. They differ in their system architecture, data model, rule model, and rule language. We survey these systems to help researchers, often coming from different backgrounds, in understanding how the various approaches they adopt may complement each other. In particular, we propose a general, unifying model to capture the different aspects of an IFP system and use it to provide a complete and precise classification of the systems and mechanisms proposed so far. In addition, commercial software Environmental Data Management Systems (EDMS) or E-MDMS are increasingly in common use by regulated industries. They provide a means of managing all monitoring data in a single central place. Quality validation, compliance checking, verifying all data has been received, and sending alerts are generally automated.

Function module: Why we use meaning of “ecological stress area”? Ecological stress area — combine that kind of areas have some problems with ecological factors. There is many ways to get data from ecological stress area:

- getting special data from observation points;
- processing aerospace pictures;
- getting expert's information (solutions and diagnoses);

— applying the knowledge of an expert and developing expert systems;

Given arguments of collecting data, help us to define state of ecological stress areas. Observation points can collect and send data about given area through sensor network. Actually, these points' data related to sensor type, for example sensors can get data from water, ground or from other objects (figure 2).

As you see, figure 2 shows that, we have a special ecological stress area with water soiling factors. Observation points can define value of water soiling with intermediate value 0 to 5. For example, table gives that, X2 and X3 observation points are normal area. Because, the indicator shows that water soiling less than other observation points. This environmental monitoring is used to define value of water soiling in special ecological stress area.

Solution of environmental monitoring need developing mathematical models of getting data from observation points. The mathematical model considers environmental monitoring tasks are non-linear partial differential equations that describe the processes occurring in the subsurface hydrosphere variations in temperature (ten-day, monthly, seasonal) of air.

As you know, GIS technology is one the best thing to illustrate data that collected from observation points. Actually, GIS technology has different kind of functions. GIS is a broad term that can refer to a number of different technologies, processes, and methods. It is attached to many operations and has many applications related to engineering, planning, management, transport/logistics, insur-

ance, telecommunications, and business. For that reason, GIS and location intelligence applications can be the foundation for many

location-enabled services that rely on analysis and visualization (figure 3).

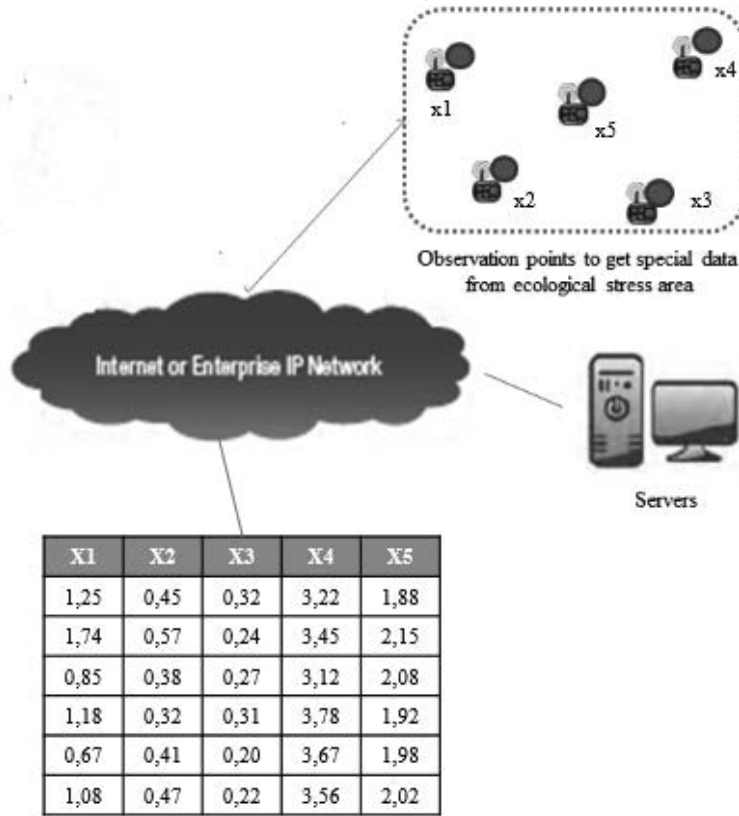


Figure 2. System architecture of observation points

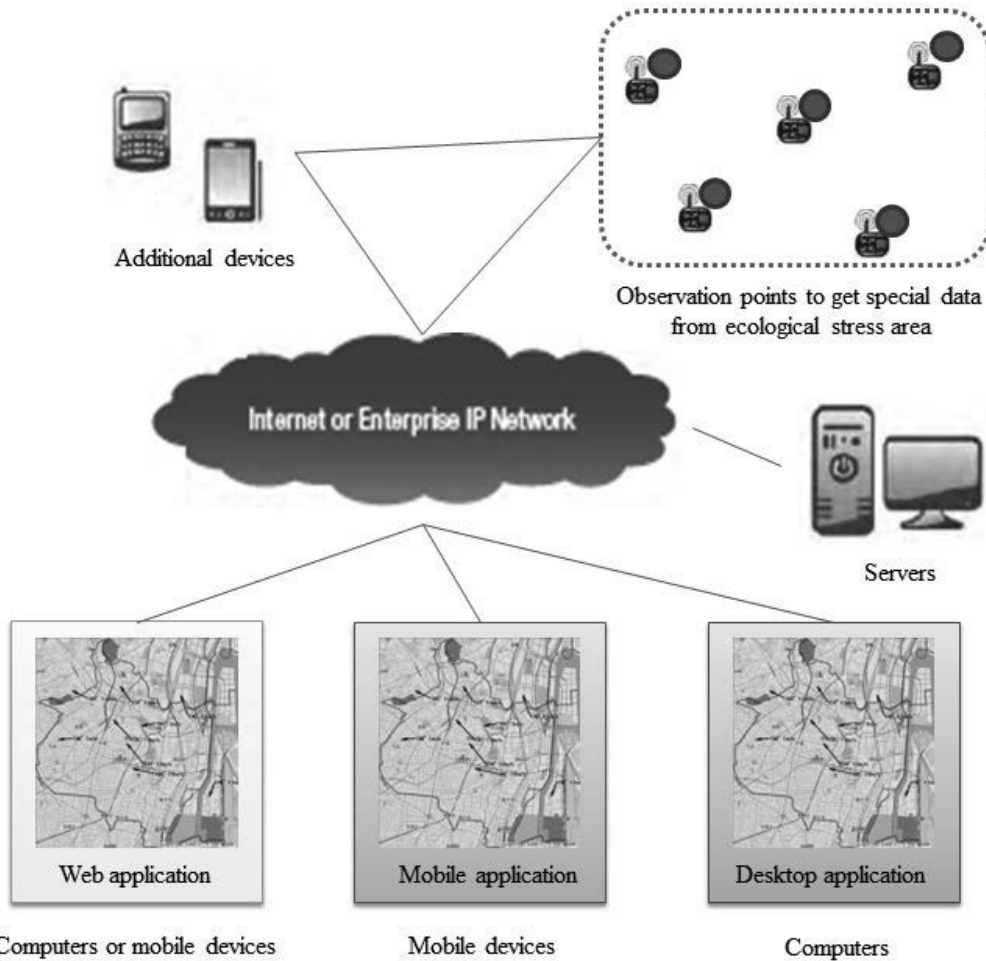


Figure 3. Sensor network to get special data from observation points in ecological stress areas

Typical interrogation functionality enables comparison of data sets both temporarily and spatially. Actually, defining ecological stress areas following ecological factors and monitoring environments are necessary:

- Air quality monitoring
- Soil monitoring
- Water quality monitoring

Air quality monitoring is performed using specialized equipment and analytical methods used to establish air pollutant concentrations. Actually, air monitors are operated by citizens, regulatory agencies and researchers that is investigated air quality and the effects of air pollution. Air dispersion models that combine topographic, emissions and meteorological data to predict air pollutant concentrations are often helpful in interpreting air-monitoring data.

Soil monitoring is the process of collection of soil and testing in laboratory by analytical methods. Soil samplings are of two types:

- Grab sampling: in this method, sample is collected randomly from field.
- Composite sampling: In this method, mixing of multiple sub samples for larger and non-uniform fields.

Water quality monitoring is of little use without a clear and unambiguous definition of the reasons for the monitoring and the objectives that it will satisfy. Almost all monitoring (except perhaps remote sensing) is in some part invasive of the environment under study and extensive and poorly planned monitoring carries a risk of damage to the environment. This may be a critical consideration in wilderness areas or when monitoring very rare organisms or those that are averse to human presence. Some monitoring techniques, such as gill netting fish to estimate populations, can be very damaging, at least to the local population and can also degrade public trust in scientists carrying out the monitoring.

Solution of environmental monitoring is developing mathematical models of getting data from observation points. The mathematical model considers environmental monitoring tasks are non-linear partial differential equations that describe the processes occurring in the subsurface hydrosphere variations in temperature (ten-day, monthly, seasonal) of air.

Complex mathematical model of filtration of groundwater and migration of salts in the groundwater flow is represented as:

$$\mu \frac{\partial h}{\partial t} = \sum_{i=1}^2 \frac{\partial}{\partial x_i} (\tilde{k}_i h \frac{\partial h}{\partial x_i}) + f - w \quad (1)$$

$$\frac{\partial(hc)}{\partial t} = \sum_{i=1}^2 \frac{\partial q_i}{\partial x_i} + f c_f - pwc \quad (2)$$

$$q_i = v_i c - \tilde{D}_i \frac{\partial c}{\partial x_i} \quad (3)$$

where,  $h(x_1, x_2, t)$ ,  $vc(x_1, x_2, t)$  — groundwater salinity,  $k_i(x_1, x_2)$ ,  $\tilde{D}_i(x_1, x_2)$  — filter coefficients and diffusion salts,  $q_i$  — salts coefficients.

The system (1) and (2) are implemented with the objectives of the relevant initial and boundary conditions, certain natural conditions [1]. Territorial distributed objects characterize the parameters of these models, so the implementation of such models is carried out based on modern GIS technology.

**Summary:** This paper details that clarifying the useful method that to get special data from observation points in ecological stress areas without human factors. In this case environmental monitoring can play more important role to get special data that water quality, water or grand soiling, air quality and others from observation points. We should create sensor network and share special data through servers to different kind of devices that computers or mobile devices.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-220-223>

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## Optimization of hydraulic parameters of irrigation canals in earthen channel

**Abstract:** A review and analysis of the stock and the published materials devoted to the methods of calculating the parameters of irrigation canals. We consider the analysis of the hydraulic characteristics of the channels in earthen channel. It is shown

that to determine the optimal parameters to minimize possible deformations necessary records kinematic parameters of the flow. The analysis of existing dependencies to determine the relative width of the irrigation canals in earthen channel. A new relation relative to the channel width, in view of the kinematics of the turbulent flow and flow channel interaction with the bed soil.

**Keywords:** irrigation system, water, kinematics of stream turbulence of the flow channel cross-section, relative width.

**Relevance of the topic.** At the modern stage of development of water management of market relations and conditions for increasing domestic food shortages, raw materials, resources, occupy a special place on indigenous improvement of the whole complex of water works as part of water economic technologies. Traditional technologies of construction of irrigation systems lead to non-productive costs of raw materials, the equipment, which greatly increases the cost of construction of such facilities, extend their payback. Reduced costs of various building materials in the construction of water facilities through the introduction of innovative technologies and optimization of structural elements of irrigation systems, reducing the time of reconstruction of the system — these are the main areas which should develop the best solutions in the field of irrigation technology.

Irrigation Channels during operation characterized by a significant reduction in bandwidth, which directly influenced the deformation and roughness of the channel, its overgrowing with aquatic vegetation, modes and operating conditions [1–3]. All this eventually leads to a change in the roughness and the coefficient values of hydraulic resistances compared with the design data in the direction of increasing, sometimes several times. Therefore, undercounting of these factors can lead to a loss of hydraulic efficiency of channels, their operational reliability during prolonged operation.

Most of the currently existing dependencies to determine the hydraulic elements, based on bringing even flow of any shape to a rectangular flat stream, excluding the turbulent flow characteristics, so the effect of the shape the channel remained unexplored until recently [3; 4].

If natural wide riverbeds that question is not so essential, the irrigation channels of different sections is very important to establish a distributed shear stresses and friction of the flow rate of the flow depth, and their impact on bandwidth. Open channel often designed at a relatively high speed, so the movement of water in them occurs mainly in the quadratic resistance.

This leads to the necessity of searching the optimal hydraulic elements, depending on the nature and state of the channel bed, in this regard, the development of scientific methods of calculating the flow of elements using new theoretical relations, taking into account the turbulent flow characteristics, is an actual [3–7].

**The research methodology** includes the compilation and scientific analysis of the existing stock, and published materials. The problem is solved by means of special theoretical and field studies on the channels of the Republic of Uzbekistan. The proposed relationship to determine the relative width of the irrigation canal, obtained on the basis of the model of turbulent fluid flow professor K. Sh. Latipov, further developed by the authors. Full-scale research carried out in accordance with conventional methods of field experiments widespread in the hydraulic and hydrological studies.

The existing methods of hydraulic calculations of turbulent flows in channels and rivers based on the concepts and data that were obtained in the late XIX — early XX centuries. Attempts subsequent revisions were in the nature of theoretical constructs obtained on reasonable hypotheses enough, either on semi-empirical approaches, requiring the use of experimental data. To date, there are new methods of measurement and effective methods of experimental data processing with the use of computer technology, which

open up the possibility of further development of hydraulic methods for calculating turbulent flows in open channels. At present, the current situation in this area requires further study the possibility of using previously obtained by hydraulic calculation in the new conditions, as well as the receipt of calculation formulas, suitable for a wider range [8–11].

It is therefore particularly important to clarify, the development and introduction of rational, economical methods of calculation and design of irrigation canals. One of the most important moments in this issue is the question of the definition of morphometric parameters corresponding to the condition of stability of the cross-sections of channels.

Accounting for the effects of many factors on bedforming theoretically extremely difficult. So far evaluation of morphometric dependencies based on empirical approaches. The basis of the existing approaches is to study formed over a long period of time, the channel bed, are in dynamic equilibrium, and the relationship between morphometric elements of the course and the characteristics that define the natural environment in which processes bedforming.

The practical significance of such an approach is very large as far obtained are used depending on the design of sustainable earthen channels [12–14]. The existing methods for calculating the hydraulic channels can be found mention of their connection with the optimal conditions for economic decisions are made, but in fact we are talking about the search for the optimal solution for the parameters that determine the living section of the channel, but not associated with a channel like structure as a whole [5].

The focus of the work [4; 5] is given to the issue of determining the most advantageous in terms of section hydraulics, in an area of the living section, all other things being equal, is minimal. Such cross sections are obtained is not broad, but deep, their creation requires using special equipment and expensive ways to work performance. The main drawback of these papers [7–14], and many other studies posvyashennyh this problem lies in the fact that they hydraulic channel estimates do not relate to finding the optimal structures in general solutions intended for supplying water from one point to another in a uniform mode. Unfortunately, this flaw can be found in modern domestic and foreign studies.

Assessment study morphometric sustainable channel characteristics associated with the work A. A. Cherkasov, E. A. Zamarin, G. S. Chekulaev, V. V. Poslavski, M. A. Velikanov, A. S. Girshkan. Their findings were based on the experimental data on the channels of irrigation systems downstream of the Amu Darya River.

Later these studies were continued by N. A. Rzhantsyn, V. S. Altunin, A. M. Muhamedov, E. K. Rabkova, S. H. Abalyants, Yu. A. Ibad-zade and others with the latest information on new built irrigation systems.

It should be noted that over the years of the last century, researchers have been seeking such a cross-section of the channel in earthen channel, in which the resultant of the forces applied to each particle of soil, would be the same anywhere in the wetted perimeter. The solution to this problem is found in the papers [5,6]. However, to put into practice full-strength cross-section of the channel is practically impossible.

At present has accumulated considerable amount of factual material on channels operating in the different regions and condi-

tions, which may be used for the pooled analysis of these data and the development of computational dependencies. At the modern stage of development of science and the theory of riverbed channel process it can be assumed that there is every reason to take into account in the developed hydraulic dependencies noted above determinants. However, in these terms, the problem turned out to be quite difficult, because of the little-studied form of the theory of kinematic parameters of the turbulent flow.

A group of researchers (H. Aidov, S. Annaev, A. Muhamedov) for developing morphometric dependencies sustainable river beds channel, based on the principle of dimension M.A. Velikanov offer formula:

$$\frac{B}{h_{cp}} = f\left(\frac{Q}{d_{cp}^{2.5} \sqrt{gdJ}}\right) \quad (1)$$

where Q – water flow in the channel, m<sup>3</sup>/s  
 d – diameter of the soil particles, mm;  
 J – the slope surface of the water;  
 g – acceleration of gravity, m/s<sup>2</sup>.

V.S. Altunin based on kinematics and morphological method, using the formula for average speed and average speed equating non-blurry for the soil and an average depth offers [1]:

$$\frac{B}{h_{cp}} = \left(\frac{Q}{d_{cp}^2 \sqrt{gd}}\right)^{1/8}, \quad (2)$$

At research of the issue of optimization of parameters of the channel based on the practical aspects of S.A. Girshkan suggested dependence [2]:

$$\frac{B}{h_{cp}} = 3\sqrt[4]{Q} + m, \quad (3)$$

where m – the coefficient of slope.

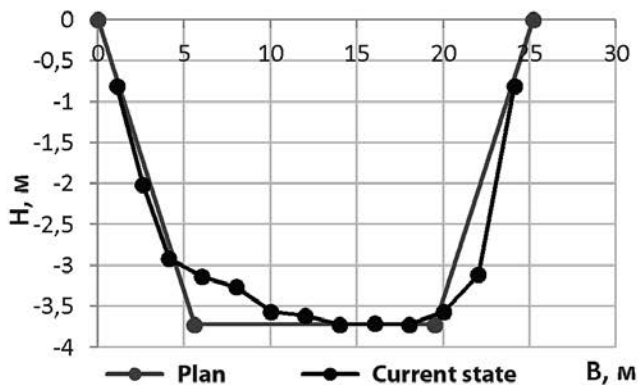


Figure 1. Comparison design and field data channel Tashkent. PC 257 + 00

The cross section of the channels should be sufficiently resistant against riverbed non-siltation, non-erodibility stability and cross-sectional shape for a long period of operation.

Considering the above mentioned methods as a supplement proposes a new relationship for the determination of morphometric parameters of irrigation canals in earthen channel. In developing the proposed according to the relative width of the channel we passed a law on the constancy of the resistance section of the perimeter, according to [9]. This means that in the channels of sustainable sectional friction force of the flow cross section for the perimeter, must be constant. Reduction or increase in frictional force any field causes drift and erosion as long as it does not become constant along the

E. K. Rabkova and V.V. Petrov based on generalizations broad analysis with field data, taking into account factors that affect the process of forming a sustainable channel, offers the following analytical dependence for relative widths:

$$\frac{B}{h} = KQ^{0.2}, \quad (4)$$

where  $K = \frac{K_h}{K_b}$  ratio is determined depending on the soil bed [2].

Analysis of the above mentioned methods for the determination of morphometric parameters of the flow has a different character. This circumstance requires, further trials in determining the characteristics of hydraulic flow, taking into account many factors behind an sustainable formation section of the channels in earthen channel.

As is known, the design of irrigation canals occupies a special place setting of hydraulic parameters of the cross-section of the channel. The selected section of the channel with a certain optimal hydraulic parameters must be sufficiently resistant bed for a long period of operation.

However, experimental and full-scale studies have shown that the cross-section of channels on a straight section of earth in terms of the channel are curved kind of semi-ellipse or a cosinusoid. This is also confirmed in [4; 7; 11] that the shape of the channels formed by the turbulent flow, has a curved shape.

According to many field data, the flow velocity divided by the width of the channel is fairly evenly, significantly decreasing only within the coastal slopes, where the impact is more pronounced transverse vortex structures with scale commensurate with the size of the flow cross-section. The bed of the channel, affecting hydraulic resistance and the internal structure of the kinematic flow by acting on the boundary surface of the channel, change its shape. As a result, the projected any form of channel section takes a curved outline (Figure 1–2).

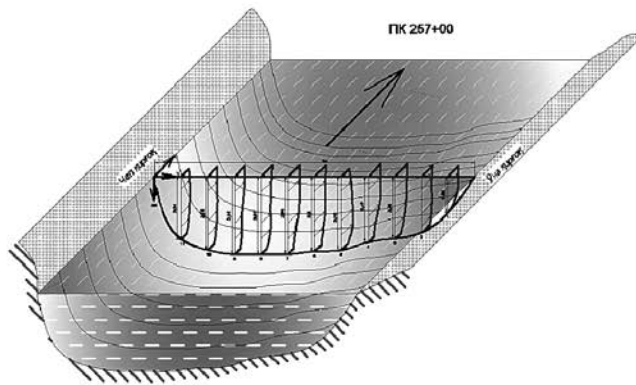


Figure 2. Modifying the channel cross-section of Tashkent. PC 257 + 00

perimeter of the section. Thus, we posed the problem is solved on the basis of the equations of motion of turbulent flow [3,9], in view of the turbulent flow characteristics and channel status.

As a result, the dependence of the relative width of the irrigation canals in earthen channel providing channel-section stability.

$$\frac{B}{h} = \frac{\rho g i}{\tau_{don} \alpha} \frac{1}{\alpha} \ln\left(\frac{sh\alpha h + ch\alpha h + 1}{sh\alpha h - ch\alpha h + 1}\right), \quad (5)$$

where h – the depth of the channel, m;  
 B – width of the channel at the water's edge, m;  
 ρ – density of water, kg/m<sup>3</sup>;  
 g – acceleration of free fall, MS<sup>2</sup>;  
 i – the slope of the water surface (in uniform motion the flow

of free water surface slope and channel bed are equal);

$$\alpha = \sqrt{\frac{L}{\mu}}, L - \text{parameter that takes into account the turbulent}$$

$$\text{flow characteristics; } L = 0,0025 \cdot \frac{\sqrt{i} \cdot \sqrt{g} \cdot \rho}{n \cdot h^{\frac{1}{2}}}$$

$$\mu - \text{dynamic viscosity coefficient, Hc/m}^2$$

$n$  – roughness coefficient channel bed;

$ch$  – hyperbolic cosine of the angle;

$sh$  – hyperbolic sine of the angle;

To assess the formation of a stable cross-section of irrigation canals were analyzed results of field and laboratory studies of a number of researchers, including our study table 2.

Table 2. – Results of a comparison of the offered method with the methods of other authors

Channel Name	$Q, \text{ m}^3/\text{c}$	Relative width at the top, B/h				
		V. S. Altunin	S. A. Girshkan	E. K. Rabkova	Measured	Proposed
Tashkent	74,0	11,7	10,3	10,2	7,5	9,7
Khandam	10	12,8	6,8	6,8	6,4	6,5
Parkent	26	34,7	7,5	7,5	9,5	9,2
The Large Andijan Canal	100	24,9	9,5	10,9	11,3	5,8
The Large Ferghana Canal	36,0	17,7	9,1	8,8	11,5	12,0
Mirishkor	100	22,0	13,2	11,5	11,5	10,6
Kegeyli	140	12,7	11,8	11,6	13,0	12,8
Kuanysy-Zharma	185	26,9	12,6	12,3	14,2	13,8
Suyenli	130	25,8	11,3	11,4	10,0	10,3
Parallel	140	26,0	11,5	11,6	9,9	10,1
Kyzketken	400	19,0	15,4	14,3	18,4	18,3

As can be seen, the comparative analysis sushestvuet dependencies for the relative width of the stream in earthen channel, proposed V. S. Altunin, S. A. Girshkan, E. K. Rabkova and has a large deviation from the natural settings. The reason for this is undercounting many factors characterizing the course of development of hydraulic parameters depending on the driving mode, as well as interaction of the flow channel and a ground box. As can be seen from table 2, under identical conditions tehze relative width of

the channels sushestvuet methods it has the highest deviation from the measured parameters as compared to the proposed plan. As the results of the calculation of the present embodiment, the relative channel widths were close to the design data. It can be concluded that the proposed dependence of the relative flow in a channel width earthen channel based on the theory of flow, taking into account the interaction and flow channel bed soil is the most appropriate in comparison with known dependencies.

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## About the method of determining the symmetrical components of voltages and currents

**Abstract:** The article presents the methods of determination of the symmetrical components of voltages and currents. The existing methods of calculation of the symmetrical components of voltages and currents are analyzed. The biggest attention is paid to the analytical method of calculation. Accurate and universal equations are presented.

**Keywords:** method of symmetrical components, asymmetry of current and voltage.

With the development and wide spread of three-phase systems of alternating current, the need in accurate description of their asymmetrical regimes, quite diverse in their nature, has come up. Currently, asymmetrical regimes are becoming not only emergency, but also operating modes. Asymmetrical regime can be comparatively easily calculated with the use of method of symmetrical components. Moreover, only the use of the method of symmetrical components provides an opportunity to determine currents and voltages in the rotating machines of alternating current, i. e. in such installations, the input resistances of which depend on the order of alternation of phases of supply line.

According to the method of symmetrical components, the linear symmetrical components of voltages and currents are defined as follows:

$$U_1 = \frac{1}{3} \cdot (U_{AB} + a \cdot U_{BC} + a^2 \cdot U_{CA}), \quad (1)$$

$$U_2 = \frac{1}{3} \cdot (U_{AB} + a^2 \cdot U_{BC} + a \cdot U_{CA}), \quad (2)$$

$$\varepsilon_2 = \frac{U_1}{U_2} \cdot e^{j\varphi_2}, \quad (3)$$

$$I_1 = \frac{1}{3} \cdot (I_A + a \cdot I_B + a^2 \cdot I_C), \quad (4)$$

$$I_2 = \frac{1}{3} \cdot (I_A + a^2 \cdot I_B + a \cdot I_C), \quad (5)$$

$$I_0 = \frac{1}{3} \cdot (I_A + I_B + I_C), \quad (6)$$

where  $U_{\nu}, I_{\nu}$  — complex voltage and current in the phase A of linear symmetrical components of direct sequence;  $U_2, I_2$  — complex voltage and current in the phase A of linear symmetrical components of inverted sequence;  $I_0$  — current of symmetrical components of zero sequence;  $U_{AB}, U_{BC}, U_{CA}, I_A, I_B, I_C$  — complex values of linear voltages and currents;  $\varepsilon_2$  — complex coefficient of asymmetry of voltage on the inverted sequence;  $\varphi_2$  — argument of the coefficient of asymmetry on the inverted sequence;  $a$  — phase operator ( $a = e^{j120^\circ}$ ).

Phase symmetrical components of voltages and currents are defined according to the equations:

$$U_{1\phi} = \frac{1}{3} \cdot (U_A + a \cdot U_B + a^2 \cdot U_C), \quad (7)$$

$$U_{2\phi} = \frac{1}{3} \cdot (U_A + a^2 \cdot U_B + a \cdot U_C), \quad (8)$$

$$U_0 = \frac{1}{3} \cdot (U_A + U_B + U_C), \quad (9)$$

$$\varepsilon_0 = \frac{U_0}{U_1} \cdot e^{j\varphi_0}, \quad (10)$$

$$I_{1\phi} = \frac{1}{3} \cdot (I_{AB} + a \cdot I_{BC} + a^2 \cdot I_{CA}), \quad (11)$$

$$I_{2\phi} = \frac{1}{3} \cdot (I_{AB} + a^2 \cdot I_{BC} + a \cdot I_{CA}), \quad (12)$$

where  $U_{1\phi}, I_{1\phi}$  — complex voltage and current (in the phase A) of symmetrical components of direct sequence;  $U_{2\phi}, I_{2\phi}$  — complex voltage and current (in the phase A) of symmetrical components of inverted sequence;  $U_0$  — voltage of symmetrical components of zero sequence;  $U_{A'}, U_{B'}, U_{C'}, I_{A'}, I_{B'}, I_{C'}$  — phase voltages and currents;  $\varepsilon_0$  — complex coefficient of asymmetry of voltage on the zero sequence;  $\varphi_0$  — argument of the coefficient of asymmetry on the zero sequence.

The relation of the modules of linear symmetrical components to the phase ones is  $\sqrt{3}$ .

The calculation of each of symmetrical components of voltages and currents of three-phase network in the equations (1)–(12) presupposes preliminary measurement of three vectors (three modules and three phases), i. e. six values, which presents significant difficulties in their measurements and leads to bigger errors of measurement and determination of symmetrical components.

In the practice of exploitation of electrical networks, linear and phase voltages and currents are measured with the help of voltmeters and ampere-meters. Herewith, they take the form of real numbers, and not complex ones, as it is specified in (1)–(12), thus, it is reasonable to consider the ways of determination of symmetrical components according to the results in the real electrical networks.

The existing ways of determination of symmetrical components can be divided into the analytical methods of calculation, definition with the help of graphical constructions, nomograms and tables. Analytical methods of calculation are divided into accurate, requiring the use of the means of computing technology in most cases, and approximate.

The accurate analytical ways of calculations include formulas recommended in [1]. Thus, the existing values of voltages of the direct  $U_1$  and inverted  $U_2$  sequences, according to [1], are recommended to be calculated according to the equations (1) (2), which can be unified:

$$U_{1,2} = \sqrt{\frac{1}{12} \left[ \left( \sqrt{3} \cdot U_{AB} \pm \sqrt{4 \cdot U_{BC}^2 - \left[ \frac{U_{BC}^2 - U_{CA}^2}{U_{AB}} + U_{AB} \right]^2} \right)^2 + \left( \frac{U_{BC}^2 - U_{CA}^2}{U_{AB}} \right)^2 \right]} \quad (13)$$



where  $U_{AB}, U_{BC}, U_{CA}$  — applicable values of interphase voltages.

The presented equation provides accurate decision, but the sphere of its application is limited: in the case of extreme asymmetry at  $U_{AB}=0$  and  $U_{BC}=U_{CA}$  the fractions in the radical expression give an uncertainty in the form of

$$\frac{U_{BC}^2 - U_{CA}^2}{U_{AB}} = 0 \quad (14)$$

In addition, the equation (13) refers to the private case of the method of symmetrical components, when the initial vectors of linear voltages form a closed triangle, i. e. the conditions are performed:

$$\left. \begin{aligned} U_{CA} + U_{BC} &\geq U_{AB}, \\ U_{AB} + U_{BC} &\geq U_{CA}, \\ U_{CA} + U_{AB} &\geq U_{BC}, \end{aligned} \right\}$$

which should be taken into account, because, in practice, inaccuracies in the metering of measurement devices are possible.

Same applies to the calculation of applicable values of current of the direct and inverted sequence according to the equations identical to (13):

$$I_{1,2} = \sqrt{\frac{1}{12} \left[ \left( \sqrt{3} \cdot I_A \pm \sqrt{4 \cdot I_B^2 - \left[ \frac{I_B^2 - I_C^2}{I_A} + I_A \right]^2} \right)^2 + \left( \frac{I_B^2 - I_C^2}{I_A} \right)^2 \right]} \quad (15)$$

where  $I_A, I_B, I_C$  — applicable values of the phase currents.

To determine the applicable value of the voltage of zero sequence in [1], it is recommended to use the equation:

$$U_0 = \frac{1}{6} \sqrt{\frac{\left[ \frac{U_{BC}^2 - U_{CA}^2}{U_{AB}} - 3 \cdot \frac{U_B - U_A}{U_{AB}} \right]^2 + \left[ \frac{U_{BC}^2 - U_{CA}^2}{U_{AB}} - 3 \cdot \frac{U_B - U_A}{U_{AB}} \right]^2}{4 \cdot U_{BC}^2 - \left( U_{AB} + \frac{U_{BC}^2 - U_{CA}^2}{U_{AB}} \right)^2 - 3 \cdot \left[ \frac{U_{BC}^2 - U_{CA}^2}{U_{AB}} - 3 \cdot \frac{U_B - U_A}{U_{AB}} \right]^2}} \quad (16)$$

where  $U_A, U_B, U_C$  — applicable values of phase voltages.

During the determination of  $U_0$  in four-phase networks according to (16) at  $U_{AB}=0$  and  $U_{BC}=U_{CA}$  (two-phase short circuit), the equation gives uncertainty identical to (14) and, thus, it is not used in extreme cases of asymmetry. Moreover, the equation (16) is notable for crotchhood, which makes it difficult to use it for practical purposes.

[1] presents the equations for tasks, where only the calculation of modules of symmetrical components and coefficients of asymmetry is required, but there are not expressions to determine phase angles  $\varphi_2$  and  $\varphi_0$ .

[2] presents the equations to determine symmetrical components presupposing the measurement of absolute values of three, and to determine the component of zero sequence — six (three linear and three phase) voltages:

$$U_1 = \frac{U_{AB}}{3} \sqrt{\left[ 1 + x \cdot \cos \left( \arccos \frac{1+x^2-y^2}{2 \cdot x} - \frac{\pi}{3} \right) + y \cdot \cos \left( \frac{\pi}{3} - \arccos \frac{1+y^2-x^2}{2 \cdot y} \right) \right]^2 + \left[ x \cdot \sin \left( \arccos \frac{1+x^2-y^2}{2 \cdot x} - \frac{\pi}{3} \right) + y \cdot \sin \left( \frac{\pi}{3} - \arccos \frac{1+y^2-x^2}{2 \cdot y} \right) \right]^2} \quad (17)$$

$$U_2 = \frac{U_{AB}}{3} \sqrt{\left[ 1 + x \cdot \cos \left( \arccos \frac{1+x^2-y^2}{2 \cdot x} + \frac{\pi}{3} \right) + y \cdot \cos \left( \frac{\pi}{3} + \arccos \frac{1+y^2-x^2}{2 \cdot y} \right) \right]^2 + \left[ x \cdot \sin \left( \arccos \frac{1+x^2-y^2}{2 \cdot x} + \frac{\pi}{3} \right) - y \cdot \sin \left( \frac{\pi}{3} + \arccos \frac{1+y^2-x^2}{2 \cdot y} \right) \right]^2} \quad (18)$$

$$U_0 = \frac{1}{3} \sqrt{3 \cdot U_A^2 (1+x_0^2+y_0^2) - U_{AB}^2 (1+x^2+y^2)}, \quad (19)$$

where

$$y_0 = \frac{U_C}{U_A}, x_0 = \frac{U_B}{U_A}, x = \frac{U_{BC}}{U_{AB}}, y = \frac{U_{CA}}{U_{AB}}, \quad (20)$$

There are also equations to determine phase angles of the vectors of voltages of the direct ( $\varphi_{AB}^+$ ) and inverted ( $\varphi_{AB}^-$ ) sequences relative to the vector of voltages in the phase AB [2]:

$$\varphi_{AB}^+ = \arctg \frac{y^2 - x^2}{\sqrt{3} + \sqrt{2 \cdot x^2 \cdot y^2 + 2 \cdot x^2 + 2 \cdot y^2 - 1 - x^4 - y^4}} - \pi \cdot n, \quad (21)$$

$$\varphi_{AB}^- = \arctg \frac{x^2 - y^2}{\sqrt{3} - \sqrt{2 \cdot x^2 \cdot y^2 + 2 \cdot x^2 + 2 \cdot y^2 - 1 - x^4 - y^4}} - \pi \cdot n, \quad (22)$$

where  $n$  is established according to the sign of numerator and denominator of equations (21)–(22).

As it is seen from (17)–(22), in the event of equality of any linear voltages to zero (for  $U_{AB}, \varphi_{AB}^+, \varphi_{AB}^- - U_{AB}=0$ ), the equations give the division by zero and, consequently, are limited in use. Moreover, (17)–(20), (21), (22) represent complex mathematical expressions and require significant calculations.

According to [3], the algorithm with the highest accuracy of calculation (with the procedure error  $\Delta_n=0$ ) of symmetrical components  $U_1$  and  $U_2$  is based on the correlations of the triangle [4]. In the obtaining the expressions [4], vector  $U_{AB}$  was accepted as real axis relative to which, phases of vectors  $U_1$  and  $U_2$  were determined.

At the same time, the algorithm [4] is difficult to use for quick evaluation of the values of  $U_1$  and  $U_2$  (it contains 19 arithmetical operations and two operations of square rooting), hence, in [3], its analytical simplification at the expense of the fact that real axis is directed along the vector of direct sequence is done. In this case, the relation of linear expressions with voltages  $U_1$  and  $U_2$  is expressed with the system of equations

$$\left. \begin{aligned} U_{AB} &= \sqrt{(U_1 + U_2 \cdot \cos \varphi_2)^2 + U_2^2 \cdot \sin^2 \varphi_2}, \\ U_{BC} &= \sqrt{((U_1 + U_2 \cdot \cos(\varphi_2 + 120^\circ))^2 + U_2^2 \cdot \sin^2(\varphi_2 + 120^\circ)),} \\ U_{CA} &= \sqrt{((U_1 + U_2 \cdot \cos(\varphi_2 - 120^\circ))^2 + U_2^2 \cdot \sin^2(\varphi_2 - 120^\circ)),} \end{aligned} \right\} \quad (23)$$

the solution of which, after further simplifications, made in [6], leads to the result:

$$U_{1,2} = \sqrt{\frac{1}{6} \left[ \frac{U_{AB}^2 + U_{BC}^2 + U_{CA}^2 \pm \sqrt{3} \cdot \sqrt{4 \cdot U_{AB}^2 \cdot U_{BC}^2 - (U_{AB}^2 + U_{BC}^2 + U_{CA}^2)^2}}{4 \cdot U_{AB}^2 \cdot U_{BC}^2 - (U_{AB}^2 + U_{BC}^2 + U_{CA}^2)^2} \right]} \quad (24)$$

As calculations showed, the equations (24) give accurate solutions in all cases, do not have limitations of the sphere of use like equations (13), (17), (18) and are simpler in calculations than the expressions from [1].

Considering a known correlation of modules of linear and phase symmetrical components from (24), one can obtain equations for phase symmetrical components, which were also received in the work [5]:

$$U_{1,2\phi} = \sqrt{\frac{1}{18} \left[ \frac{U_{AB}^2 + U_{BC}^2 + U_{CA}^2 \pm \sqrt{3} \cdot \sqrt{4 \cdot U_{AB}^2 \cdot U_{BC}^2 - (U_{AB}^2 + U_{BC}^2 + U_{CA}^2)^2}}{4 \cdot U_{AB}^2 \cdot U_{BC}^2 - (U_{AB}^2 + U_{BC}^2 + U_{CA}^2)^2} \right]} \quad (25)$$

Such equations can also be used to determine linear and phase symmetrical components of currents identically with (15):

$$I_{1,2} = \sqrt{\frac{1}{6} \left[ I_A^2 + I_B^2 + I_C^2 \pm \sqrt{3} \cdot \sqrt{4 \cdot U_A^2 \cdot U_B^2 - (U_A^2 + U_B^2 + U_C^2)^2} \right]}$$

$$I_{1,2\phi} = \sqrt{\frac{1}{18} \left[ I_{AB}^2 + I_{BC}^2 + I_{CA}^2 \pm \sqrt{3} \cdot \sqrt{4 \cdot I_{AB}^2 \cdot I_{BC}^2 - (I_{AB}^2 + I_{BC}^2 + I_{CA}^2)^2} \right]}$$

Based on the known correlations of the method of symmetrical components,

$$\left. \begin{aligned} U_A &= U_{1\phi} + U_{2\phi} + U_0, \\ U_B &= a^2 \cdot U_{1\phi} + a \cdot U_{2\phi} + U_0, \\ C &= a \cdot U_{1\phi} + a^2 \cdot U_{2\phi} + U_0, \end{aligned} \right\} \quad (25)$$

and equations (7) — (9), the calculation of symmetrical component of voltage of zero sequence can be done according to the equation

$$U_0 = \sqrt{\frac{1}{3} \cdot (U_A^2 + U_B^2 + U_C^2 - U_1^2 - U_2^2)},$$

which, considering (24), takes form:

$$U_0 = \frac{1}{3} \sqrt{3 \cdot (U_A^2 + U_B^2 + U_C^2) - U_{AB}^2 - U_{BC}^2 - U_{CA}^2}. \quad (26)$$

The equation (26) gave accurate results in all cases during calculations, doesn't have limitations in the sphere of use like (16), (19) and has a simpler form than the equation from [1].

Based on (26), the equation to determine symmetrical component of current of zero sequence will be an equation:

$$I_0 = \frac{1}{3} \sqrt{3 \cdot (I_{AB}^2 + I_{BC}^2 + I_{CA}^2) - I_A^2 - I_B^2 - I_C^2}.$$

For quick evaluation of  $U_1, U_2, U_0$  in [1], it is permissible to use approximate equations:

$$U_1 = \frac{1}{3} \cdot (U_{AB} + U_{BC} + U_{CA}), \quad (27)$$

$$U_2 = 0,62 \cdot (U_{нб} - U_{нм}), \quad (28)$$

$$U_0 = 0,62 \cdot (U_{нб.ф} - U_{нм.ф}), \quad (29)$$

where  $U_{нб}$  ( $U_{нб.ф}$ ),  $U_{нм}$  ( $U_{нм.ф}$ ) — the most and least applicable values from three interphase (phase) voltages.

Unlike precise equations, the determination of symmetrical currents according to (28) and (29) is not permissible because  $I_2$  and  $I_0$  can reach significant values and these equations are based on the allowances:  $U_2 \ll U_1$  and  $U_0 \ll U_1$ , which are usually performed in the networks of electric supply.

The attempts to simplify the definition of symmetrical components with the help of graphic constructions [6], nomograms [2, 7], tables [2] have been made repeatedly.

Geometric constructions allow clearly determining the calculation equations but require significant time.

Nomograms, despite small accuracy defined by one-two signs, play quite important role in the analysis of asymmetrical processes, definition of maximal values of linear and phase voltages and currents, qualitative evaluation of non-balanced processes during the prediction of dynamics of multi-phase systems in the emergency regimes, calculations of short circuits.

Despite the simplicity and sufficient accuracy, the tables and nomograms are not convenient to use during the processing of a big amount of measurement data.

Due to the availability of means of computing technology during the processing of a big amount of information, which is related to the control of quality of electric energy, precise analytical methods of determination of symmetrical components are preferred. The calculation of symmetrical components of voltages should be done according to the equations (24), (26), which have advantages before the equations recommended by GOST 32144–2013: and are more universal; give an opportunity to determine complex values and are simpler in calculation. Proposed expressions can be used to calculate complex values of symmetrical components of currents.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-226-228>

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## Doing up the scattered seeds of wheat soil of the furrow collected at formation

**Abstract:** In article problems about fillers are studied by the soil received from irrigating groove, the scattered seeds of wheat on a furrow on the basis of it parametres furrow and its wings for filling up are defined.

**Keywords:** The open space, the special installation, the new technology, irrigated flute, stroke soils, hillers with wings, a surface, a return proportion.

For crops of seeds of wheat on the open space in Republic farms disk seeders of type C3 [1, 87–88] till now were used. However, in view of their small quantity, for these purposes the adapted seeders of type HPY-0,5 and KPX-4 are applied. In this case, after scattering of seeds and cutting of irrigating furrows, along the edges of furrows the layer of earth that leads to decrease in a useful area of crops [2, 39–42] gathers. This process is shown on figure 1.

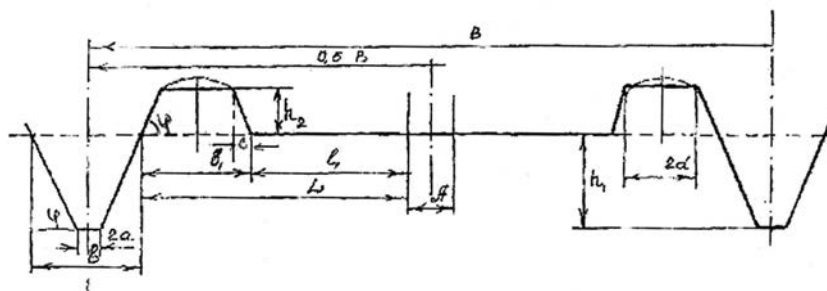


Figure 1. Formation of a soil layer at cutting of irrigating furrows.

The design of the given device consists of two parts (fig. 2): the first part (1) — serves for cutting irrigating furrow; the second part (2) — wings of a special configuration.

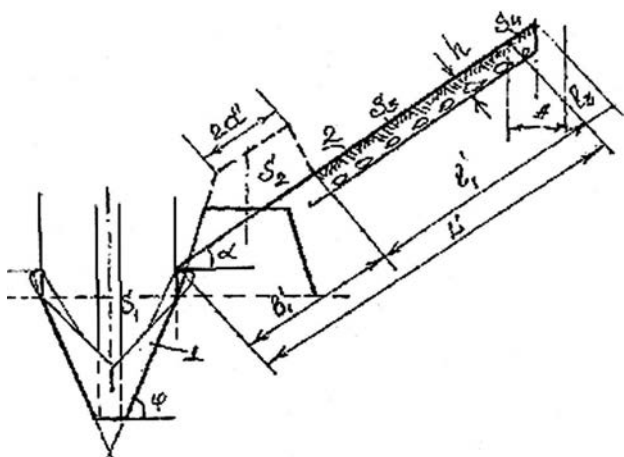


Figure 2. The scheme spreading soils on a surface of a furrow and definition of its parameters

At cutting irrigating furrow on their edges the layer of earth which then by means of wings is in regular intervals leveled over the scattered seeds gathers. In drawing one part of this wing is shown. For prevention of increase in a layer of earth and accordingly increases in forces of resistance, wings furrow are established under a corner  $\alpha$  to a horizontal plane.

**Definition of the area of a cross-section thickness of a layer of earth spreading on a furrow with the scattered seeds.** Width of a furrow we will designate through  $L=B_1+l_1$ . On a furrow surface on which seeds are in regular intervals scattered, by means of wings furrow it is necessary to spread a uniform layer of earth. The size of a wing we will designate through  $L^1 = \sigma_1^1 + l_1^1$ , where:

$$\sigma_1^1 = \frac{\sigma_1}{\cos \alpha}; \quad l_1^1 = \frac{l_1}{\cos \alpha}; \quad L^1 = \frac{\sigma_1 + l_1}{\cos \alpha}; \quad (1)$$

Where  $B_1$  — Width of the basis of a layer of earth, sm;

$l_1$  — The distance between a layer of earth and the wing end, sm.

If to express volume of a layer of earth leveled on a surface of grains through cross-section area  $S_3$  we will receive:

$$S_3 = L^1 \cdot h_3 = \frac{\sigma_1 + l_1}{\cos \alpha} \cdot h_3 \quad (2)$$

Where  $h_1$  — thickness a layer of earth on a surface of grains.

At increasing an installation corner  $\alpha$  the length covered increases and on the contrary.

At  $\alpha=0$  length covered will be the least and resistance of a layer of earth of the greatest. At  $\alpha=90^\circ$  length covered will be maximum and on a surface of grains soil is not leveled.

**Definition of parameters of a layer of earth.** The soil volume should be such that it was spread a uniform layer defined height. The bias of this layer trapezium shape should correspond to a bias of an irrigating furrow. If we consider, that the soil is leveled without a bias the cross-section area of layer  $S_2$  will be defined as follows:

$$S_2 = \frac{(b_1^1 + 2d^1)}{2} \cdot h_2 \quad (3)$$

Where  $b_1^1$  — length of the bottom basis of a trapeze, at a bias equal  $\alpha$ , sm;

$h_2$  — Height of a layer of earth, sm;

$2d^1$  — length of the bottom basis, at a bias equal  $\alpha$ , sm.

The length of the bottom basis will be:

$$2d^1 = \sigma_1^1 - 2c; \quad c = h_2 \cdot \text{ctg} \phi \quad (4)$$

$$\text{Or, } 2d^1 = \sigma_1^1 - 2h_2 \text{ctg} \phi \quad (5)$$

In that case  $S_2$  will be:

$$S_2 = \frac{(2\sigma_1^1 - 2h_2 \text{ctg} \phi) h_2}{2} = (\sigma_1^1 - h_2 \text{ctg} \phi) h_2 \quad (6)$$

If to designate through to factor of expansion of volume of soil we will receive:

$$S_2 = k \cdot h_2 (\sigma_1^1 - h_2 \text{ctg} \phi) \quad (7)$$

Where  $k=1,20 \dots 1,25$  — factor of expansion of volume of the loosened soil [3].

The zone A in the middle of a furrow should become covered by a part of soil collected by working body. This process is carried out by wings of a corresponding configuration. This area we will designate through  $S_4$ , where:

$$S_4 = l_3 \cdot h_3; \quad l_3 = \frac{0,5 A}{\cos \alpha} \quad (8)$$

Then  $S_2$  it is possible to divide on two components:

$$S_2 = S_3 + S_4 \quad (9)$$

Substituting values and sampling, we will receive:

$$\kappa h_2^2 \operatorname{ctg} \phi - \kappa \theta_1^1 h_2 + h_3 (l_1^1 + \theta_1^1) + l_3 h_3 = 0 \quad (10)$$

If  $a = \kappa \operatorname{ctg} \phi$ ;  $\theta = \kappa \theta_1^1$ ;  $c = h_3 (l_1^1 + \theta_1^1) + l_3 h_3$ , we will receive:

$$a h_2^2 - \theta h_2 + c = 0 \quad (11)$$

Where

$$h_2 = \frac{\kappa \cdot \theta_1^1 \pm \sqrt{(\kappa \theta_1^1)^2 - 4 \kappa \operatorname{ctg} \phi [h_3 (l_1^1 + \theta_1^1) + h_3 l_3]}}{2 \kappa \operatorname{ctg} \phi} \quad (12)$$

The sizes irrigating furrow it is defined from equality of trapezes ABCO and O $\Delta$ EF (fig. 3). Designating the area of trapeze ABCO through  $S_1$  and the area of trapeze O $\Delta$ EE through  $S_2$ , we find depth of an irrigating furrow h

$$S_1 = S_2 \quad (13)$$

$$\frac{2a^1 + \theta_1^1}{4} \cdot h_1 = \frac{2d^1 + \theta_1^1}{2} h_2 \quad (14)$$

$$h_1 = \frac{2(2d^1 - \theta_1^1)}{2a^1 + \theta_1^1} \cdot h_2 = \frac{4d^1 + 2\theta_1^1}{2a^1 + \theta_1^1} \cdot h_2 \quad (15)$$

The general depth of a furrow after leveling by a layer of earth:

$$h = h_1 + h_3 \quad (16)$$

Where h — the general cross-section depth of a furrow, sm.

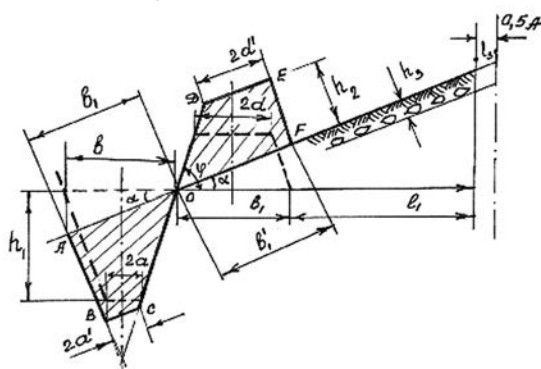


Figure 3. The scheme to definition of depth of an irrigating furrow

Considering that depth of a furrow should be uniform and accepting an inclination corners  $\alpha$  (fig. 3), we will define its sizes:

$$\theta = \theta_1 \cdot \cos \alpha \quad \text{and} \quad 2a = 2a^1 \cdot \cos \alpha \quad (17)$$

Being based on the sizes  $\theta_1=12$  sm,  $2a=4$  sm,  $2d=6$  sm and  $\alpha=60^\circ$  and accepting width of a furrow equal  $B=90$  sm,  $A=20$  sm we define the sizes for  $h_3=1$  sm, 2 sm, 3 sm, 4 sm, 5 sm and 6 sm.

Results are shown on figure 4, whence it is possible to establish depth of an irrigating furrow depending on height of a layer of earth on a surface of seeds of wheat.

**Definition distance between the ends of wings.** The distance between the ends of wings is defined as follows:

$$B^1 = \theta \cdot 2\theta_1 + 2\theta l_1 \quad \text{and} \quad B^1 = \theta + 2L \quad (18)$$

$h_1$  – depth of a furrow,  $h_2$  – height a layer of earth,  $h_3$  – height of a layer of earth on a surface of seeds.

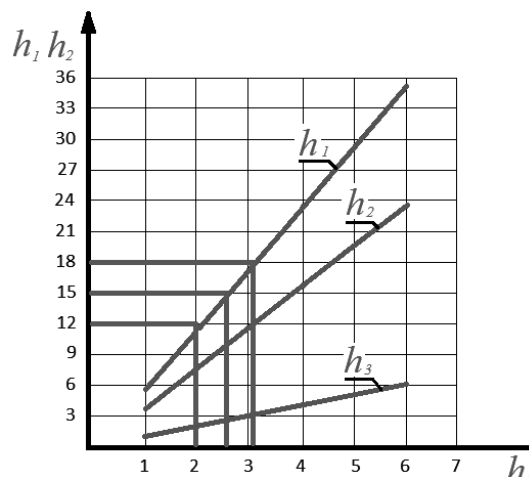


Figure 4. Dependence of height of a layer of earth and depth of a furrow on height spreading a layer of earth on wheat seeds

**Definition of a corner of an inclination of wings  $\alpha$ .** The corner of an inclination of wings is defined considering resistance of a layer of earth and also this layer should not be excessive (i. e. ahead of wings the excessive layer should not gather).

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-228-230>

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## Mobile water measuring weir with rectangular opening for farmlands

**Abstract:** The article shows the importance of equipping seasonal irrigation canals with water measuring devices and describes a mobile water measuring weir with a rectangular opening. It also provides some simple formulas for main sizes for weir elements and instructions for its installation.

**Keywords:** accurate water measurement, seasonal irrigation canals, mobile water measuring weir, rectangular opening, rubberized material.

Public concept about limited water distribution and control changes continuously and the reason for it is the fact that the competition has been increasing between various water using spheres of economy, such as, for example, agriculture, industry, municipal water use, esthetic water use, recreation and many others. Since the water resources are limited, main researches in the sphere of water use must be based on the amount of water used, consciously wasted water amounts, water use impact on environment and etc. Water users will have to increase their share of water use by the means of the latest technologies and the most efficient key to such technology is accurate water measurement practices.

Organization of farm enterprises in the Republic of Uzbekistan resulted in the increase of the number of water consumers significantly. Therefore, the problem of delivering water to each consumer, i. e. farmer by their schedule complicated even further, but still each farmer must receive water according to determined irrigation norms, their plant type and other factors [1].

Stationary water discharge measuring weirs made of steel sheets are well known. Stationary weirs are bulky and their installation at seasonal irrigation canals is unreasonable since seasonal irrigation canals are built for one season. Besides, the number of sectional and seasonal canals is so large, that their equipping with measuring devices requires significant material costs and land alienations. They cannot be carried over from one place to another [2].

Farmer must know, what amount of water is necessary to grow a plant and order that amount exactly, therefore water measurement must be organized directly in the field. Installation of 31 thousand water measuring devices throughout the republic has been foreseen. Besides that, equipping field water distribution canals with water measurers would be reasonable [3].

Based on the above-mentioned facts, mobile water measuring weir with rectangular opening has been constructed by Prof. M. R. Bakiev, Ph. D. E. I. Kirillova, assistant J. M. Choriev in the department of Hydraulic construction and engineering structures of the Tashkent institute of Irrigation and melioration. These mobile water measuring weirs are 3–4 times cheaper than the stationary ones, and they can be carried over to the next field after watering the previous one or can be reassembled and kept for use next season.

Picture 1 illustrates the structure of the mobile water measuring weir with rectangular opening.

The body of the weir is made of rubberized fabric (1), it has a rectangular opening (2) for water passage, glued or sewed sleeves (3) for vertical bars (4, 5), horizontal bars (6, 7), openings (8) for stakes (9) to fasten the weir on the canal bottom, scale (10) to measure pressure head and discharge, apron (11) to protect canal bottom from scouring, glued or sewed patches (12, 13) for strengthening angles and holes. Measuring rod (17) and cross level (18) are also added to the weir. The measuring rod is installed at the distance of  $3H$  ( $H$ —water depth) from the weir at the head race. The cross level is used to make sure the weir is installed horizontally level.

Horizontal and vertical bars have curved ends to make sure they overpass through sleeves.

In order to raise the stability of weir the horizontal bars are doubled in separate sleeves.

Pressure head measuring scale can be printed on the fabric directly or can be glued or sewed separately. The scale shows the pressure head and discharge value, so the discharge passing through the weir can be read directly.

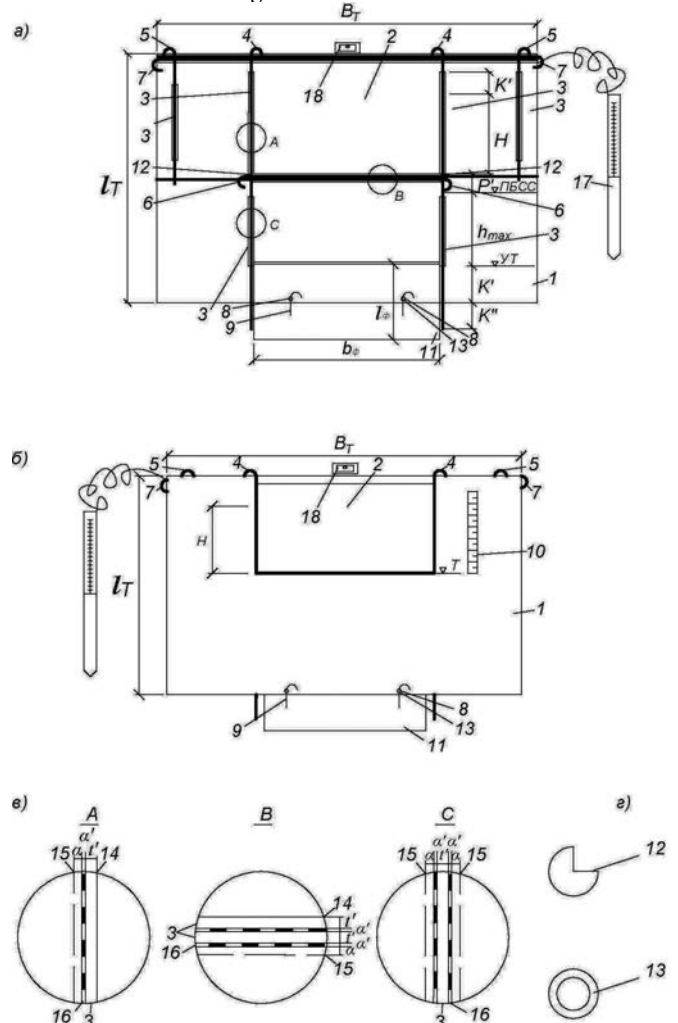
Such mobile water measuring weir can be fabricated individually by a farmer.

1. For individual fabrication the canal sizes and maximal discharge must be known.

2. For mass production of it the typical sizes and maximal discharges of sectional canals and seasonal canals are taken as a basis.

3. The necessary width of rubberized material (1)  $B_T$  depends on the width of the weir opening, and the distance from sides to slopes on each side must be no less than  $h_{max}$ .

4. Weir material height



Picture 1. Mobile water measuring weir with rectangular opening

a) head race view; б) tail race view; B) joints; r) patches.

1 – rubberized material body; 2 – discharge opening; 3 – vertical and horizontal bar sleeves; 4 – side bars; 5 – berm bars; 6 – bottom horizontal bars; 7 – upper horizontal bars; 8 – openings for bottom stakes; 9 – bottom stakes; 10 – measuring scale; 11 – apron; 12 – angle patch; 13 – circle patch; 14 – material bending line; 15 – material cutting line; 16 – seam; 17 – measuring rod; 18 – cross level;  $\nabla T$  – weir threshold mark;  $\nabla \Pi БСС$  – water level at tail race;  $\nabla Y T$  – canal bottom level at tail race.

$$l_T = h_{max} + p' + H_T + t + K, \text{ mm} \quad (1)$$

where:  $p' = \nabla T - \Delta \Pi БСС = 30$  to  $50$  mm (for free air access under threshold at tail race);

$\nabla T$  – tail race mark;

$\nabla \Pi БСС$  – water mark at tail race for maximal discharge;

$t$  – bent part of the material for upper horizontal bar sleeves (3)

$$t = 2t' + a + 2a' \text{ mm} \quad (2)$$

where:  $t' = 1,75d_c$  — sleeve width;

$a' = 2$  mm seam width;

$a = 2 \text{ mm}$  if sewed;

$a = 10 \text{ mm}$  if glued;

$d_c$  — side vertical bar and threshold horizontal bar diameters can be determined from the condition of thin wall weirs.

$$\frac{d_c}{H} < 0,5 \text{ or } d_c < 0,5H$$

$K$  — height of buried part of material below canal bottom,  $K=200 \text{ mm}$ .

5. The diameter of upper horizontal bars may be taken equal to threshold ones or determined designed statically by the condition of their stability.

6. Side vertical bar length

$$l_c = \frac{l_T}{\sin \beta} + K, \text{ mm} \quad (3)$$

$A=0^\circ \beta=90 \text{ Sin}\beta=1$

$$l_c = l_T + K \text{ mm} \quad (4)$$

7. Length of vertical bars on berms (2')

$$l_o = (0,5 \div 0,8) l_c \quad (5)$$

8. Upper horizontal bar length (3)

$$l_p = B_T + 2\epsilon_o \quad (6)$$

where  $\epsilon_o = 100 \text{ mm}$  — berm width for seasonal canals;

$\epsilon_o = 500 \text{ mm}$  — berm width for sectional canals.

9. Length of threshold horizontal bars (3')

$$l_p = B + 0,5(B_T - B_{cy}) \text{ mm} \quad (7)$$

10. Bending width for side vertical bars.

$$t = t' + 2a \quad (8)$$

where  $t' = 2,5 d_c$  — sleeve width.

11. Width of weir linen for bar direction

$$t = t' + a \quad (9)$$

12. Apron sizes for tail race scouring prevention: width  $B_\phi = \epsilon_k$ , length  $l_\phi = 2h_{\max}$ , where  $\epsilon_k$  — canal bottom width.

Below there is a worked example for determining the sizes for individual fabrication of a mobile water measuring weir with a rectangular opening.

Given: Design discharge  $Q = 40 \text{ l/s}$ , channel bottom width  $b_c = 0,3 \text{ m}$ , maximum depth  $h_{\max} = 0,23 \text{ m}$ , overall height  $H_c = 0,3 \text{ m}$ , berm width  $b_b = 0,1 \text{ m}$ , slope ratio  $m = 1,0$ , roughness coefficient  $n = 0,03$ , flow velocity  $V = 0,37 \text{ m/s}$ , longitudinal channel slope  $i = 0,002$ .

We take the standard threshold width to be  $B = 250 \text{ mm}$ .

From the table we determine, that for the given discharge the pressure of  $H = 19,5$  would be enough, so we take  $H = 20 \text{ sm}$ .

According to above given formulas we determine the structure parameters:  $B_{cy} = 400 \text{ mm}$ ,  $B_T = 1100 \text{ mm}$ ,  $t' = 10,5 \text{ mm}$ ,  $t = 30 \text{ mm}$ ,  $l_T = 740 \text{ mm}$ ,  $l_c = 912 \text{ mm}$ ,  $l_o = 597 \text{ mm}$ ,  $l_p = 1300 \text{ mm}$ ,  $l_k = 150 \text{ mm}$ ,  $l'_p = 650 \text{ mm}$ ,  $t_1 = 22 \text{ mm}$ ,  $t_2 = 24,5 \text{ mm}$ ,  $l' = 230 \text{ mm}$ ,  $l'' = 299 \text{ mm}$ ,  $B_\phi = 300 \text{ mm}$ ,  $l_\phi = 460 \text{ mm}$ .

Based on the obtained sizes we determine the material amounts for mobile weir individual fabrication: ribberized linen —  $1,96 \text{ m}^2$ , steel rod  $d6 \text{ mm}$  —  $6,88 \text{ m}$ , measuring rod —  $0,4 \text{ m}$ , scale —  $1 \text{ ea}$ , paint —  $0,5 \text{ l}$ , fabric for encasement —  $0,4 \text{ m}^2$ .

The installation recommendations for mobile water measuring weir are as follows:

a) it must be installed on straight part of canal;

b) weir is installed perpendicularly to canal axes. The water level measuring rod is installed at the distance of at least  $3H$ , where  $H$  is the depth of water at head race;

c) at the head race the canal berms must be raised to the height  $lt$  to prevent overflow and sufficiently compacted;

d) the distance from the edge of the weir to canal slope at head race must be no less than  $h_{\max}$ ;

e) free air access under weir threshold at tail race must be provide, therefore  $P' = \nabla T - \nabla П6CC = 30$ ;

f) water seepage through sides and bottom is not accepted, i. e. must be hermetic;

g) after completing watering the field, the weir can be carried over to the next seasonal canal;

h) at the end of vegetation period the weir can be reassembled and kept for the use next year.

### Conclusions

1. Irrigation canals including sectional and seasonal ones must be equipped with water measuring devices.

2. Each farmer must measure water entering the irrigated land for each plant specifically.

3. Mobile water measurement weirs for farmers can be fabricated individually based on canal sizes and maximal discharge or mass produced based on the typical sizes and maximal discharges of sectional canals and seasonal canals.

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## Synthesis and identification of infrared spectroscopic ester for fatliquor leather

**Abstract:** Ester synthesized based on oleic acid, and isoamyl alcohol. The factors are affecting the output of the ester, such as temperature, molar ratios of selected components. Spectroscopic analysis is infrared of the ester. The ester is including available raw materials, and expands the range of natural leather fattening substances.

**Keywords:** ester, fattening, fatliquoring, synthetic fats, fatty acids, isoamyl alcohol, IR — spectrum, the absorption band.

Fattening — is one of the main production processes that affect the quality of the finished leather. The disposition of the interaction with the skin fatliquoring agent depends on its structure, and the structure of the fatliquoring agent.

In connection with the shortage of natural fats for the production of fattening materials and an increase in production of different kinds of soft leathers emerged the need to find sources of available raw materials, design and development of methods of converting them into components of composition for half-finished leather fattening.

Underway [1] developed a new structure for the fatliquoring of leather with synthetic sulfated fat. It is determined that the best, fatliquoring and dispersing the action in regards of dermal fibers has modified synthetic oil having a degree of sulfating 30%.

The researches have shown that the half-finished leather with different composition fattening substances differ significantly in physic-mechanical properties, and in many ways change their properties under Hydrothermal and thermic influences. Fatliquoring agent containing as the cationic emulsifier is a quaternary salt of an ester of a fatty acid triethanolamine, has environmental advantage, and gives the half-finished leather good water resistance and good plasticizing effect. It can be obtained by partial etherification of triethanolamine with fatty acids in the presence of phosphoric acid,

followed by passing the air and reaction with dimethyl sulfate or ethylene oxide. According to the conducted research offered an optimal composition for fattening the following composition: 50% oxy fat, parahlor 35%, 15% of synthetic cod-liver. Samples fatliquored this composition on sensory of organoleptic and elasto-plastic figures corresponds to the best samples treated with individual components [2–7].

To select the optimum fattening acids conducted a study on the use of fattening substances of natural origin, obtained by purification of oils and fats, waste oil and fat and hydrolysis-alcohol production.

The productions of cottonseed oil fatty acids, depending on the technological scheme and the basic methods of isolating. The main products are formed a plurality of secondary food products and wastes.

Esters are having in its structure acid or unsaturated alcohol, capable of addition reactions. And also, for the research as a second agent used fusel oils derived from hydrolysis-distillery “Biokimyo” (Uzbekistan, Tashkent region, Yangiyul city). It is known that, fusel oil is a by-product of alcohol production, its average composition of 10% ethanol, 13% n — propanol, 15% of isobutanol, isoamyl alcohol 51%, 11% mixed alcohols and water. Its main component is the isoamyl alcohol, which can form the ester compound.

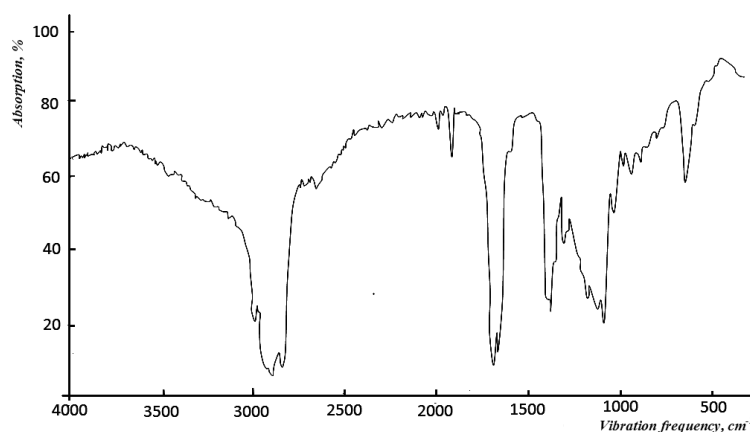


Figure 1. IR — absorption spectrum of oleic acid

Acid interaction was performed with the alcohol in the ratio 1:3 with excess alcohol in the presence of a catalyst.

The resulting ester is a pasty appearance, slightly peculiar smell, dark brown color, density  $\rho = 0.878$ , volatile, insoluble in water liquid, but readily soluble in most organic solvents, the boiling point

$T = 115^\circ\text{C}$ . The main part of these compounds is in the saturated state, 66.25% and 33.75% unsaturated state.

To identify chemicals on the spectrophotometer were removed IR — spectra. The figure shows the IR — spectra of fatty acids (Figure 1), alcohol (Figure 2.) and synthesized ester (Figure 3.):

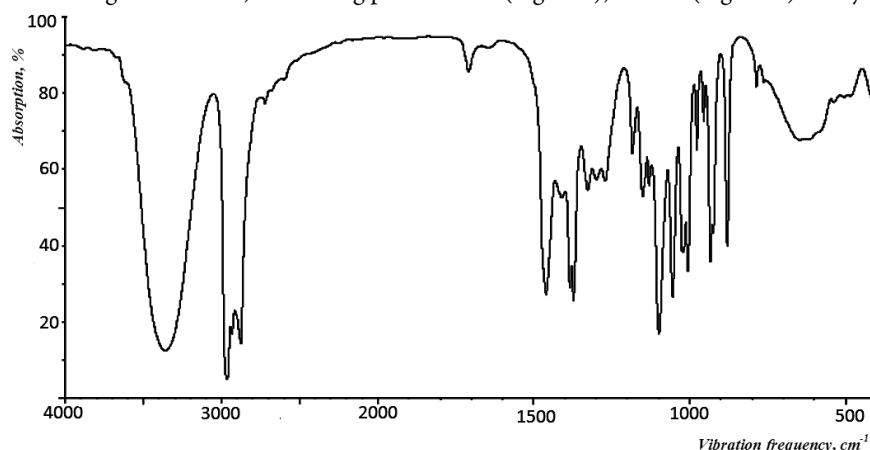


Figure 2. IR — absorption spectrum of isoamyl alcohol

Spectra unscrambled using literature facts on the absorption of the characteristic frequencies of the different groups of atoms [8–9].

The researches showed that, in all the samples in the 1150–2940  $\text{cm}^{-1}$  is observed the appearance of absorption bands belonging to the groups  $\text{CH}_3$  stretching vibration and the pendulum.

At presented IR — spectrum (Figure 2) shows a wide band of strong vibrations of the OH group near 3360  $\text{cm}^{-1}$ . Compare this band with an ester can be seen that the band almost disappears and leaves a very narrow peak near 3482  $\text{cm}^{-1}$  and shifted to the left.

Isoamyl alcohol in and around the 1710  $\text{cm}^{-1}$  meets the carbonyl C = O group and an ester it disappears (Figure 3). The absorption bands of 1465  $\text{cm}^{-1}$  treated with C–C group, and 1370–1175  $\text{cm}^{-1}$  to C–O group. The stretching vibrations –  $\text{CH}_2\text{COOR}$  group absorbed in the band 1750  $\text{cm}^{-1}$  confirms a limit aliphatic ester due to overtones and combination tones. Band at 1726  $\text{cm}^{-1}$  in samples of oleic acid vanishes completely in the ester. Very strong broad band formed in 1183  $\text{cm}^{-1}$  relating to  $\text{HCOOR}$  groups. The same strong broad band at 1240  $\text{cm}^{-1}$  is absorbed –  $\text{CH}_3\text{COOR}$  acetate groups C–O–C vibrations in oleic acid samples (Figure 1).

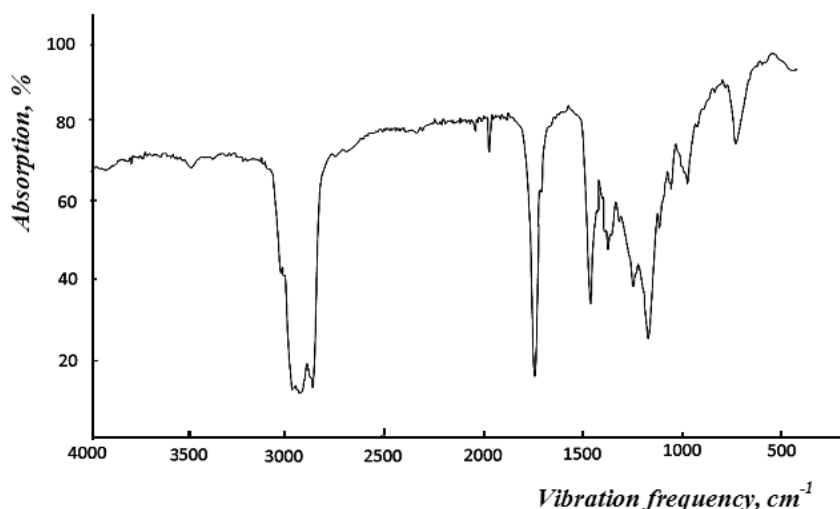


Figure 3. IR — spectrum absorption based on an ester of isoamyl alcohol and oleic acid

In samples of the ester (Figure 1) of the absorption bands occur in the oscillation frequency of 1250  $\text{cm}^{-1}$  inherent R–COOR groups. The ether spectrum shows a characteristic absorption band attributable to the deformation vibrations of CH located in the area of 718  $\text{cm}^{-1}$ .

In and around the 2876  $\text{cm}^{-1}$  and 2970  $\text{cm}^{-1}$  appears at the ester absorption band of CH stretching vibrations substituent. The provisions of these absorption bands like the position of the methyl and methylene groups, but the rate may be considerably shifted to three methyl and methylene groups. The band is absorbed in the 1050  $\text{cm}^{-1}$  refers to the average fluctuation of O– $\text{CH}_2$  group.

There are bands absorbed with a wave number of about 1478  $\text{cm}^{-1}$ , due to the symmetric and ant symmetric vibrations of

COO-. Broadening of the shift of the absorption bands in the regions 3009, 2970, 2987 and 2876  $\text{cm}^{-1}$  indicates the existence of strong intermolecular hydrogen bonds.

Bands fluctuation 2935–2987, 2876 and 1478  $\text{cm}^{-1}$ , respectively, and should include the asymmetric, symmetric and scissor stretching vibrations of  $\text{CH}_2$  groups. As in the investigated esters are present higher aliphatic acid fragments, the fluctuation in the spectra appears in and around 718  $\text{cm}^{-1}$  corresponding to the rocking vibration of several related groups – $\text{CH}_2$ -, these vibrations also applies band at 1183  $\text{cm}^{-1}$  ester.

Analysis of IR — spectra of products shows, which has been a change in the position and intensity of some of the characteristic ab-



sorption bands, with the most significant in the presence of double bonds of the  $\text{CHR}=\text{CHR}'$  is characterized by the selection of appropriate bands. The strips are arranged bending vibrations tend to Trans — isomers in the  $1310\text{--}1290\text{ cm}^{-1}$ , cis — isomers in the  $1420\text{--}1400\text{ cm}^{-1}$ . The bands are of stretching vibrations settle and cis — isomers in the  $3040\text{--}3010\text{ cm}^{-1}$ . The presence is in spectrum of oils and esters at  $1438\text{ cm}^{-1}$  and  $3009\text{ cm}^{-1}$  gives an indication of predominantly unsaturated compounds in the cis configuration, which is characteristic of fats, oils, and esters.

To create a more efficient fattening composition in the process of leather fatliquoring of shoe upper using an ester, this provides uniform distribution of fat on the leather structure.

For the study were taken experienced and inspection lot rawhide average weighing 17–22 kg. Shoe uppers, obtained by the typical procedure proposed composition of waste on the dye bath for black.

Fattening leathers performed in suspension drums, with the temperature at  $55\text{--}60\text{ }^\circ\text{C}$ , fluidic coefficients 0.8. The duration is of the process for 2 hours. The flow rate was fatliquoring mixtures in composition a total amount of 7% by weight of the wringing leather based on 100% – s fat (Table 1).

Table 1. – Consumption of fattening mixtures for fatliquoring shoe uppers

Fatliquoring agents	Versions of the fattening mixtures	
	Control	Experienced
Fish oil 20	20	–
Synthetic fat	30	–
Combined oil (Touring)	50	–
Scrapings fat	–	15
Technical fat	–	10
Spindle oil	–	15
Ester	–	60
Total:	100	100

The process of fattening experienced and control versions leather held normally. All the processes before and after the fatliquoring carried out according to traditional methods. Difficulty in carrying them was not observed.

The research accorded that skin fatliquored experienced fat mixture, on organoleptic features were better control leathers quite full, soft and with a good griffin. Grades ready experienced leather was the same as the control leathers.

In order to determine the degree of influence the composition of the oiling mixture quality leather chemical analyzes was carried out and the physical and mechanical testing of the experimental and control leather. Sample preparation and testing procedures meet the requirements of existing standards.

Physical, mechanical and chemical control and experimental leather are given in Table 2.

Table 2. – Chemical, physical and mechanical control and experimental leathers developed using etherification

Parameter	Control	Experienced	State Standard (939–88)
Moisture,%	13,7	14,5	10–16
Ash,%	0,31	0,28	no more 0,35
Fat Content,%	7,6	8,2	7–12
Chromium oxide,%	3,9	4,1	no more 4,3
The average thickness of, mm	1,28	1,35	1,2–1,4
Tension with the appearance of the surface layer cracks 10 MPa	1,68	1,89	no less 1,3
Tensile strength, MPa, 10 MPa	2,14	2,31	no less 1,5

According to test results shown in Table 2, it is seen that the experimental and control both leather state satisfy standard requirements.

The facts in Table 2 can be seen that indicators of the surface layer strength and leather in general, and have a higher reading of the tensile strength. These facts confirm that strength is dependent not only hides the amount of injected fat, but also on the nature of the fat, its polarity, providing improvement of physic-mechanical properties of the finished leather.

Research has shown that a fatliquoring composition based on etherification suitable for fatliquoring of shoe leather chrome tanning. Depending on the required elasticity, softness, flexibility and rigidity etherification content fatliquoring mixtures and emulsions should be regulated to a certain optimum amount depending on its structure and purpose leathers. Considering the strength characteristics of various leathers etherification optimum amount in fatliquoring mixtures should not hanged and 75%, depending on the purpose of the leather.

Compared with other fatliquors material benefit received esters are extensive and rational use of secondary and by-products of local industries. In particular, the important point is the cost of production, as we believe, based on preliminary estimates, it has a cost much lower than they are now used synthetic oil and natural fats.

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## Section 11. Transport

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-234-236>

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### Method for evaluating the energy efficiency of regulated driving cycles

**Abstract:** The theoretical fundamentals of defining the energy consumption of a car under urban conditions and method for evaluating the energy efficiency of vehicles and driving cycles are represented in this paper.

**Keywords:** Energy, driving cycle, average speed, energy efficiency, car.

Since the usage of natural resources has been increasing in all branches the energy efficiency and energy saving are significant directions for economical development. Nowadays there are the number of models and modifications of cars more than 3000 in the world. Production volume of them more than 75% of total volume 89,7 million including trucks and buses [5]. The share of cars in consumption of oil products is 67% [6]. Mainly most cars are used in cities.

The traffic jam, frequent stops, decreasing of average speed, increasing of uneven ride — acceleration and deceleration are occurred in urban conditions.

The fuel consumption in urban conditions and on the high way is more applied gauge of fuel economy of vehicles in practice. Corresponding city and high way driving cycles are developed for evaluating the fuel consumption of each type of the vehicle in mentioned conditions [1, 8–11].

There are own regulated driving cycles in different countries, with the help of which fuel economy and emission of vehicles are determined and more than 55 of them (for instance LA 92, Unified LA 92, Japanese 10–15, CBD, SAE J1376, ECE+EUDC, HWFET, UDDS, ECE, EUDC, NYCC, UDDS, US06 and etc.) are analyzed.

After analyzing more than 55 driving cycles was fixed, that duration of operation of the vehicle at unstable regimes in urban conditions reaches up 67%. A distance of acceleration and deceleration sections, which essentially influence to average speed, is about 70–80% of total distance, covered by a vehicle [3, 75–87].

The average speed and ride regime of cars in urban conditions is the one of performances, which defines energy efficiency of a car. Changing the average speed of the vehicle due to outer factors influences to its energy efficiency.

The average speed change of the vehicle in Tashkent city depending on day times, week days and seasons of the year, is determined by experiment and we can see the following results. The range of average speed change in day times is from 29.53 km/h (11–12 a.m.) to 26.67 km/h (7–8 p.m.), i.e. increasing is 5.73% and decreasing is 4.50% with reference to fixed average speed

(27.94 km/h). The range of average speed change in week days is from 28.26 km/h (on Fridays) to 27.53 km/h (on Thursdays), i.e. increasing is 1.14% and decreasing is 1.46% with reference to fixed average speed. The range of average speed change in seasons of the year is from 28.56 km/h (in summer) to 25.10 km/h (in winter), i.e. increasing is 2.22% and decreasing is 10.14% with reference to fixed average speed.

It is possible to improve the fuel economy and emission parameters of the vehicle through defining the energy efficiency of driving cycles, share of average speed change, mentioned above and monitoring the change of energy efficiency. It increases the importance of developing driving cycles for certain conditions and evaluating the energy efficiency of latter.

Nowadays there is no method for comparative evaluation of standardized driving cycles and all standardized driving cycles have different parameters. As the driving cycle is the one of definers of energy consumption of the vehicle, the energy, consumed per distance (or time) can be applied as criterion for comparative evaluation [2, 124–135]. Defining the energy balance of the vehicle in moving phase of driving cycle is necessary to reach the goal mentioned above. The first stage to make the energy balance of the vehicle is to make force and power balances at three main phases of the vehicle ride:

Acceleration phase. The power balance of the vehicle looks as following:

$$N_T = m_a \cdot \delta_r \cdot v_a \cdot \frac{dv_a}{dt_a} + (P_a + P_f) \cdot v_a; \quad (1)$$

$$N_T \cdot dt_y = m_a \cdot \delta_r \cdot v_a \cdot dv_a + (N_a + N_f) \cdot dt_a; \quad (2)$$

Where,  $N_T$  — Traction power, (Wt);

$N_f$  — rolling resistance power, (Wt);

$N_a$  — air resistance power, (Wt);

$t_a$  — acceleration time, (s);

$v_a$  — vehicle speed, (m/s).

$$dE_T = N_T \cdot dt_a; \quad (3)$$

$$dE_T = m_a \cdot \delta_r \cdot v_a \cdot dv_a + (N_a + N_f) \cdot dt_a; \quad (4)$$

Where  $E_a$  — energy, required for accelerating a vehicle, (J);

By integrating both sides of equation (2) we can get following

$$E_r = m_a \cdot \delta_r \cdot \frac{v_f^2 - v_i^2}{2} + \int_0^{t_a} (N_a + N_f) \cdot dt_a = ; \quad (5)$$

$$= m_a \cdot \delta_r \cdot \frac{v_f^2 - v_i^2}{2} + \int_0^{t_y} v_a \cdot (f_r \cdot (1 + a_f \cdot v_a^2) \cdot m_a \cdot g + c_{ae} \cdot v_a^2) \cdot dt_a$$

Taking an acceleration of the vehicle as constant  $a = \frac{dv_a}{dt_a} \left( dt_a = \frac{dv_a}{a} \right)$  and integrating the equation (4) relatively  $v_a$ ,

$$E_a = m_a \cdot \delta_r \cdot \frac{v_f^2 - v_i^2}{2} + \int_{v_i}^{v_f} \frac{v_a \cdot (f_r \cdot (1 + a_f \cdot v_a^2) \cdot m_a \cdot g + c_{ae} \cdot v_a^2) \cdot dv_a}{a} ; \quad (6)$$

Then the energy, required to accelerate the vehicle from initial speed  $v_i$  to final speed  $v_f$  for time  $t_a$  is

$$E_a = m_a \cdot \delta_r \cdot \frac{v_f^2 - v_i^2}{2} + m_a \cdot g \cdot f_r \cdot \frac{v_f^2 - v_i^2}{2 \cdot a} + \frac{(c_{ae} + m_a \cdot g \cdot f_r \cdot a_f) \cdot (v_f^4 - v_i^4)}{4 \cdot a} ; \quad (7)$$

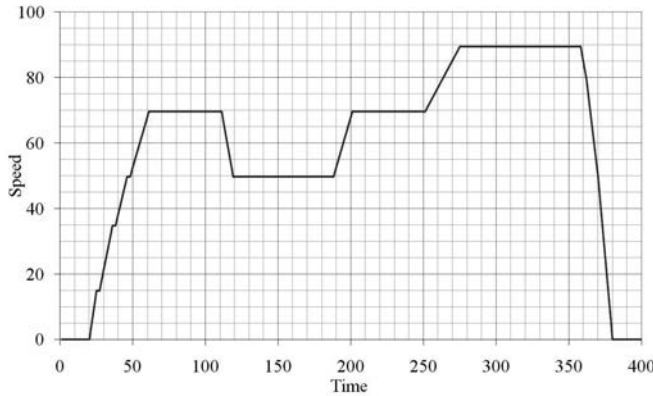


Fig. 1. Regulated driving cycle Eudc

The parameters of driving cycles EUDC (Fig.1) and EUDC\_LOW (Fig.2) are analyzed with the help of mentioned above method and energy consumption is determined (Table 1.).

Table 1.

Name of cycle	Time, s	Road, km	Average acceleration/deceleration $m/s^2$	Max. speed, m/s	Average speed, m/s	Energy, kJ	Energy per road unit kJ/m
EUDC	400	6915	0.38/0.93	33.1	17,3	7100.4	1.03
EUDC_LOW	400	6610	0.42/1.0	25.0	16.5	6329.8	0.96

In order to define the energy economy of mentioned driving cycles the specific energy is determined

$$E_{ef(EUDC)} = \frac{E_{dc}}{S} = \frac{7100.4}{6915} = 1.03 \text{ kJ/m}$$

$$E_{ef(EUDC\_LOW)} = \frac{E_{dc}}{S} = \frac{6329.8}{6610} = 0.96 \text{ kJ/m}$$

The results show that the driving cycle EUDC\_LOW is energy efficient. But it is not correct to evaluate a difficulty level of driving cycle by energy with the help of mentioned method. Increasing the share of unstable ride of the vehicle causes decreasing the energy efficiency of last. It raises the significance of evaluating a difficulty level of certain driving cycles.

A difficulty level of driving cycle can be defined through energy, consumed to cover the distance of driving cycle with constant average speed of driving cycle on plain road. The energy consump-

tion, defined by second method is the minimal consumption of the energy to cover the certain distance and it increases by changing the ride regimes. Hence, it is possible to evaluate a difficulty level of driving cycles by comparing defined energy consumptions.

$$E_s = (v_a \cdot f_r \cdot (1 + a_f \cdot v_a^2) \cdot m_a \cdot g + c_{ae} \cdot v_a^3) \cdot t_s ; \quad [J] \quad (8)$$

Where  $E_s$  — energy, required for stable ride, (J);

$v_a$  — speed of the vehicle at stable ride, (m/s);

$t_s$  — ride time at speed  $v_a$ , (s).

Deceleration phase. Deceleration of the vehicle occurs by energy distributing (which is equal to the sum of kinetic energy of the vehicle and energy of its rolling parts) which is usually absorbed by brakes of the vehicle.

$$E_d = m_a \cdot \delta_r \cdot \frac{v_i^2 - v_f^2}{2} ; \quad [J] \quad (9)$$

Taking in account mentioned above equations the energy balance of the vehicle in driving cycle can be determined as following.

$$E_{dc} = E_a + E_s + E_d ; \quad [kJ] \quad (10)$$

Defining the ratio of amount energy, consumed for driving cycle to covered road is necessary to define the specific energy per road unit.

$$E_{ef} = \frac{E_{dc}}{S} ; \quad [kJ/m] \quad (11)$$

The energy efficient driving cycle can be determined by comparing the standardized driving cycles between and using specific energy for certain vehicle model.

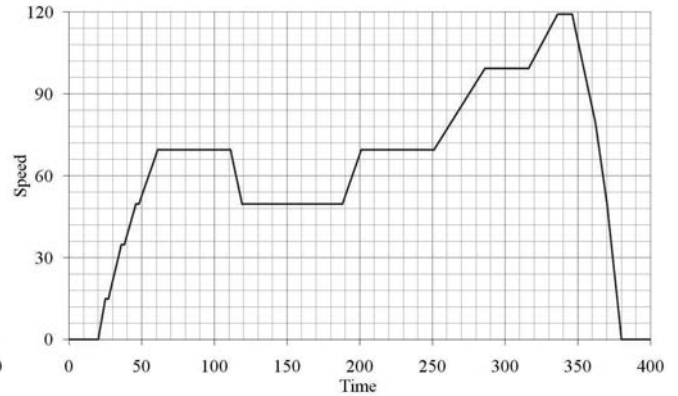


Fig.2. Regulated driving cycle Eudc\_Low

tion, defined by second method is the minimal consumption of the energy to cover the certain distance and it increases by changing the ride regimes. Hence, it is possible to evaluate a difficulty level of driving cycles by comparing defined energy consumptions.

It is obviously that increasing the share of unstable ride regimes of driving cycles, causes raising a difficulty level of latter, i. e. energy consumption will increase. Therefore coefficient  $\gamma$  is applied as criterion for evaluating driving cycles.

A difficulty level of driving cycles by energy efficiency can be determined with the help of following equation:

$$\gamma = \frac{E_{dc}}{E_{vca}}$$

Where:  $E_{dc}$  – energy consumption of driving cycle, (kJ);

$E_{vca}$  – energy, consumed to cover the distance of driving cycle with constant average speed of the cycle.

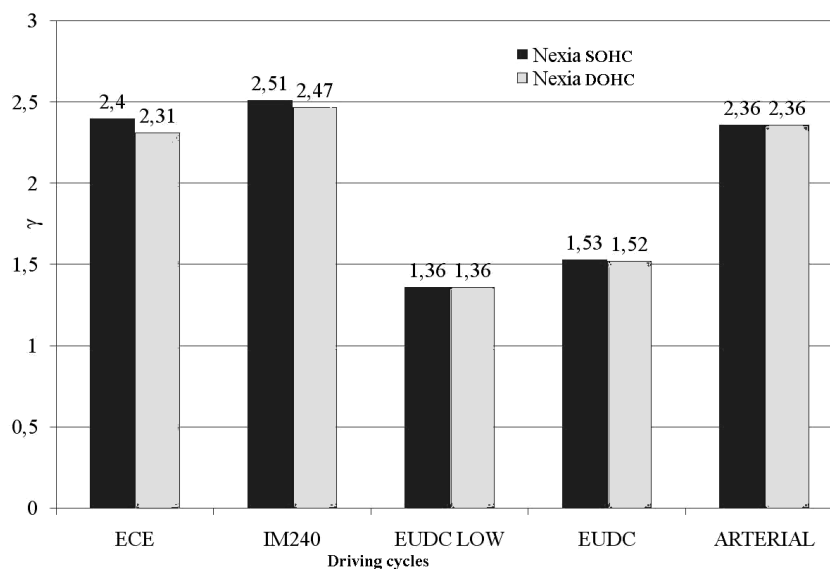


Figure 3. Changing the energy efficiency of vehicles Nexia SOHC ва Nexia DOHC depending on driving cycles

Difficulty levels of a few driving cycles (ECE, IM240, EUDC\_LOW, EUDC, ARTERIAL) for two models of the vehicle NEXIA, were defined with the help of the method mentioned above (Fig. 3).

Hence, we can see that Nexia DOHC has high energy efficiency than Nexia SOHC in ECE driving cycle [4, 93–94]. In fact the fuel consumption of the Nexia DOHC more than Nexia SOHC but energy usage efficiency of the first is high. The energy efficiency of both vehicles is the same in EUDC LOW and ARTERIAL driving cycles. Driving cycle IM240 is most difficult and driving cycle

EUDC\_LOW is easier for mentioned vehicles by energy efficiency than others.

This method allows choosing optimal type of a vehicle for urban conditions or choosing optimal driving cycle for certain vehicle by energy usage efficiency.

The conclusion is that nowadays with the help of applied complex and continuously monitoring system of transport it is possible to define and evaluate the energy efficiency of vehicles all time.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-234-236>

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## Design procedure of the mode of movement of the articulated lorry transporting liquid cargo in mountain conditions

**Abstract:** The mathematical model and design procedure of a motion mode (regime) of the semi-trailer truck transporting liquid cargo is proposed. The model allows to define average speed of the semi-trailer truck taking into account change of motion parameters (turn radius, speed, acceleration, up- or down-hilling, influence of dynamics of a liquid cargo on tank walls).

The comparative analysis of results of calculations with experimental data shows adequacy of the offered mathematical model and the design procedure to real processes, the average deviation is in limits of 4,8%.

**Keywords:** semi-trailer truck lorry; a motion mode; liquid cargo; mountain conditions; external factors; operational properties.

Road transport plays an important role in the transportation of goods in different regions of the country. It is known that the main important issues in transportation of goods are the safety and efficiency of transportation. However, road routs of semi-trailer trucks are constituted of rapidly changing road and weather conditions.

In this paper, the method of selecting a safe and effective motion mode of semi-trailer truck, carrying liquid cargo in the mountainous conditions is proposed.

It is known that liquid cargo sloshing during transportation seriously alter train instant center of gravity and thus affects the critical speed of motion. For these reasons, the definition of the critical speed of semi-trailer trucks on dangerous sections of the mountain road can be considered relevant problem.

The theoretical, practical and organizational issues of road transport of goods in severe mountain conditions studied by many researchers [1,2,3,4]. However, it is not enough investigated the complex influence on the functioning of semi-trailer truck carrying liquid cargo, such factors as the turning radius, speed, acceleration and the dynamic effects of liquid on the tank wall and the road conditions.

Quite often the process of interaction of machine with the environment, particularly in curvilinear motion, is associated with and dependent upon the speed, it would be appropriate to define also stability as a function of speed [1,5].

The motion mode is affected by the operation and usage conditions of these trucks.

Operating conditions in general are determined by road, transport and climatic conditions, each of which is characterized by certain factors: road conditions — the elements of the road profile and outline, terrain, type of pavement and its irregularities, traffic, traffic

disturbances, road condition continuity and motion modes [4].

Change of road conditions at different altitude on the mountain roads leads to a corresponding change in motion modes and safety of the vehicle.

Each specific route is largely different and may consist of areas characterized by different road conditions on which motion modes can vary drastically [5].

The parameters that affect average speed  $v_{avg}$  mainly include traffic volume, road speed limits, the presence on the settlements along the road, the number of intersections with other roads and the number of lanes [3; 5].

Thus, the analysis of key factors influencing the mode of motion has shown that there are the finite numbers of factors that must be considered when developing a method of selecting a mode of motion.

Let's consider the mode of motion of semi-trailer truck under the «Kamchik» passage in Uzbekistan.

It is known that the road Tashkent-Osh highway (A-373) is the only transport route connecting the Fergana valley with the main regions of Uzbekistan. Along 78 kilometers (in interval 117–195 km) the road it crosses the Kurama mountain system through Kamchik and Rezak passages. The interval of the road between 144–192 km (48 km length) is the most severe, characterized by large road meander, a significant number of turns and protracted deviations of the longitudinal profile. In this section of road a turning radius of 50–70m and protracted deviations of the longitudinal profile of 7–10% can be observed. The highest elevation of the Kamchik passage is 2196 meters above sea level.

General methodology of the study with a comprehensive structural scheme consisting of theoretical and experimental studies is shown in Figure 1.

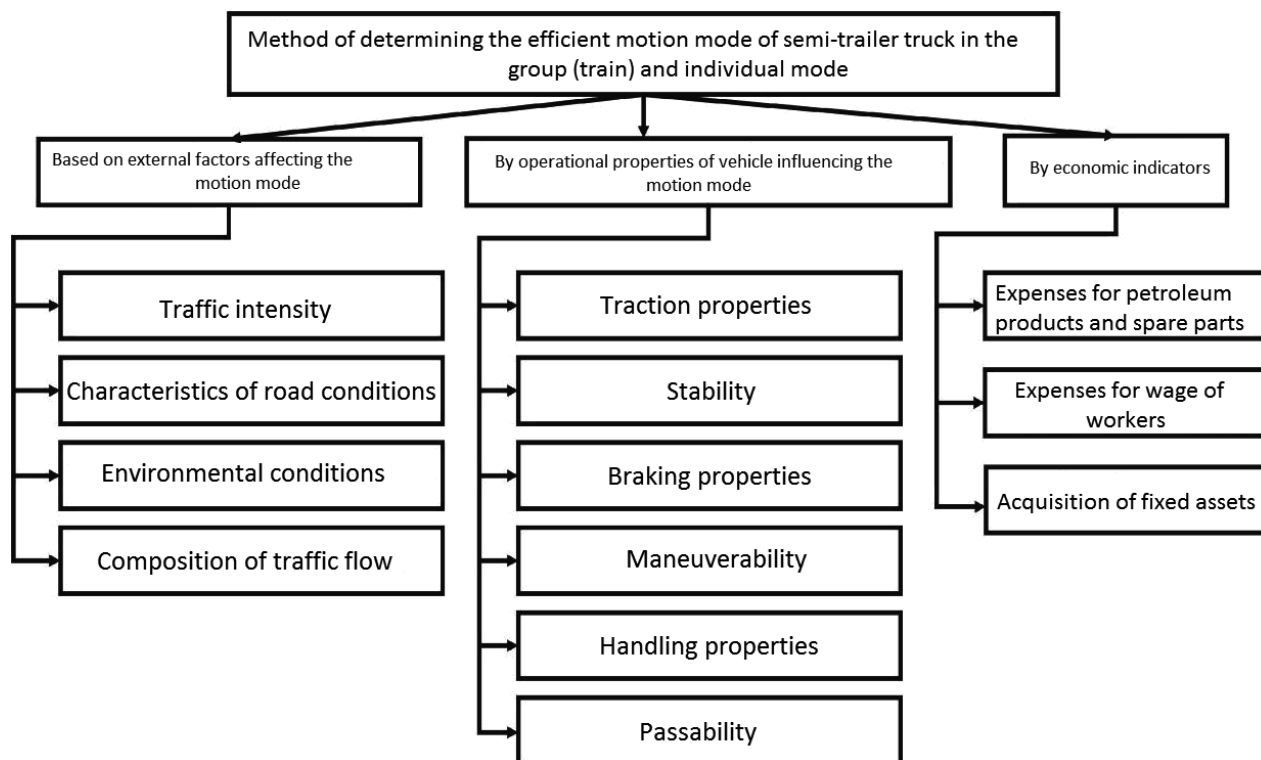


Figure 1. General research methodology

Limit values for the velocity of the semi-trailer trucks transporting petroleum products during motion on road A-373 in the «Kamchik» passage in group (train) and in individual modes, depend on the average speed of traffic on this part of the road.

The average speed of the motion of the vehicles is one of the most important indicators used to determine the motor expenses and investment in road transport during the feasibility study of design decisions. Traffic speed varies along the length of the road and a time depending on the traffic and the composition of the traffic flow, traffic conditions and characteristics of the means of traffic regulation and influence of climatic factors.

The average speed of the flow of vehicles on homogeneous part of the road, within which there is no change of any characteristics of road conditions determined by the formula [5]:

$$v = G \cdot \theta \cdot v_0 - \tau \cdot K_r \cdot N_h, \quad (1)$$

where  $G$  – coefficient taking into account the effect of the road pavement condition to average speed;  $\theta$  – coefficient taking into account the impact of the road conditions and the composition of the traffic flow at the speed of motion;  $v_0$  – the average speed of the free motion of a uniform flow consisting of passenger cars in a straight horizontal areas with carriageway width of 7.5 m, a width of

marginal strips 0.75 m, the roadside of 3.5 meters wide (accepted  $v_0 = 80$  km/h);  $\tau$  – coefficient depending on the proportion of passenger cars as part of the transport flow [5];  $K_r$  – correction factor to the value  $\tau$ ;  $N_h$  – traffic intensity, number of vehicles in one hour, which is determined by the formula:

$$N_h = 0.076 \cdot N \quad (2)$$

$N$  – annual average daily traffic, vehicles/day.

$$G = \frac{t_d \cdot g_d + t_w \cdot g_w + t_s \cdot g_s + t_i \cdot g_i}{365} \quad (3)$$

where  $t_d, t_w, t_s, t_i$  – the number of days in the year, respectively, dry, wet, snow-covered and covered with icing;  $g_d, g_w, g_s, g_i$  – speed reduction coefficients: for dry coating  $g_d = 1.0$ , wet  $g_w = 0.85$ , snowy  $g_s = 0.8$ , icy  $g_i = 0.45$ ;

$$\theta = \prod_{i=1}^9 \tau_i; \quad (4)$$

$\tau_1, \tau_2, \dots, \tau_9$  – coefficients depending on the proportion of passenger cars as part of the transport flow, road slope, type of marking, roadside width, horizontal curve radius, the visibility distance, number of lanes, the characteristics of the village, the road conditions before the rise with a slope of more than 30%.

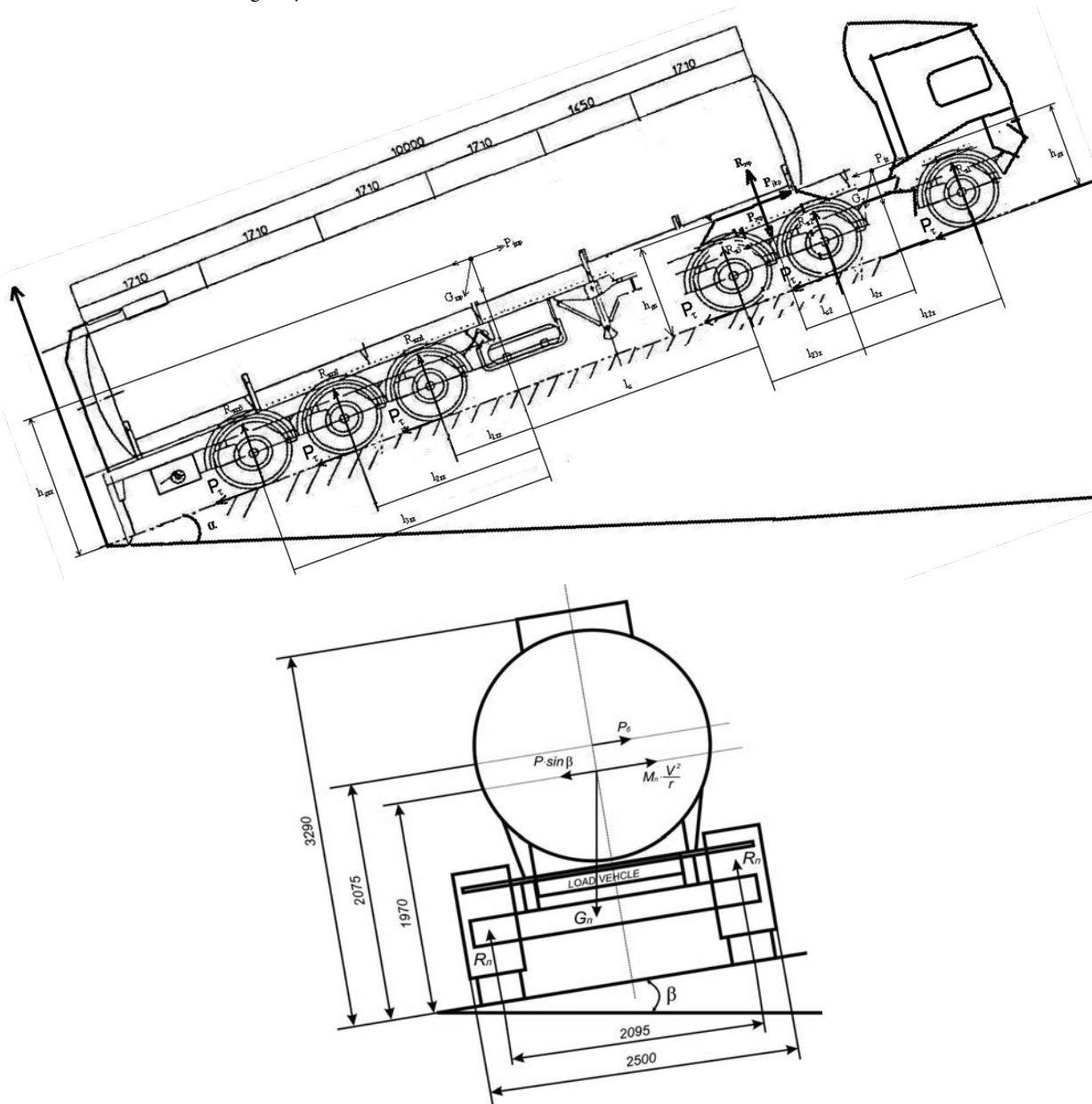


Figure 2. Forces acting on semi-trailer truck ISUZU EXZ 51 K with semi-trailer “ISTANBUL-FRUEHAUF”

When defining the parameter  $\theta$  using Equation (4), it must be noted that in areas with a significant road slope the influence of latter on speed is predominant over other characteristics of road conditions. Therefore, slopes greater than 45% and the uphill length of more than 200 m, with slopes greater than 55% and the uphill length of more than 200 m, and slopes greater than 64% and the uphill length of more than 100 m the values of  $\tau_1, \tau_2, \tau_3, \tau_4, \tau_5$  are taken as the lowest calculated, and all other coefficients are considered equal to 1.0.

Thus, from the Equations (1)–(4) the average speed of the traffic flow can be calculated depending from external factors, such as traffic flow and traffic flow composition, especially road conditions, employed traffic control means and climatic conditions.

To describe the impact of operational properties of semi-trailer trucks on the mode of motion it is necessary to write down equilibrium equations of forces and moments [1; 6; 7; 8].

Tractor and semi-trailer is a complex dynamic system consisting of two subsystems, a tractor and a semi-trailer (Figure 2).

Using the components of forces on the coordinate axes and torques about the axes, we obtain a system of equations for a semi-trailer and the tractor. As a result, the decision determined by the three forces of reaction wheels on the assumption that the reaction force of left and right wheel axles are not the same, the reaction force and the inertia force of the coupling device.

For semitrailer balance of acting forces can be written as:

$$\left\{ \begin{array}{l} \sum Z = 0; R_k + R_n + R_n - mg \cos \alpha = 0; \\ \sum X = 0; P_{jk} - mg \sin \alpha - m \frac{dv}{dt} = 0; \\ P_{jk} - m \frac{dv}{dt} - mg \sin \alpha - P_b = 0; \sum C(\cdot) = 0; \\ R_s l_2 - R_k l_1 - P_{jk} (h_g - h_c) - F_x h_g = 0; \\ R_k = \frac{m}{L} \left( gl_2 \cos \alpha - \left( \frac{dv}{dt} + g \sin \alpha \right) (h_g - h_c) \right); \\ (R_n + R_n) = \frac{m}{L} \left( gl_1 \cos \alpha + \left( \frac{dv}{dt} + g \sin \alpha \right) (h_g - h_c) \right); \\ R_k = \frac{mg \cos \alpha (l_2 - h_g \phi_{i1}) - \left( m \frac{dv}{dt} + mg \sin \alpha \right) (h_g - h_c)}{L - h_g \phi_{i1}}; \\ (R_n + R_n) = \frac{m}{L - h_g \phi_{i1}} \left( g \cos \alpha \cdot l_1 + \left( \frac{dv}{dt} + g \sin \alpha \right) (h_g - h_c) \right); \\ N_k + (R_n + R_n) \cdot \phi_{i2} + mg \sin \beta - \frac{m \mathcal{G}^2}{r} - P_b = 0; \quad (5) \\ R_n + R_n - mg \cos \beta = 0; \\ R_n \cdot \frac{B}{2} - R_n \cdot \frac{B}{2} + (R_n + R_n) \cdot \phi_{i2} \cdot h_g + N_k (h_g - h_c) - P_b \cdot h_g = 0; \\ R_n = \frac{1}{2B} \left( mg \cos \beta \cdot (B - 2\phi_{i2} h_c) + 2 \left( mg \sin \beta - \frac{m \mathcal{G}^2}{r} \right) (h_g - h_c) \right); \\ R_n = \frac{1}{2B} \left( mg \cos \beta \cdot (B + 2\phi_{i2} h_c) - 2 \left( mg \sin \beta - \frac{m \mathcal{G}^2}{r} \right) (h_g - h_c) \right); \\ R_n = R_{n1} + R_{n2} + R_{n3}; R_{n1} = R_{n2} = R_{n3}; \\ R_n = R_{n1} + R_{n2} + R_{n3}; R_{n1} = R_{n2} = R_{n3}; \end{array} \right.$$

Balance of acting forces for tractor:

$$\left\{ \begin{array}{l} F_1 + F_2 - P_{jk} - mg \sin \alpha = m \frac{dv}{dt}; \\ R_1 + R_2 + R_3 - R_k - mg \cos \alpha = 0; R_2 = R_3; \\ -R_1 a + 2R_2 - P_{jk} (h_c - h) - R_k l_0 - (F_1 + F_2) h = 0; \quad (6) \end{array} \right.$$

$$R_2 = \frac{mg \cos \alpha \cdot a + mg \sin \alpha \cdot h + m \frac{dv}{dt} h + P_{jk} h_c + R_k (a + l_0)}{a + b};$$

$$R_1 = \frac{mg \cos \alpha \cdot b - mg \sin \alpha \cdot h - m \frac{dv}{dt} h - P_{jk} h_c + R_k (b - l_0)}{2(a + b)};$$

$$m_n g \frac{B}{2} \cos \beta + m_n g \sin \beta \cdot h_g - \frac{m_n \mathcal{G}^2}{2} h_g + N_k h_c - R_k \frac{B}{2} = 0$$

$$\frac{m_n \mathcal{G}^2}{r} + N_k - m_n g \sin \beta - \sum R \cdot \phi_{i2} = 0$$

$$R_n = R_{n1} + R_{n2} + R_{n3}; R_{n2} = R_{n3};$$

$$R_n = R_{n1} + R_{n2} + R_{n3}; R_{n2} = R_{n3};$$

where  $R_k, R_n$  – the forces of reaction wheels;  $R_k$  – reaction force coupling,  $N_k$  – lateral reaction force coupling,  $P_{jk}$  – longitudinal inertia force acting on the coupling;  $m_n$  – gross weight of the semitrailer and  $m$  – gross weight of the tractor,  $h$  – height of the center of gravity,  $v$  – speed articulated lorry,  $r$  – radius turn,  $\beta$  – angle cross slope of the road,  $a_1$  – the distance from the center of mass of the towing vehicle to the front axle,  $a_2$  – the distance from the center of the tractor weight to the rear axle,  $l_0$  – the distance from the center of the tractor weight to coupling,  $h$  – height of the tractor's center of gravity,  $B_t$  – track tractor,  $g$  – acceleration due to gravity,  $g=9.8 \text{ m/s}^2$ ,  $L$  – the distance from the rear wheel of the semitrailer up hitch,  $h_g$  – height of the center of gravity of semi-trailer,  $h_c$  – height hitch,  $l_2$  – the distance from the rear wheel of the semitrailer to a semitrailer of center of gravity,  $l_1$  – the distance from the center of gravity of semitrailer to the hitch,  $a$  – road ramp angle,  $B$  – track semitrailer,  $\phi_{i1}$  – longitudinal friction coefficient,  $\phi_{i2}$  – cross-coupling coefficient,  $dv/dt$  – linear acceleration articulated lorry,  $P_b$  – cross dynamic effects of liquid cargo in the tank wall,  $P_n$  – longitudinal dynamic influence of liquid cargo on the tank wall.

$P_b$  and  $P_n$  values are determined by the dependencies shown in Figure 4.

Thus, using the projection of forces on the coordinate axes and torques about the axes, we obtain a system of 28 differential equations. These equations together with initial and boundary conditions are a mathematical model of the motion of the semi-trailer truck.

This mathematical model allows the calculation of the following basic parameters of vehicles:

– Reaction forces of the wheels and coupling, lateral reaction force on the coupling, longitudinal force of inertia acting on the coupling;

– The critical speed for roll over and skidding of the semi-trailer as well as the tractor;

In addition to equations (5) and (6) for the calculation of the critical speed as a function of given forces, i. e., the total forces that contribute or prevent rollover, and the total force contributing or preventing the skidding, with and without dynamic effects of liquid cargo in the tank wall, the following equations are used:

for semi-trailer

$$F_{onp} = \left( m_n g \frac{B}{2} \cos \beta + m_n g \sin \beta \cdot h_g - \frac{m_n \mathcal{G}^2}{2} h_g - N_k h_c - R_k \frac{B}{2} - P_n h_g \right) / B,$$

$$F_{onp} \geq 0 \quad (7)$$

$$F_3 = \frac{m_n g^2}{r} + P_n - N_k - m_n g \sin \beta - \sum R \cdot \phi_{i2}, F_3 \geq 0 \quad (8)$$

for tractor unit:

$$F_{onp} = \left( m_T g \frac{B}{2} \cos \beta + m_T g \sin \beta \cdot h_g - \frac{m_T g^2}{2} h_g + N_k h_c - R_k \frac{B}{2} \right) / B, F_{onp} \geq 0 \quad (9)$$

$$F_3 = \frac{m_T g^2}{r} + N_k - m_T g \sin \beta - \sum R \cdot \phi_{i2}, F_3 \geq 0 \quad (10)$$

The foregoing parameters are determined depending on the lead angle and the turning radius. In the calculations the following parameters are accepted:  $m_T=8950$  kg;  $a_1 = 1.71$  m;  $a_2 = 1.89$  m;  $l_0 = 0.26$  m;  $h = 0.975$  m;  $B_t = 2.032$  m;  $m_p = 30500$  kg;  $g = 9.8$  m/s<sup>2</sup>;

$L = 6.30$  m;  $h_g = 1.97$  m;  $h_c = 1.4$  m;  $l_2 = 2.65$  m;  $l_1 = 3.65$  m;  $\beta = 0.03$  rad;  $B = 2.095$  m;  $f_{i1} = 0.35$ ;  $f_{i2} = 0.7$ ;  $dv/dt = 1$  m/s<sup>2</sup>.

The above mentioned mathematical model is implemented in a numerical simulator using MatLab/Simulink environment developed by the authors.

The calculated numerical values of reaction forces at each wheel of the truck will determine the parameters of steady motion of a truck in mountain conditions.

Dynamic effects of liquid cargo on the tank wall are defined by means of the Navies — Stokes equations using a software package Solid Works + Cosmos.

Figure 3 shows a simulation result of the speed for liquid flowing in the tank.

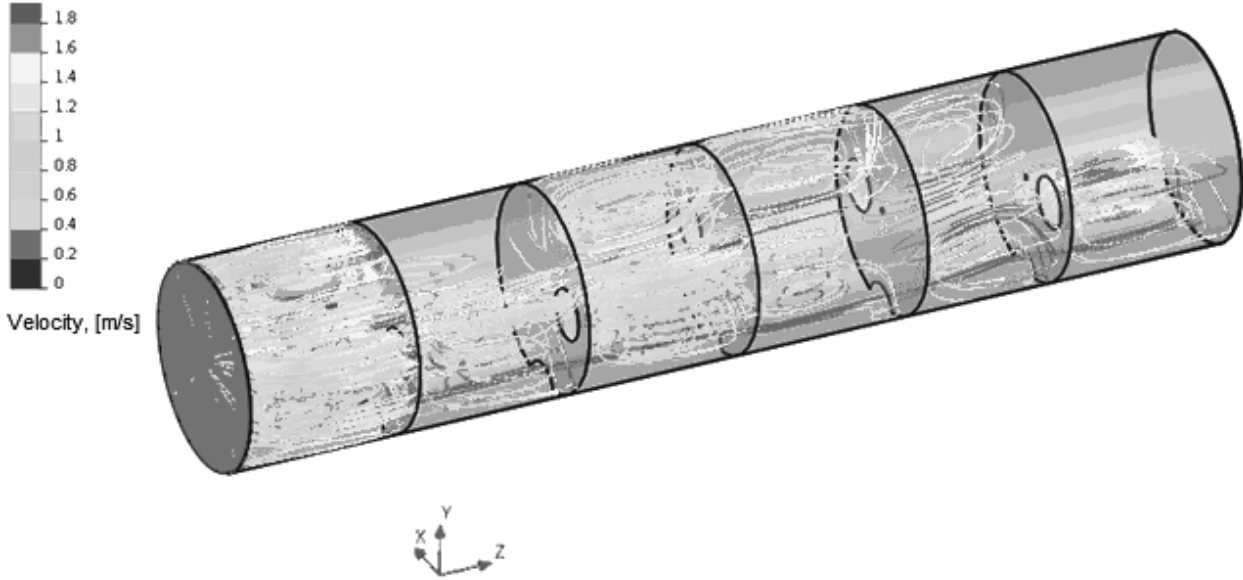


Figure 3. Solid Works + Cosmos simulation result for the flow of the liquid in the tank

Figure 4 and 5 shows the dependence of change of fluid pressure on the tank wall of the acceleration and the speed of the semi-

trailer truck in rectilinear and curvilinear motion path.

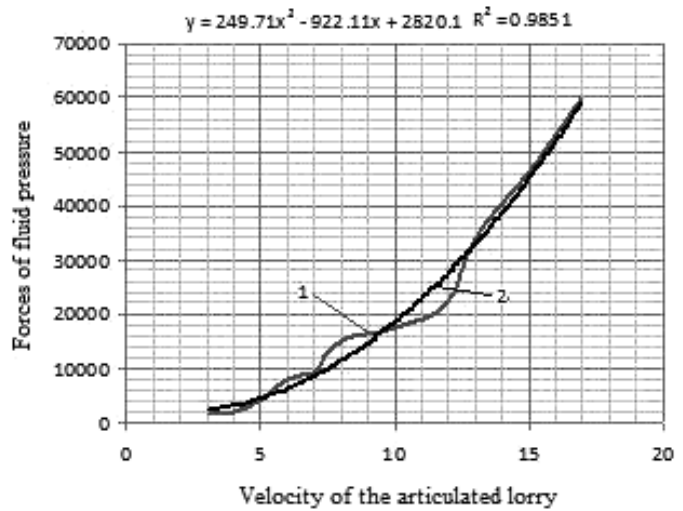
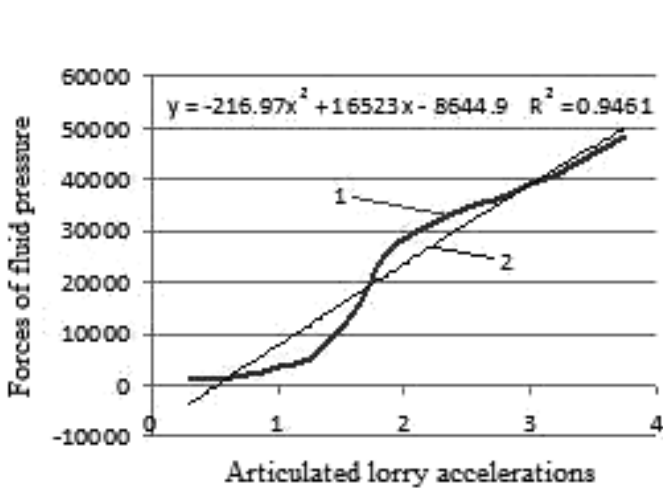


Figure 4. Fluid pressure force on the tank wall as a function of the truck acceleration and speed: 1 — Numerically calculated value; 2 — Polynomial approximation

Having examined the complex influence of parameters such as the slop angle of uphill, turning radius, acceleration (deceleration) of the cargo on the proposed model, we can determine the truck critical speed under all road conditions.

Figure 5 shows the variation of the total force, contributing or preventing roll over and skidding. Based on these values we can determine the critical speed of the semi-trailer truck at which the motion starts to be unstable (point of intersection of the curves skidding and roll over the abscissa passing through the «0» of the ordinate axis).



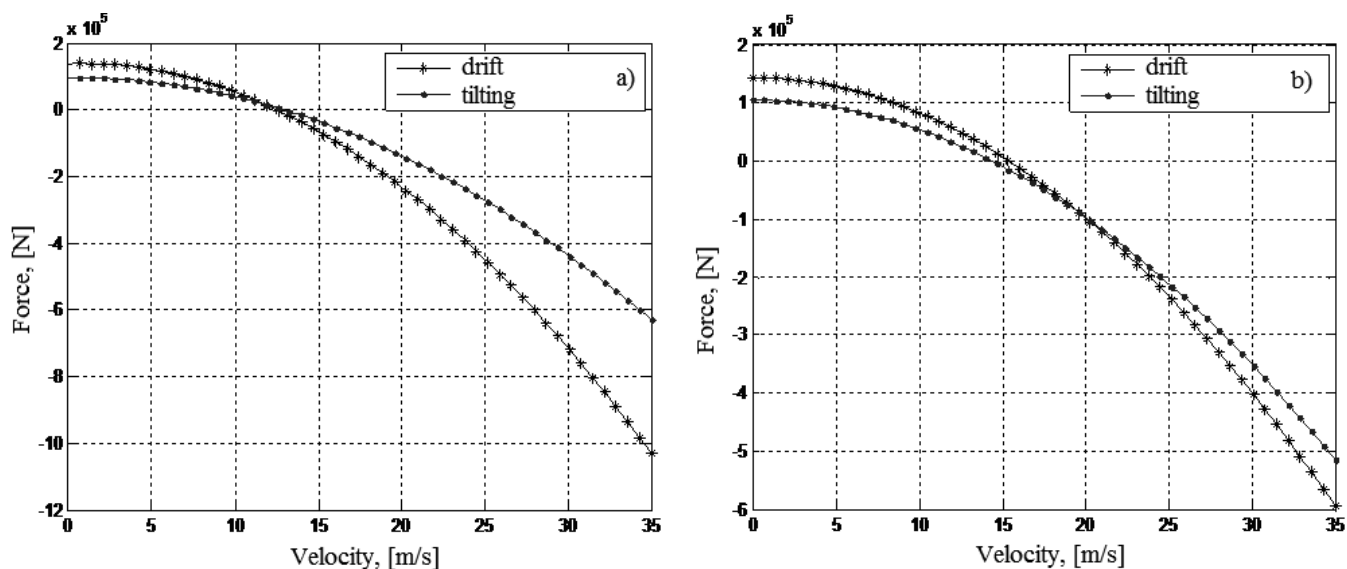


Figure 5. Dependence of the forces contributing and preventing skidding and roll-over of the speed of the tractor train in the 145<sup>th</sup> km part of the road A-373 (turning radius  $R = 80$  m, longitudinal slope of 7%):  
 a) – taking into account the effects of liquid cargo, b) – excluding the effects of liquid cargo

Analysis of the graphs shows that the critical speed of truck carrying petroleum products, when the dynamic effects of the fluid in the tank wall is taken into account is smaller than the one when this impact is excluded (for the rectilinear motion by 8–10%, for curvilinear motion 10–14%).

Figure 6 shows the curves reflecting the following relationship:

— Average speed of truck in steady motion in terms of condi-

tions as skidding, roll over and dynamic effects of the fluid obtained from equations (5) — (10) (curve 1).

— The average speed of vehicles at maximum traffic intensity (14,000 units, curve 2);

— The average speed of vehicles at minimum traffic intensity (8000 units, curve 3).

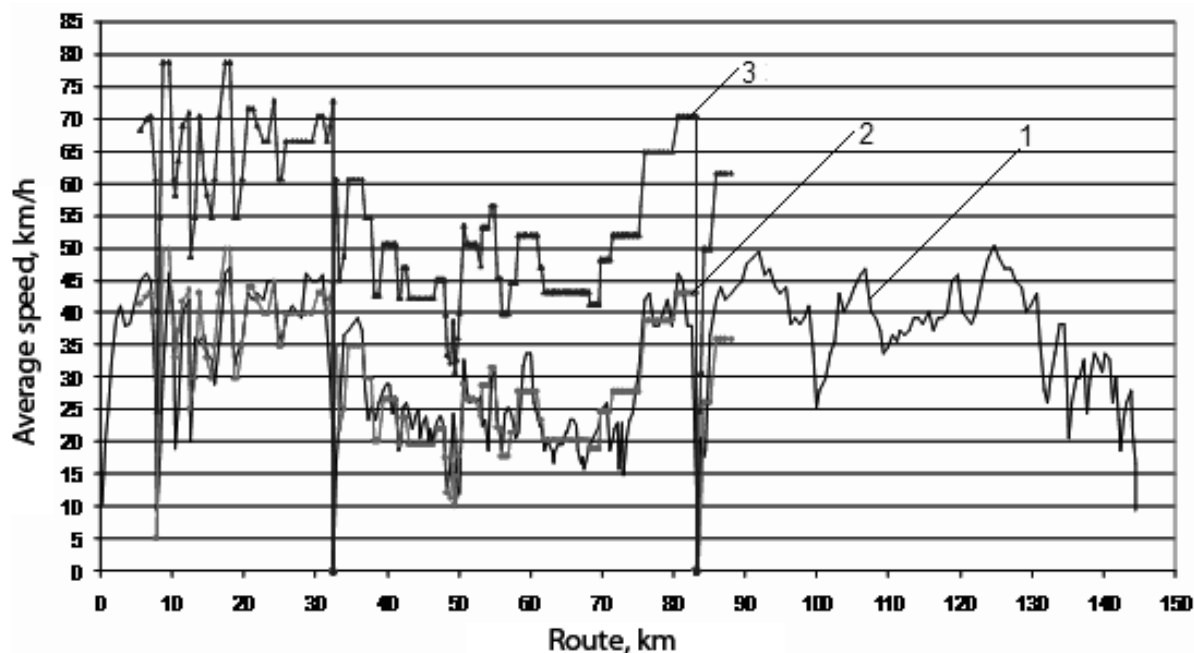


Figure 6. The dependence of the average speed of trains on the route Angren — Pap (wet coating)

Analysis of dependencies shows that the average speed values, at a steady motion of the truck and at maximum traffic intensity, are close one to other and the smaller of them can be chosen. With a decrease of traffic intensity an average speed of steady motion becomes the main criterion for determining the motion of trucks. This confirms the importance of taking into account the conditions of stability in skidding and roll over, as well as the dynamic effects of the fluid that is determined using the mathematical model.

Within the research program method of experiments was developed. The adopted object of investigation is the tractor-trailer ISU-

ZU EXZSIK ISTANBUL-FRUEHAUF, transporting petroleum products in the mountains. Tests were carried out on the road A-373 on site of Kamchik passage under various road conditions (the road is covered with asphalt).

To determine the speed of the semi-trailer truck the satellite navigator «Navibe GPS receiver» with 20 channels is used. It receives the signal from 10 satellites of the Earth every 0.2 seconds and records the change of parameters. The results of the acquisition is shown in Figure 7.

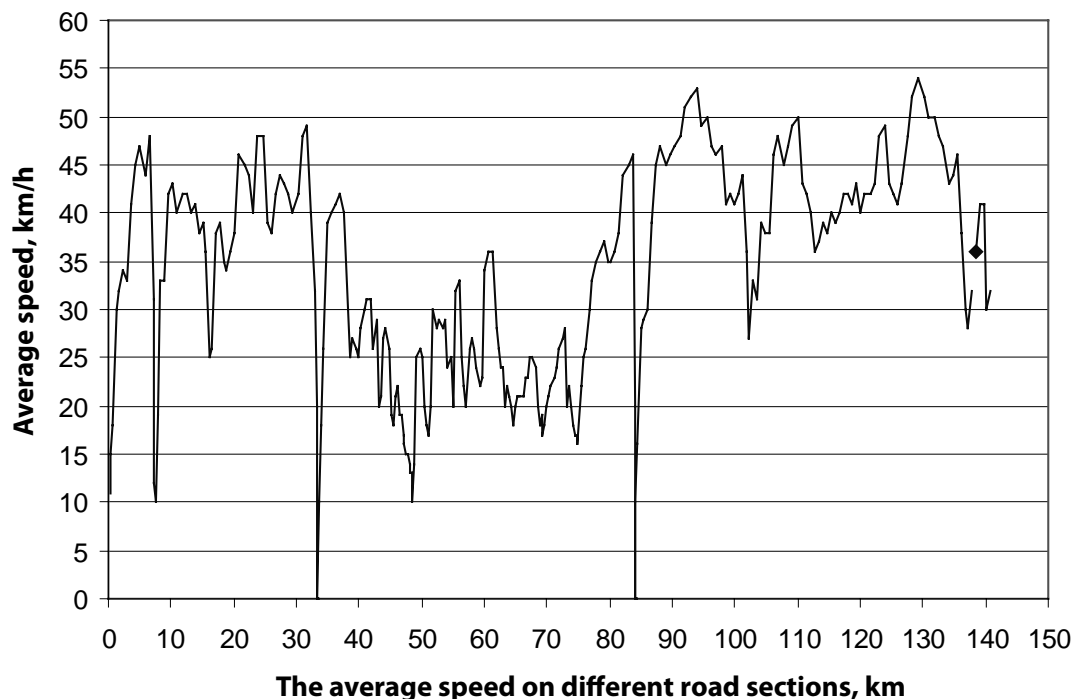


Figure 7. The average speed on different road sections (from the Angren to Pap terminals on the dry road surface)

Comparative analysis of the results obtained from mathematical models and experimental data showed that the average deviation is within 4.8%.

Thus, according to the results of the research the following conclusion can be drawn: the proposed method allows determining trucks average speed, adjusting the parameters of motion (turn radius, speed, acceleration, up- and down-hilling, the dynamic effect of the fluid on the wall of the tank).

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## Section 12. Physics

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-243-246>

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### Optical properties of Si-nanoclusters and channels for the recombination in porous silicon

**Abstract:** We have discussed in detail the theoretical results using local functional density method in parameterized modification of silicon nanoclusters. One of the main conclusions is that the comparison between theory and experiments shows the possibility of different radiative channels for the recombination in porous silicon.

**Keywords:** nanoclusters, silicon, method, modification.

#### Motivation of the study

Research into semiconductor nanoclusters is focused on the properties of quantum dots (QD) — fragments of semiconductor (for example, Si) consisting of some to hundreds of atoms — with the bulk bonding geometry and with surface states eliminated by enclosure. QD exhibit strongly size-dependent optical and electrical properties [1–3]. Two peculiar characteristics of semiconductors influence the ways in which we think of an ideal semiconductor cluster, which is often called a QD. First, it is important to realize that in any material, substantial variation of fundamental electrical and optical properties with reduced size will be observed when the electronic energy level spacing exceeds the temperature. In semiconductors, this transition occurs for a given temperature at a relatively large size compared to metals, insulators, or molecular crystals.

The luminescence observed for por-Si raises an interesting problem related to the possibility of using Si in optoelectronics [2]. One likely explanation is *quantum confinement*, induced by the formation of nanocrystallites, whose effect is to break partially the optical selection rules and allow the material to luminesce.

The most striking property of semiconductor nanocrystals is the massive change in optical properties as a function of size. As size is reduced, the electronic excitations shift to higher energy, and the oscillator strength is concentrated into just a few transitions. These basic physical phenomena of *quantum confinement* arise as a result of changes in the density of electronic states and can be understood by considering the relation between position and momentum in free and confined particles. For a free particle, or a particle in the periodic potential of an extended solid, the energy and the crystal momentum can both be precisely defined, whereas the position cannot. For a localized particle, the energy may still be well defined, but the uncertainty in position decreases, so that momentum is no longer well defined.

For example, the kinetic stability of tetrasilatetrahedrane ( $\text{Si}_4\text{H}_4$ ), hexasilaprismene ( $\text{Si}_6\text{H}_6$ ) and octasilacubane ( $\text{Si}_8\text{H}_8$ ) depends strongly on the steric bulkiness of the substituents (matrix). The silyl-substituted  $\text{Si}_n\text{Y}_m$  ( $\text{Y}=\text{t-Bu}$ ) is stable in an inert atmosphere,

but is oxidized in air to give colourless solids. The 1,1,2-trimethylpropyl-substituted  $\text{Si}_n\text{Y}_m$  ( $\text{Y}=\text{CMe}_2\text{CHMe}_2$ ) is very stable even in air and survives for two weeks in the solid state. The prismanes with Si and Ge skeletons are yellow to orange. These prismanes have absorptions tailing into the visible region. So,  $\text{Si}_6\text{H}_6$  has an absorption band with a maximum at 241 nm tailing to ca 500 nm. The absorption band of  $\text{Ge}_6\text{Y}_6$  ( $\text{Y}=2,6\text{-i-Pr}_2\text{C}_6\text{H}_3$ ) has a maximum at 261 nm, which is red-shifted compared to that of  $\text{Ge}_6\text{Y}_6$  because of the higher-lying orbitals of the Ge-Ge bonds [4].

The discrete energy eigene functions of the particle may then be viewed as super positions of bulk momentum states. Given the relation between energy and momentum in the bulk solid, one can see how a series of nearby transitions occurring at slightly different energies in the bulk be compressed by quantum confinement into a single, intense transition in a QD.

The experimental data reveal a more complex situation probably characteristic of several radiative channels. Our main aim of this paper is to review the relevant theoretical information in order to identify radiative channels.

#### Calculations of quantum confinement effect

A number of calculations have been performed over the last few years, as for quantum dots as for silicon nanoclusters since both possibilities have been invoked for porous silicon. They essentially belong to four classes: effective mass approximation (EMA), empirical tight binding (ETB), empirical pseudopotential (EPS) and finally ab initio local density functional theory (LDFT). In Fig. 1 we give the predicted band gaps versus size as obtained from LDFT calculations compiled in Ref. [5] for hydrogen-terminated Si-nanoclusters, wires and slabs.

They are compared to the results obtained in our group using DFT approach with parameters (PDFT [3]) providing an extremely good fit to the bulk band structure. One can notice a good agreement between the LDFT and PDFT predictions which gives some confidence into the reliability of these theoretical values. At this stage it is important to notice that the LDFT gap values include a rigid shift of 0,6 eV since it is known that LDFT underestimates the

bulk band gap by this amount. Note that the theoretical calculation grossly overestimate the blueshift.

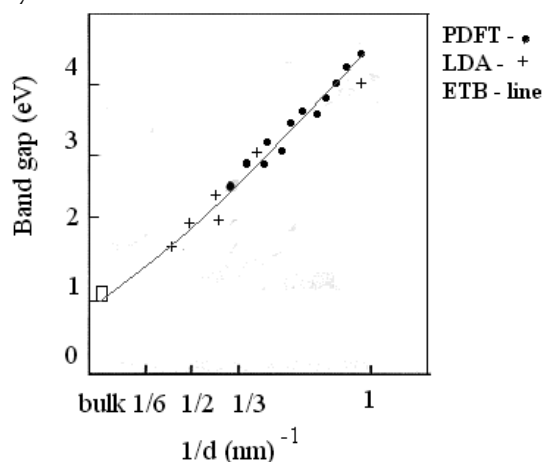


Figure 1. Energy gap vs confinement parameter  $1/d$  for hydrogen-terminated Si nanoclusters ( $d = a(0,75 N)^{1/3}$  for nanoclusters,  $d = a(0,75 N)^{1/2}$  for wires;  $a = 0.54$  nm and  $N$  is the number of Si atoms in the unit cell) [5]

They must then be discarded since EMA can be considered as an approximation to the best ETB or EPS descriptions which match the effective masses. One can, however, wonder why parameterized techniques should provide quantitative estimates of the one-electron gap. The basic point is that they are based on the postulate of transferability of the parameters from the known bulk band structure (to which they are fitted) to the unknown crystallite case. If this is accepted, then an essential criterion by which a particular semi-empirical model can be judged is how well it describes the bulk band structure. So from Fig. 1 we could conclude that PDFT as well

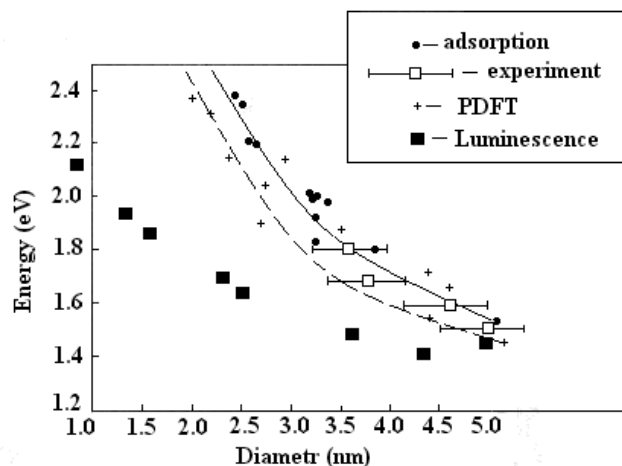


Figure 2. Compilation of optical band gaps of silicon crystallites and porous silicon samples obtained from optical absorption and luminescence (filled symbols and also the more experimental results of B. Kohn group with error bars). Dashed and continuous lines: calculated values with and without the excitonic correction.

We are presently investigating the possible existence of defect states in the band gap induced by the oxidation of the surface. Among different systems that we have studied, preliminary results show that an oxygen atom doubly bonded to a silicon atom ( $\text{Si}=\text{O}$ ) at a nanocrystal surface is a good candidate to be involved in the luminescence of porous silicon. It gives rise to a deep level below the conduction band minimum which could explain the evolution with size of the luminescence peak in Fig. 3.

as corrected LDA techniques are likely to give reliable predictions for crystallites.

Channels for the radiative recombination Fig. 2 presents a compilation of data showing that observed luminescence energies on porous silicon or silicon nanocrystals in an oxide matrix are consistently lower than the predicted optical gaps of Fig. 1. On the other hand, they qualitatively agree with optical absorption data. Recent results also show that the luminescence of fresh porous silicon samples is subject to a large red shift when it is exposed to air and when the average size of the nanocrystals is smaller than 3 nm (Fig 3). On the other hand, recent luminescence measurements on silicon crystals obtained by silane decomposition are in good agreement with theory, but the luminescence is only observed for the largest crystallites. The situation is thus complex, even if it seems that the degree of oxidation of the samples plays an important role in the recombination mechanisms. All these results suggest that other channels for the radiative recombination are possible. Large Stokes shifts might be consistent with the eventual existence of deep luminescent centers. The problem is that nothing is presently known regarding the nature and origin of these states. Both from PDFT and LDA calculations that such states indeed exist under the form of self-trapped excitons, most probably at the surface. A possible situation is the trapping of an exciton on a Si-Si bond of a surface dimer whose dangling bonds are saturated by hydrogen atoms. We have found another interesting situation with very small crystals, containing less than about 50 silicon atoms, where we systematically obtain a large atomic relaxation in the excited state which induces an important reorganization of the bonds in the cluster. The consequence is a large Stokes shift between the absorption and the emission energies. Therefore, small nanocrystals could play a role in the luminescence of porous silicon.

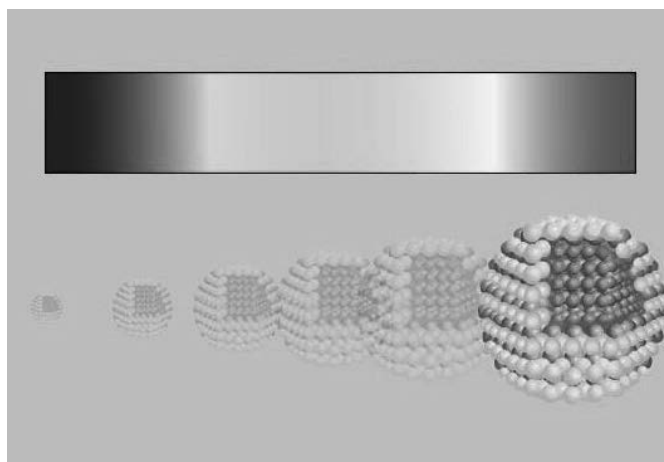


Figure 3. Illustration of the large red shift for ball-like nanoclusters

### Structural dependence of the band gap

G. Allan with coworker's shows that the radiative recombination rate in spherical silicon nanocrystals (calculated as in Ref. [4]). It is low and it decreases for smaller band gap because of the indirect bulk band gap. In this regard, it would be of interest to use a direct gap phase of silicon such as Si-III (BC8) or to use materials like SiGe alloys or amorphous silicon because the disorder breaks the selection rules. But an essential question arises about the existence

of quantum confinement effects in disordered materials. Here we describe recent results that we have obtained on these problems.

The Si-III (BC-8) crystal phase is obtained for *t* bulk samples by releasing the pressure on the high-pressure beta-tin phase (Si-II) [5]. Existing theoretical calculations show that the valence band maximum and the conduction band minimum occur at the same H point in the Brillouin zone. BC-8 silicon is thus a direct gap material but the calculations conclude that it is close to a zero gap semiconductor. To calculate the electronic structure of BC-8 crystallites with size in the 1–3 nm range, we have chosen the same non-orthogonal ETB technique as used for silicon crystallites with the diamond structure but we have developed a specific parameterization for that structure.

Our results show that the confinement effect is quite similar for BC-8 and diamond nanoclusters. The only difference when one goes from the BC-8 cluster to the diamond one with the same size comes from the bulk gap value which simply shifts the cluster gap energy. We have also performed PDFT calculations. One can see that the values calculated with PDFT for two small nanoclusters and shifted by 0.6 eV to take into account the underestimation of the bulk gap, are in very good agreement with our ETB calculation. This confirms the transfer-ability of the ETB parameters from the bulk material to nanoclusters.

Experimentally, it was shown [2], [6], [7] that the BC-8 structure is obtained upon release of a high pressure on porous silicon. But the luminescence band remains practically unchanged except perhaps for a small shift (of order 0.1–0.2 eV) after release of the pressure. This finding completely disagrees with our predictions, where this redshift should amount to ~ 1 eV for crystallites of the same size. This would rule out quantum confinement as the origin of the observed luminescence band and favor other possibilities.

We compare the variation of the recombination rate as a function of the cluster gap for the BC-8 [5] and the diamond structures [8]. Because it has a direct bulk band gap, the recombination rate in the BC-8 phase remains constant and pretty high when the cluster size increases and the blue shift decreases. It is of the order of a few  $\text{ms}^{-1}$  (i. e. more than  $10^3$  times larger than in the diamond phase below 2 eV), but remains however lower than the result for GaAs (~  $\text{ns}^{-1}$ ) which is also a direct gap semiconductor. However, the luminescence yield must be strongly improved for the BC-8 structure compared to the diamond structure.

With improved optical properties compared to silicon,  $\text{Si}_x\text{Ge}_{1-x}$  alloys are also interesting materials. We have studied the strong confinement effects in SiGe nanoclusters performing ETB calculations with the parameters. We consider spherical nanoclusters passivated by hydrogen atom where the atomic sites are occupied randomly by Si or Ge atoms following the composition *x*. Our results shows that the band gaps of  $\text{Si}_{0.8}\text{Ge}_{0.2}$  and Si nanoclusters are quite close, with comparable blue-shift. This is due to the fact that the electronic states in bulk SiGe alloys are still delocalized, so they experience the full confinement effect as for crystalline Si (c-Si).

We now analyze the case of stronger disorder as obtained in amorphous silicon (a-Si). It raises extremely interesting problems related to the confinement induced blue shift of the energy gap: (a) does it exist in nanoclusters of a-Si and is it comparable to what is obtained for c-Si; (b) what is the behavior of disorder-induced localized states in this regard. It has been often assumed that quantum confinements effects are small in a-Si nanostructures due to the short coherence length of free carriers in these materials. We will see that it is not true.

We calculate the electronic structure of a-Si and a-Si: H spherical nanoclusters using the ETB and PDFT model. The interaction parameters are limited to first-nearest neighbors and the usual  $d^2$  Harrison law can be used to calculate their variation with interatomic distance *d*. The starting structure for the a-Si or a-Si: H nanoclusters is obtained by selecting the atoms belonging to the respective atoms unit cell. Due to the new boundary conditions the structure is no more in equilibrium and we have thus relaxed the atomic positions using a Keating potential.

A generally accepted picture of the electronic structure of a-Si is that it is still composed of valence and conduction bands separated by an energy gap but with bandtails of defect or disorder-induced localized states extending into the gap. For what follows we find it useful to classify the electronic states into three categories: delocalized states, experiencing the full confinement effect as for c-Si; strongly localized states with extension in space much smaller than the cluster diameter and energies deep in the gap, insensitive to the confinement effect and showing no blue shift; weakly localized states with extension in space of the order of the cluster diameter and energies near the gap limits, subject to an intermediate blue shift.

To characterize the luminescence of our a-Si nanoclusters with 1–2.5 nm size we have first computed their fundamental gap, i. e. the distance in energy between the HOMO (highest occupied molecular orbital) and the LUMO (lowest unoccupied molecular orbital). There is a substantial blue shift in both cases, more important for a-Si than for a-Si: H. Furthermore, our larger a-Si nanoclusters give rise to a two-peak distribution. We have checked that the lower and upper peaks are, respectively, due to strongly and weakly localized or delocalized states. The relative intensity of the upper peak thus corresponds to the proportion of nanoclusters which do not contain strongly localized states. The apparent blue shift in a-Si nanoclusters has thus two origins: (a) the varying proportion of nanoclusters with strongly localized states and (b) the normal confinement effect on the other states. This is confirmed on the sapie figure by the a-Si: H nanoclusters which show only the second type of behavior.

Thus we have discussed in detail the theoretical calculations on the band gap of Si nanoclusters. One of the main conclusions is that the comparison between theory and experiments shows the possibility of different radiative channels for the recombination in porous silicon which is a complex material such as, for example, clustered heterostructures [5].

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-246-248>

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## Korrektirovanie parametr of Photothermoelectrical characteristic of the base p-n branches in converters of the solar energy before 500 temperatures Kelivina

**Abstract:** In article is studied and explored adjustment characteristic parameter p -n branches of Photothermoelectrical converter for fuel and solar radiations.

**Keywords:** adjustment, photothermoelectrical converter, solar radiations, thermoelectric generator.

At present, the main way of the direct transformation of the sunshine in electric energy is a photoelectric method, realized on the base semiconductor solar element. Modern technology has drawn near firm importance's performance such element to 25–30% depending on base material. In spite of so appreciable successes, factor, holding up broad practical application of the Photoelectric method, is its high cost. So central problem of solar energy are a development of the methods of the maximum selection to energy of the light in converter and reducing the price of converting device.

The first from delivered problems possible to solve by creation cascade converters, for instance, photothermoconverters (PhTC), in which photoelectric cascade will convert the light radiation, but thermoelectrically — associated overheads radiant and heat energy in thermo element. Herewith thermoelectric generator (ThEG) in addition executes the function of the cooling photoconverter.

The ways to decision of the second problem opens use as material for photocell comparatively cheap film amorphous silicon and join  $A^{II}B^{VI}$ , in which development and optimization of the technological methods can be reached high performance.

Reducing the price of worked out electric powers possible to reach when use concentrator solar radiation. However in this case, because of essential heating photo convertor, noticeably fall the worked out power and performance. For instance, losses to solar energy in photoconversion structure on base monocrystalline silicon form more than 50%. In this case loss to powers possible to compensate the additional generation to electric powers in thermoelectrically cascade.

The purpose of the work was a study performance PhTC on base solar element from semiconductor film and ThEG from polycrystalline hard solution based on  $Bi_2Te_3$ .

In PhTC between photoelectric and thermoelectrically cascade is located dielectrically plate with high thermal conduction (the ceramics) for ensuring the good heat contact between them and galvanic uncoupling. Such a joining allows providing the tap of the heat from photoelectric converter that raises its energy factors reduces degradation photosensitivity of the element, because of si-

multaneous influence of the light and temperature, the conducted heat is used for the further transformation in electric energy of thermo generator. The heat with thermo generator leaves by means of air or heat cooling. Efficiency of PhTC can be increased by means of glass plates, covering Photosensitive element.

Under development in persisting work device is calculated on operating range of the temperature 300–500 K. For this interval of the temperature the most efficient and, probably, single for present-day thermo electrical material are  $Bi_2Te_3$ ,  $Bi_2Se_3$  and hard solutions on their base.

The choice photo converting device for multifunction PhTC depends on construction particularities of the energy installation. Vicinity greatly reached efficiency in solar element on base different material (refer to, for instance, [1–3]) does important under such choice not as much material itself as ease of manufacturing of the fabrication element, stability their characteristic, sufficient resource at fall of the powers with the temperature, stability to external influence and economy.

The decision delivered here problems more is effectively realized when use Photo converters on base amorphous silicon or join  $A^{II}B^{VI}$  films.

The most efficient PhTC is an element from photo-and thermo elements, prepared from isolator laying, having high thermal conduction. In this case there are load miscellaneous in circuit of each element. PhTC carries the name PhTC with prepared by load.

The energy of the radiation, falling on converter, is partly converted in electric power, but remaining portion of the radiation, converting in heat, warms photo convertor and hot end thermo element. The cool junction thermo element is supported under constant temperature.

In device with separate load coordination current (the voltages) possible produce selecting the number of elements in Photo-and thermobatteryes.

Elements were used for study of the field-performance data solar element from ready pilot models solar battery on base  $\alpha - Si$  : H with maximum performance 9–12%. The elements on the base

CdS/CdTe thin-film heterojunction were made on perfected technology [2-3]. The measurements were conducted on standard methods, user for study Photo generating structures [2].

The family of load VACH and dependencies  $W(U)$  thin-film photocell on base  $\alpha - Si : H$  under different temperature was submitted for fig. 1 Solar elements fitted on heating device, allowing is sailed to change its temperature. The temperature was measured by means of copper thermometer of the resistance. The power falling radiations was supported at a rate of  $40 \text{ mW} / \text{sm}^2$ , area to surfaces element was  $1,2 \text{ sm}^2$ . Performance element under  $T=300\text{K}$   $\eta \approx 7,5\%$ . He falls before 6% under  $T=350\text{K}$  and 4,5% under  $T=420\text{K}$ . Re-

duction performance (power) is connected with significant fall worker voltages, because of heating of the photocell by solar radiation. The Warm-up factor of the voltage of the castrated move for amorphous silicon negative and can reach  $0,3-0,4\%/K$ . Opposite, warm-up factor of the current of the castrated move-positive and forms  $0,07-0,08\%/K$ . Fall worker voltage at heating solar element is partly compensated by growing of the current of the short circuit when increase the powers falling radiations (the voltage of the castrated move practically is not changed when change of luminosity). In any event, the heating element leads to reduction of the output power.

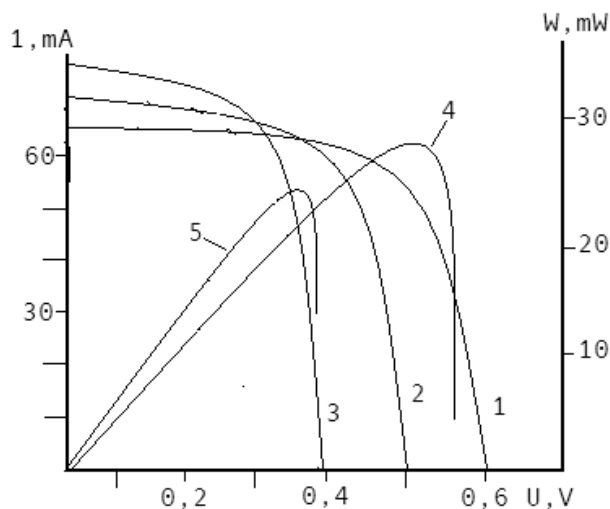


Fig. 1. Load VACH (1, 2, 3) and output power (4, 5) of the photocell on base amorphous silicon under  $T, K$ : 300 (1, 4); 350 (2); 400 (3, 5)

The similar studies are organized for solar element on base CdS/CdTe. Family load VACH is shown on fig.2 under different level of the powers giving radiations, which was adjusted by means of concentrator. The elements were warmed to account of the increase to intensities of the illumination. Their temperature and in this case it was defined by means of copper thermometer of the resistance. The conditions of the experiment were following. The Solar element in two events was supported under room temperature by means of cooling device (running water) under different

level of luminosity (the curves 1, 2 on fig. 1). Performance element herewith increased from 6% before 7,5%. If photocell specially is not cooled then at powers falling radiations he is warmed before the temperature 350K, but its performance decreases to account of the heating on 1,5% (the curves 2,3). The further increase to powers falling radiations reduces performance before 5% (the curve 4). Thereby heating sample when increase the intensities of the solar radiation greatly influences upon amount worked out powers on load.

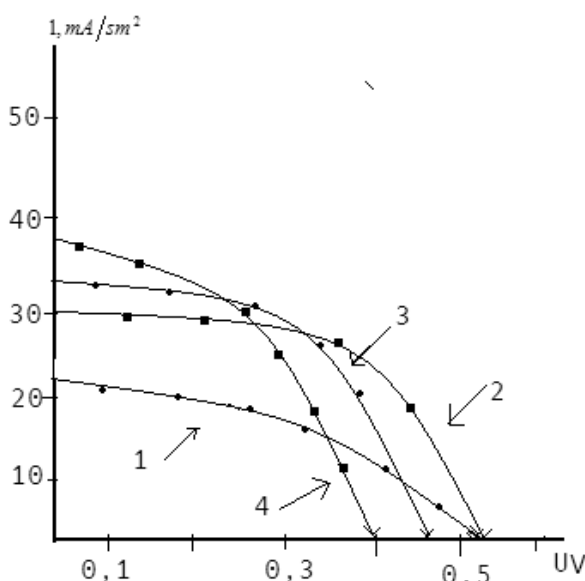


Fig.2. Load VACH solar element on base  $(In_2O_3 + SnO_2)/CdS/CdTe$  under different level of the powers falling radiations  $W, \text{mW} / \text{sm}^2$  :60 (1), 140 (2,3) and 180 (4). The Temperature of the element  $T, K$ : 300 (1, 2); 250 (3); 400 (4)

Producing quantitative comparison result for Photocell from  $\alpha - Si : H$  and  $CdS/CdTe$ , possible conclude that really in solar element on base film  $A^{II}V^{VI}$  exists the more low warm-up gradient of the fall to powers, as this and was noted in [2; 3].

The photocells responsible for direct transformation of the solar radiation are going to in modules. The solar modules — a main part of any photoelectric system. The most spreading has got the modules from monocrystalline, polycrystalline or amorphous silicon element. However principles of construction modules for different material practically like.

The maximum power of the solar module from amorphous silicon  $W = (585 \pm 5)$  mW is generated  $U = (490 \pm 5)$  mV and  $I = (1, 18 \pm 0, 02)$  A. Maximum power of THEG  $W = (190 \pm 5)$  mW is generated under  $U = (240 \pm 10)$  mV and  $I = (0, 80 \pm 0, 02)$  A. Considering

that falling radiation had a power  $W_s = 5, 2$  W (with provision for dissipations ~20%), maximum performance solar module  $\eta \approx 11, 3\%$ . Since diffused by solar module power  $W_d = W_s(1 - \eta) \approx 4, 6$  W, performance of ThEG  $\eta_{TEG} \approx 4, 2\%$ .

On fig.3 are presented warm-up dependencies performance component parts of PHTC and performance of “photo-thermo” as a whole.

According to this given in all working range performance converter weakly depends on the temperature. Such behavior of performance is explained by opposite nature of the change to efficiency of the different converters with growing of the temperature.

Thereby for PhTC with module from amorphous silicon and ThEG from hard solution of bismuth telluride in interval of the

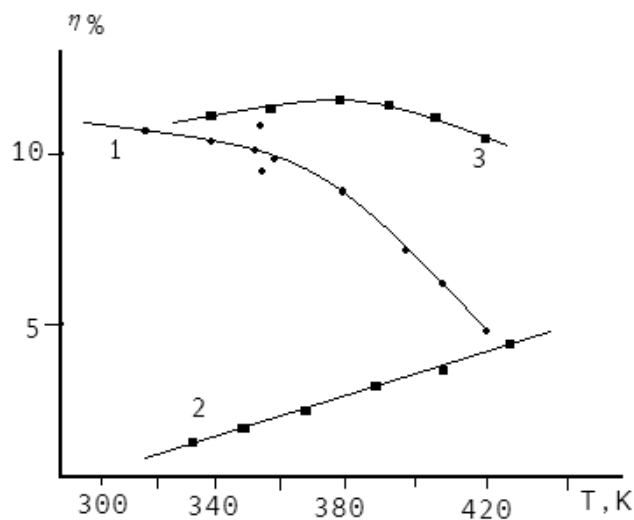


Fig.3. The warm-up dependencies of performance of solar module (1), ThEG (2) and PhTC (3). Temperature of the refrigerator was 295 K

Temperature 300–450 K performance PhTC practically does not depend on the temperature to account self compensation losses to powers with the temperature in solar module by increase to powers, worked out ThEG, to the account of the growing to differences of the temperature between the ends of thermoelements.

As to development material for ThEG, that possible note that exists the row a material on base hard solution  $Bi_2Te_3$  for instance

$Bi_2Te_{2,4}Se_{0,6}$  for m-branches and  $Bi_{0,5}Sb_{1,5}Te_3$  for p-branches. Selecting corresponding to doping concentration of the carriers of the charge, possible provide optimum thermoelectric generation within the range of before 500K. The most suitable and cheap technology of the creation thermoelectrically material will see pressing a polycrystals. The cardinal principles to such technologies are brought, for instance, in [4].

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## Revisiting the nature of dark sunspots

**Abstract:** A new physical mechanism explaining the reason of darkness of sunspots is proposed in this work. It is based on the results of the experimental research of the effect of magnetic fields on the intensity of the light of incandescent electric lamps. These results indicate the magneto-optic nature of sunspots.

**Keywords:** magnetic fields, magneto-optic phenomena, dark spots on the Sun.

So far, extensive observational material about sunspots has been accumulated, but there is still no clear understanding of their physical nature [1; 2]. The question why the spots are actually dark remains open. There is only one answer to this question in reference literature: the spots are dark because they are colder than photosphere as their magnetic fields suppress the convection of photospheric plasma. However, the hypothesis about the magnetic refrigeration of spots cannot be acknowledged as either proved or convincing.

It has been known for long that the convection is not suppressed even in the biggest spots [1, 272]. Constant magnetic field conceptually cannot change mean kinetic energy of charged particles, because the force it affects them with is either perpendicular to the particle velocity or equal to zero. The transfer of energy in the photosphere of the Sun is primarily radiative and the role of convective heat exchange is comparatively small due to the low density ( $\sim 10^{-7}$  g/cm<sup>3</sup>) of the substance. Considering that the degree of ionization of photospheric gas is lower than 0,1%, it appears unlikely that the magnetic field, influencing the convection and not influencing the radiative heat exchange, can generate such considerable and sustainable refrigeration of the spots.

The model of a cold spot is inconsistent with a lot of observational data, for instance, such as sharpness of the spot borders and photosphere, shadow and half-shadow, possible bright bridges in the shadow, fiber structure of the half-shadow, delicate bright structure of the spot [2, 208–216] etc.

Photometric changes [1, 104–132, 144–146] causing different temperatures of the spots and photosphere are based on the laws of thermal radiation and presumption that both, photosphere and spots are similar to absolutely black bodies. But there are significant differences between spectra of spots and spectra of photosphere [1, 132–142], and they do not relate to each other as spectra of thermal radiation of same differently heated body, i. e. substances of the photosphere. This circumstance creates a big doubt that the presumption stated above corresponds to the facts.

The difference in the spectra of spots and photosphere is especially distinctive in the continuous radiation. In case of photosphere, it is clearly observed and described by the Planck function, i. e. it corresponds to the equilibrium thermal radiation. At the same time, in wide areas of the spectrum, the purely continuous radiation of the spots is not observed at all [1, 133–134]. In [3], it is shown that averaged curve of radiation energy distribution in the spectra of the spots obtained according to the data of different observers does not agree with the curve of equilibrium thermal radiation under any circumstances. In [4], a two-component (according to the temperature) model of the shadow of the spot is proposed, because it is impossible to explain simultaneous observation of the lines with high and low

excitation potential in the spectrum of the shadow of the spot within the frames of temperature-homogenous model.

Let's emphasize another principally important fact [1, 140; 5, 233–234]. There are mutually excluding lines of titanium monoxide TiO and diatomic carbon C<sub>2</sub> molecules of almost identical intensity in the spectra of the shadow of spots, which are not observed simultaneously in the spectrum of the Sun (and in the spectra of stars). It signifies that the spectrum of the shadow of spots cannot be referred to one of the certain spectral classes typical for thermal radiation sources.

A presumption that the darkness of the spots is caused by the effect of a non-thermal factor and cannot be explained based on the thermal radiation laws logically follows from the above said. According to the author, magnetic field, an attribute of sun spots, is such factor, but their darkness is determined not by cooling, but a direct effect of the magnetic field on the intensity of radiation. In other words, this means the extinction of thermal radiation of the photospheric gas with magnetic field. Herewith, in consequence of magnet-induced dissipation of the energy of electronic excitation of atoms and molecules of the photospheric gas, sun spots should be hotter than the environment surrounding their photospheres.

For the purpose of experimental check of the hypothesis about magnetic extinction of thermal radiation, the effect of magnetic fields on the intensity of light of electric lamps was researched. Such choice of the object of research is determined by the fact that the working temperatures of tungsten wires of filament lamps are within the range (2200–2900) K, which is close (in respect of the order of value) to the temperature of the photosphere substance.

Quartz-halogen lamp for the microscopes of HL-WS4-TGL-11381–20W-6V type and regular flashlight lamp of 3,5 B×0,26 A type were used in the experiments. The intensity of the light spread in the direction along the force lines of the magnetic field affecting the hot filament of the lamp was registered.

The impulses of the magnetic field in the form of subsiding sinusoid with the frequencies around 100 and 380 Hz and the amplitudes of induction up to 5 and 12 T respectively were applied, which were obtained by the discharge of capacitor bank with the capacity of 3,46 mF and voltage up to 5 kV through copper coils with the induction of approximately 50 and 985 μHY. The charge was commutated by air trigatron [6].

The experiment was conducted as follows. Electric lamp was fixed inside the coil so that the hot filament was in its center. In the magnetic fields with the frequency of 380 Hz, a halogen lamp powered with alternate current with the force of 2 A and frequency of 50 Hz, and a lamp with the frequency of 3,5V×0,26 A in the fields of 100 Hz, the source of supply of which was a battery with the voltage of 3 V, were used.

The light from the lamp fell on the end face (diameter 3 mm, length 2 m) and arrived at the entrance window of photo-electronic multiplier FEU-36 through another face, the signal of which was registered by a two-beam memory oscilloscope C1-42. The anode of the PEM was neutralized and high voltage of negative polarity ( $\sim 1150$  V) was sent to cathode. The PEM signal had negative polarity and was sent to the entrance (direct or inverse, closed or open) of oscillograph operating in the waiting mode. The sweep of oscillograph was started by external impulse, after which to the controlelectrode of the trigatron was supplied high voltage pulse, initiating its ignition. The second beam of the oscillograph was supplied with a signal from Rogowski loop with RC-integrator that registers time travel of current (magnetic field) in the coil.

Before the application of magnetic field (and soon after it) on the lamp, a certain level of the constant component of the PEM signal was established and measured according to the intensity of oscillogram. It should be noted that the pulsation of brightness of halogen lamp at used duration of the sweep of oscillograph (1 ms/div) was not found. Relative error of the measurements of the amplitudes of signals did not exceed  $\pm 10\%$ .

The PEM was working in the linear mode (bleeder current exceeded anode current by not less than 20 times). The optical channel of the PEM was soundly protected from foreign light. The PEM had a dual copper-iron screen and distanced from the coil of the magnetic field to the distance of  $\sim 1,5$  meters. The impulse magnet, including capacitor bank, was fully closed from the PEM with an iron screen with the thickness of walls of 3 mm.

The main result of the experiment lies in the establishment of the fact of partial or complete extinction of the intensity of light of

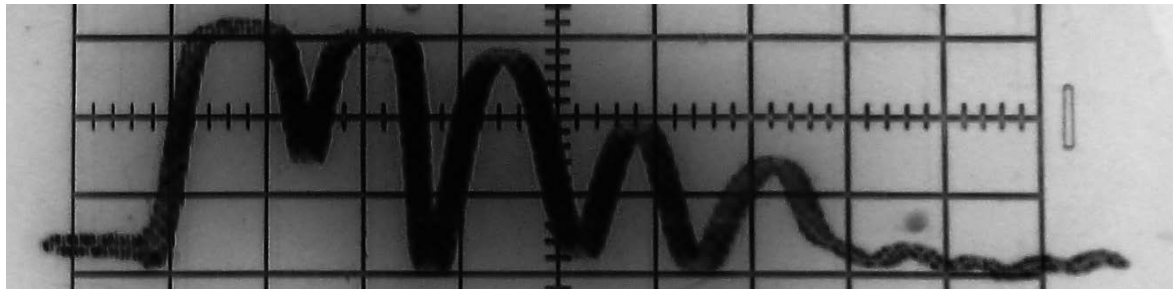
filament lamps during the application of the filament of the impulse magnetic field on them. *Threshold* values of the field induction provoking noticeable (registered) reduction of the light intensity, and *critical* values of the field induction, at which full extinction of lamp luminance is achieved, are different for different impulses of the magnetic field depending on the amplitude of induction, duration of the impulse and velocity  $dB/dt$  of the change of field induction in time.

The dynamic picture of changes of the light intensity of researched lamp in alternating magnetic fields is quite fully and appropriately reflected by oscillograms presented in Fig. 1 and Fig. 2.

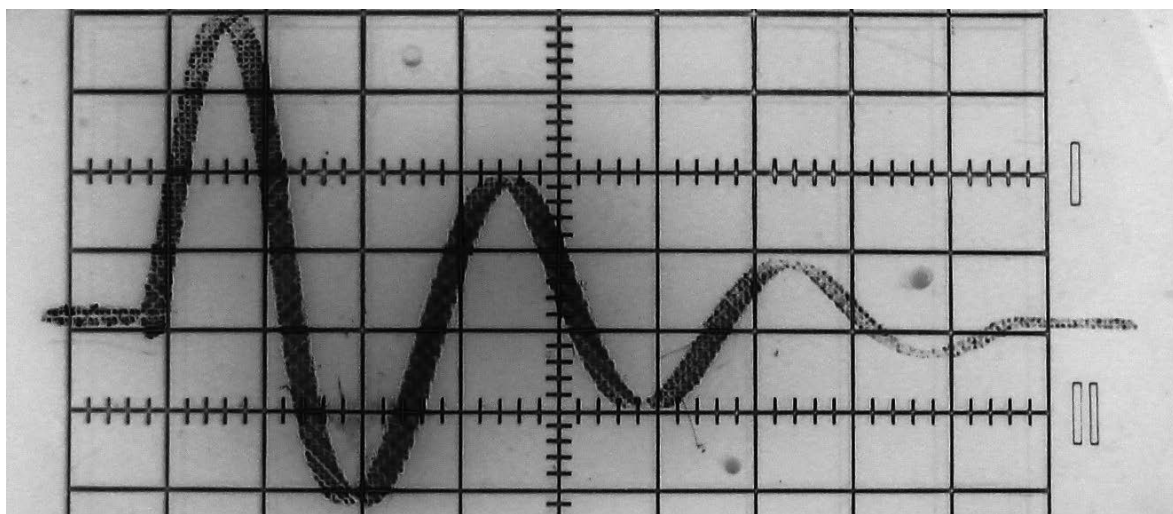
According to these oscillograms, one can assess that the critical values of induction account for about 7 T for the field with the frequency of 380 Hz and  $\sim 0,6$  T for the field with the frequency of 100 Hz, and threshold values —  $\sim 0,3$  and  $\sim 0,1$  T respectively. A big difference of critical values of the induction of magnetic fields, oscillating with less than one order of different frequencies, is determined, apparently, by a strong dependence of the efficiency of magnetic extinction on the velocity  $dB/dt$  of the change of field induction in time.

Let's comment on the oscillograms of the change of light intensity of the lamp  $3,5 B \times 0,26$  A in the magnetic field, oscillating with the frequency of 100 Hz, which are presented with curves below in Fig. 2 a), 2 b) and 2 c).

The oscillogram in Fig. 2 a) was received at the open inverse entrance of the oscillograph and shows full PEM signal, including its constant component. Already at the beginning of the half-wave of the magnetic field (amplitude 1,2 T), there is full extinction of the observed luminance of the lamp, after which, the flash of light appears only in the first minimum of the magnetic field.



a)

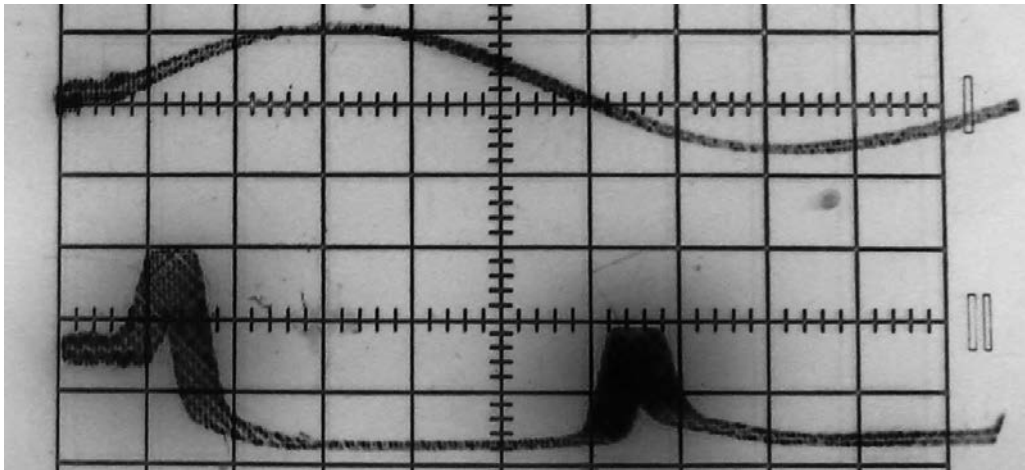


b)

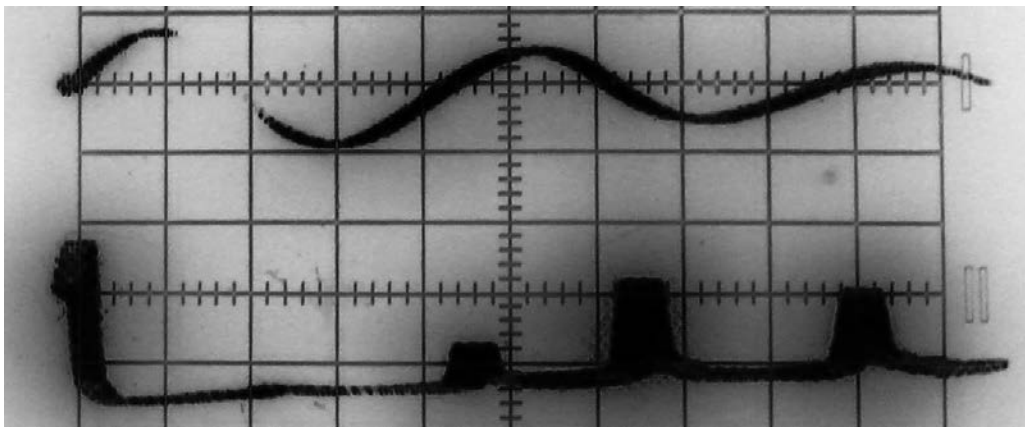
Figure 1. — a) Oscillogram of the light intensity of the halogen lamp in the magnetic field; the entrance of the oscillograph is inverse, closed, vertically 2 V/div; constant component of the signal 5,6 V. — b) Oscillogram of the current (magnetic field) of the coil, vertically 3 T/div, amplitude of induction  $B_m = 11,2$  T. The sweep for both oscillograms is 1 ms/div

The oscillogram of the intensity of the light of the same lamp in Fig. 2 b) was obtained with bigger (than in Fig. 2 a)) duration of the sweep at the closed direct entrance of the oscillograph and shows alternating component of the MEP signal. The complete extinction of the lamp's light takes place at the very beginning of the front edge

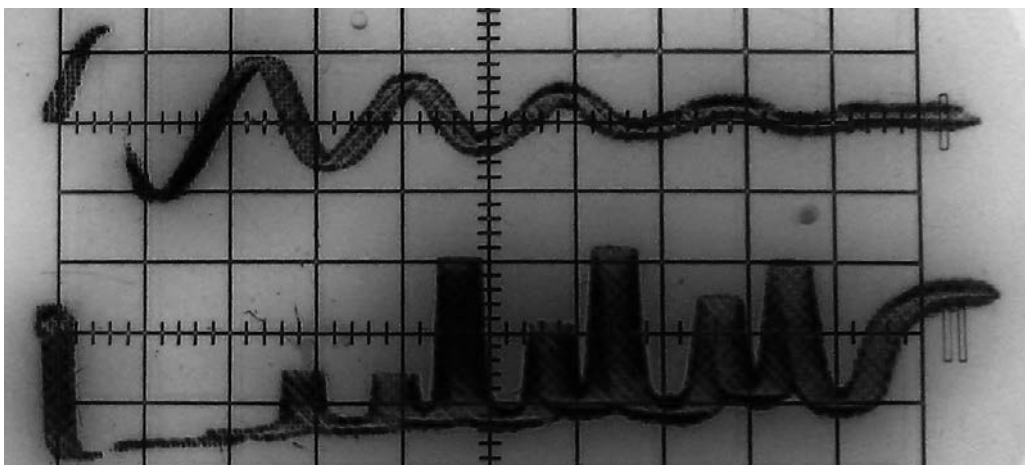
of the first half-wave of the magnetic field (amplitude 2,4 T), and future flashes of light (of different brightness) are observed starting from the second minimum of the field, which is, possibly, related to the manifestation of the effect of consequence of the magnetic field on the electronic structure of the tungsten [7].



a)



b)



c)

Figure 2. — a) Upper beam — oscillogram of the current (magnetic field) of the coil, vertically 1,5 T/div, amplitude of induction  $B_m = 1,2$  T, lower beam — oscillogram of the intensity of light of the lamp  $3,5 \text{ B} \times 0,26 \text{ A}$  in the magnetic field, the entrance of the oscillograph is inverse, opened, vertically 0,5 V/div, constant component of the signal 0,7 V, sweep 1 ms/div. — b) Upper beam — oscillogram of the current (magnetic field) of the coil, vertically 3 T/div, amplitude of induction  $B_m = 2,4$  T, lower beam — oscillogram of the intensity of light of the lamp  $3,5 \text{ B} \times 0,26 \text{ A}$  in the magnetic field, the entrance of the oscillograph is direct, closed, vertically 0,5 V/div, constant component of the signal 0,8 V, sweep 2.5 ms/div. — c) Upper beam — oscillogram of the current (magnetic field) of the coil, vertically 3 T/div, amplitude of induction  $B_m = 3,6$  T, lower beam — oscillogram of the intensity of light of the lamp  $3,5 \text{ B} \times 0,26 \text{ A}$  in the magnetic field, the entrance of the oscillograph is direct, closed, vertically 0,5 V/div, constant component of the signal 0,8 V, sweep 5 ms/div

The oscillogram of the intensity of light of the lamp (see Fig. 2 c)) was obtained in the magnetic field with the amplitude of 3,6 T. The duration of the sweep allows tracking the activity of the field during the time of about 0,05 s. As in previous cases, the lamp goes down at the very beginning of the first half-wave of the field and future flashes are observed starting from the third minimum of the field. (It should be noted that noticeable drift up of the zero line of the oscillograms of the intensity of light in Fig. 2 b) and 2 c) is explained by the fact that the constant of time of the closed entrance of the oscillograph is equal to approximately 20 ms.)

Thus, the results of the experiment allow stating a new physical phenomenon that lies in the fact that the magnetic field can reduce the intensity of the visible light of heated bodies till complete extinction. Due to the fact that the experiment in relation to the photosphere is modeled, this phenomenon cannot be directly transferred to the processes in sunspots, but there is also no basis to deny its applicability to them only on the basis of the fact that the source of radiation is a burning hot metal and not photospheric gas. One can assume that the extinction of radiation of photospheric gas should not be accompanied by any effects of the consequence of the magnetic field possible only in condensate environments.

It is interesting that the threshold ( $\sim 0,1$  T) and critical ( $\sim 0,6$  T<sub>к</sub>) values of the induction of magnetic fields with the frequency of 100 Hz for the luminance of tungsten wire agree well with the values of the lowest and biggest induction of magnetic fields in sunspots [2, 227].

If it is granted that the darkness of the spots is determined by magnetic extinction of the radiation of photospheric gas, then a lot of observational data, which is difficult to explain based on the model of cold spot, gains natural and clear interpretation. Here are several examples on this topic, which are formulated in the form of statements.

Inhomogeneity of the brightness of the spots is the reflection of inhomogeneity of their magnetic fields. Bright bridges in the shadow are the sites of the spots, where magnetic field is lower than the threshold one; they can be fairer than photosphere, because they are hotter than it. Long-living pores, which the formation of spots starts from, do not have half-shadow because their magnetic field is quite homogenous and strong. The energy of Evershed motions is the energy of radiation dissipated into the heat by the magnetic field, i. e. the shadow of the spot is the hottest area of the photosphere. Such examples may be continued (see [2, 262–264]).

To conclude, let's note that the detection of magnetic extinction of thermal radiation in simple experimental conditions is not an accidental event and has a long pre-history.

In 1913, Steubing discovered magnetic extinction (till extinguishing) of the luminescence of iodine vapors [8]. This phenomenon remained unclear for long, until 1932, when Van Vleck explained it as a result of magnet-induced pre-dissociation of iodine molecules found later in other mainly two-atom molecular gases [9].

In [10], the phenomenon of magnetic extinction of the luminescence of laser ruby at room temperature in the impulse fields with 50 T is described, which was studied at all possible mutually perpendicular and parallel orientations of the magnetic field, optic axis of the ruby sample and direction of the observation of its luminescence. Either partial (threshold induction 24 T) or complete magnetic extinction of the luminescence of the ruby (critical induction from 40 T and higher) was observed.

Within the experiment described above, the issues related to the spectral and spatial selectivity of the influence of magnetic fields on the intensity of thermal radiation of different substances remain unexplained. Additional research is required to answer these questions.

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## Using metaphors in the works of the great poet-classic Ajiniyaz

**Abstract:** The article deals with the study of the lexical stylistic device — metaphor in the poetic works of the famous Karakalpak poet-classic of the XIX-th century Ajiniyaz. Individual genuine metaphors are of a great importance, because they are coined by the poet and show the peculiarities of the individual style of the poet.

**Keywords:** metaphor, language metaphor, figurative metaphor, individual genuine metaphor.

Ajiniyaz Kosibay Uli is one of the greatest Karakalpak poets of the XIX-th century who made great contribution to the development of the Karakalpak poetry and the East poetry as well. His poetic works are well-known not only to the Karakalpak people, but to the Uzbek, Kazakh, Turkmenian and other peoples. The President of the Republic of Uzbekistan I. A. Karimov, appreciating the talent of the poet, writes that “The bright lyricism of Ajiniyaz is the unfaded artistic monument of the youth, beauty and good” [1, 1].

Ajiniyaz Kosibay Uli (his pen name was Ziyar) was born in 1824 in Muinak region in the village of the Kiyat and Ashamaili in the place “Kamis boget”, the lower reaches of the Amu-Darya river on the Southern shore of the Aral Sea. His father Kosibay was a poet, he knew the history of his country well and he was fond of hunting. His mother Nazira was a sharp-tongued and witty woman of her time. Ajiniyaz was fond of poetry and read with great interest the masterpieces of the oriental classical literature: Nizami, Dekhlevi, Navoi, Fizuli, Hafiz, Saadi, Mashrab, Andalib, Makhtumkuli and others. The time of his study in Khiva was the period of the flourishing of his poetic talent, here he got acquainted with the works of the Arab, Pharsi and Turkic literature: Agakhi, Munis, Bayaniy, Kamil, Shunasiy, Maznab [4, 10].

Ajiniyaz was greatly impressed by the poems of Dekhlevi, he called him “The Indian magician”. As Dekhlevi and Navoi, Ajiniyaz tried to find rich, changeable, flexible dynamic forms corresponding to the themes of his poems. One of the famous Karakalpak scholars — academician M. K. Nurmukhamedov writes that “It’s impossible to analyze the peculiarities of the poetic works by Ajiniyaz without knowing the works of Navoi, Fizuli and other poets” [4, 16]. Ajiniyaz left us the invaluable works, the heritage consisting of many lyrical poems. The study of the expressive means and stylistic devices in the lyricism of Ajiniyaz is of a great importance and one of the actual issues in Karakalpak Stylistics. The main aim of this article is to study a metaphor- one of the lexical stylistic devices based on the principle of identification of two objects. The term *metaphor* means transference of some quality from one object to another. From the times of ancient Greek and Roman rhetoric the term has been known to denote the transference of meaning from one word to another.

Metaphors, like all stylistic devices, can be classified according to their degree of unexpectedness. The famous Karakalpak scholar, professor E. Berdimuratov distinguishes three types of metaphor: 1) language, trite metaphors, which are commonly used in speech; 2) figurative metaphors, which are absolutely unexpected, unpredictable and 3) individual, genuine metaphors which are subjective, they are usually coined individually by certain writers and poets [2, 23]. In the lyrical poems by Ajiniyaz there are different types of metaphor [3]. In the following lines we can see metaphors:

1. Сарғайып көринген дагның қулағы,  
 Дегрәсинде әлұан-әлұан бұлағы ... [2, 113]  
*The mountain's ear, yellow and round,*  
 With colourful clouds around.
2. Дәүлетің жылдан, Меңеш, жылаға толсын,  
 Өзіңнің өмір жасың узын болсын ... [2, 223]  
*Menesh, let your life be long,*  
 I wish you luck in my song.
3. Мақтанғандай бұл қағаздың жүзине ... [2, 105]  
*It's worth praising on the paper's face ...*
4. Қара дағның уша басы,  
 Қарлы болур, қарсыз болур. [2, 131]  
*On the top of the mountain*  
 There is white snow,  
 Or there snow there is no.

In the lines given above, there are language, trite metaphors: *дагның қулағы* (mountain's ear), *өмір жасың узын болсын* (let your life be long), *қағаздың жүзине* (paper's face), *дагның уша басы* (on the top of the mountain). They are time-worn and well rubbed into the language. They help the poet to enliven his work and even make the meaning more concrete.

Ajiniyaz was skill in using figurative and individual, genuine metaphors. The topic of Motherland and love for his country takes an honorary place in the lyricism of the poet. In the following example from the historical poem “Bozatau”, he describes the country, using a metaphor:

Ел хәм жер биләндур, жер хәм ел билән,  
 Жерсиз елдің өмири дәрбәдәр билән,  
 Өмир өтті жүректеги шер билән,  
 Қәдириң сениң бизге өтті, Бозатау. [2, 26]  
*A country is in unity with land,*  
 The land cannot be without a country now  
*A country cannot live without land.*  
 We love and miss you, Bozatau.

The poem conveys the spirit of patriotism with great force, therefore it became the hymn of the Karakalpak people in their struggle for freedom and independence. Philosophic thoughts and ideas about the role and meaning of a man in the society are in the centre of attention in his poems.

Ajiniyaz is one of the poets who spent the most part of his life travelling to other countries. After graduating from Khiva madrasahs Ajiniyaz had been travelling for several years in Kazakhstan, he also was in Turkmenistan. Being far away from his native country, the poet missed and expressed all his feelings and love in his poems. As a poet — humanist he looked forward to the happy future of his people. Many poems devoted to the country were written in the

form of narration. They are: “Ellerim bardi” (It’s my country), “Dauran bolmadi” (There wasn’t time), “Megzer” (It’s like), “Barmeken” (If there is), “Bardur” (There is), “Kashkash” (Tulips), “Khoshlasiu” (Saying good bye) and others. The poem “Ellerim bardi” was written on the request of one of the richest men in Kizil-Horde Khojban, when Ajiniyaz was in Kazakhstan. He tells about his country and people with love and prouidness:

1. Сөйлегенде шекер етер сөзиңди,  
Көргенде биймағрур етер өзиңди,  
Бахары тойдырар еки көзиңди,  
Ләйли, Зүләйхадай қызлары барды. [2, 33]  
When you speak to them  
They make your words sweet  
When you see them  
You are lost, indeed.  
Spring flashes your eyes  
Their girls as Layli, Zuleykha, so nice.
2. Аналар, йығламаң көз жасты төгип,  
Көзиңди яшартып, бағрыңды сөкип,  
Қайғы-қасирет билән хәм нардай шөкип,  
Жолға қарап, ғам шекпеңиз, аналар [2, 61].  
Mothers, don’t cry, shedding tears,  
Your hearts are full of grief and sadness,  
Making you bend like camels in loneliness.
3. Қанлы яшқа толып еки көзлериң,  
Қапалықта сарғайып тур йүзлериң,  
Бағрымны тиледи айтқан сөзлериң,  
Қайғы-қасиретте жүрген аналар [2, 62].  
Your eyes are full of bloody tears,  
Sadness your face wears.  
Your words made me sad.

The examples given above may serve as illustrations of figurative metaphors: in the 1-st example: *шекер етер сөзиңди* (make your words sweet means “meaningful, effective”), *тойдырар еки көзиңди* (flashes your eyes means “to delight”), in the 2-d example: *бағрыңды сөкип* (hearts are full of grief and sadness). The metaphor may also be developed through a number of contributory images so that the whole of the utterance becomes one sustained metaphor. A skillfully written example of such a metaphor we see in the 3-d example from the poem “Mothers” by Ajiniyaz. The central image- *mothers* is developed through a number of images: *қанлы яшқа толып еки көзлериң* (your eyes are full of bloody tears), *сарғайып тур йүзлериң*, (*sadness your face wears*), *бағрымны тиледи* (your words made me sad).

Individual genuine metaphors deserve attention for the investigation, they differ from the common-used language metaphors by additional connotative meanings. In his lyrical works Ajiniyaz writes not only about the humanistic ideas, moral ideas, dreams and sufferings of the people, but also about the beauty and charming of the Karakalpak women. In the poems devoted to love and women “Gozzallar”, “Bir periy”, “Harkimsening yari bolsa”, “Bir Janan”, “Beri kel”, “Bozatauli nazalim” we find a lot of examples of metaphor and some techniques of versification used by the great Uzbek poets Alisher Navoi, Mashrab and others. In his poems we find the rhyme “Khachu” which was widely spread in the oriental versification and many allusions on Farhad and Shirin, Leyli and Medjnun from the books of A. Navoi. The lyrical works of Alisher Navoi became a “guiding star” for Ajiniyaz [4, 14–15]. Ajiniyaz used different types of metaphor, describing and creating the portraits of beautiful girls and women:

Жаңа зордан сөнген жүректің отын,  
Қайтадан жандырып кеттиң, сәўдигим [2, 26].  
*The fire in my heart  
Put out just now,  
You blazed up in my heart  
Again my beloved, now.*

Өмир гүлим, кеўил тоғым,  
Жүрегиме салған шогым,  
Көрмей сөнбес жанған отым,  
Қәдирданым, сен қайдасаң ...  
Тақат етпей шыбын жаны,  
Жүректің гилти қайдасаң ... [2, 58]  
Where are you, my dear?  
Your’re a flower in my life,  
You make me happy  
Blazing up a fire in my heart  
The soul is intolerant  
Where is the heart’s key?  
I ask you, thee.

Жанын алсын жәллад көзи,  
Хош мұлайым болсын өзи ... [2, 62]  
*Caught by suffering eyes,  
Let him be gentle and wise.*

Сени көрип яр қумары тутанды,  
Хабарың бер пәрийзадым, йол болсун ... [2, 49].  
Seeing you, the passion blazed up  
In the heart of a beloved, once.  
Oh, beauty, quickly wake up,  
Give him your answer at once.

In the lines given above there are individual genuine metaphors: *сөнген жүректің отын* (the fire in my heart put out just now), *жүрегиме салған шогым* (blazing up a fire in my heart) *жүректің гилти* (the heart’s key), *жанын алсын жәллад көзи* (caught by suffering eyes), *тутанды* (the passion blazed up), which have the subjective character and we can see them only in the poetic works by Ajiniyaz.

The novelty, distinguishing features and peculiarities of the poetry of Ajiniyaz is in introducing into the Karakalpak poetry of such genre forms and poetic devices as gazel, mukhammas, masnauiy, murabba, aytis and rubaiy. Speaking about the unrepeated lyricism of Ajiniyaz, the outstanding Karakalpak poet I. Yusupov writes: “Ajiniyaz has both: the deep knowledge and culture of the poet. Every his work presents the whole world. His poetry is clear like a river’s water, subtle like a flower, his ideas are meaningful and make our hearts feel” [6, 5]. In his poem “Sing me Ajiniyaz song” he writes:

Айт сен Әжинияздың қосықтарынан!  
Жыласын яр ышқы баўырын кескенлер.  
Еңиресин елинен айра түскенлер,  
Айт сен Әжинияздың қосықтарынан!  
Sing me Ajiniyaz song!  
Let those cry whose hearts  
Were pierced by an arrow of the bow  
Parting with Motherland and sorrow  
Sing me Ajiniyaz song! [5, 18].

The works by Ajiniyaz were published in the collections of poems in the Karakalpak, Uzbek, Russian languages and even in Georgian in the book «Idet Djeon» in 1970. Now they are being translated into English and in our article we have used the translations of some his works from Karakalpak into English [5]. Transla-

tions of the works of the great poet into English will give the people all over the world good opportunities to get acquainted with the creative work of the famous Karakalpak poet.

Coming to the conclusion, we can say that the main peculiarities of the creative work of Ajiniyaz are the following:

- he made great contribution not only to the development of Karakalpak written literature and folklore, but to the development of oriental poetry as well;
- a stylistic device metaphor was widely used by the poet in his works;
- he enriched the Karakalpak poetry by the individual genuine metaphors, which characterize the individual style of the poet, he

was skill in using different types of metaphor, especially figurative and individual, genuine metaphors;

– it should be emphasized, that in translations of the poet's works from Karakalpak into English, the interpreters tried to keep his style and use of the stylistic device metaphor.

The poet's love to the Motherland, humanistic ideas, subtle lyricism and great poetic skill let him reach to the top of the Karakalpak poetry. The heritage of the poet-classic, his well-known epigram "The best creation of the world is a human-being" (Бул дуньяның көрки адам баласы) remain valuable today, they play a great role in the upbringing and education of the young generation in our country.

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## Section 13. Chemistry

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-256-258>

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### Alkylation of 2-methylaniline with the methanol in the presence of ferrite catalysts

**Abstract:** The catalytic activity of ferrite catalyst with different composition in alkylation reaction of 2-methylaniline with methanol in the gas phase was investigated. It was established that copper-ferrite catalyst with the composition (mass.%) of  $\text{Cu Fe}_2\text{O}_4$  –30.0,  $\text{Al}_2\text{O}_3$ –70.0 was the best contact in selective (95.3%) synthesis of N-, 2-dimethylaniline. The main and side conversions that take place in the catalytic process are discussed.

**Keywords:** 2-methylaniline, methanol, alkylation, ferrite catalyst, N-, 2-dimethylaniline, 2,6-dimethylaniline, output, selectivity.

Ferrite catalysts successfully used in the processes of petrochemical synthesis, particularly, in the reactions of dehydrogenation, oxidative dehydrogenation of paraffines and olefines [1; 2], as well as in the reactions of alkylation of phenols with alcohols [3; 4], have scarcely been researched in the processes of obtaining alkyl derivative aromatic amines. Alkyl-aromatic amines, particularly methyl derivatives of aniline, are valuable products in the production of stabilizers, antioxidants, coloring agents, medicinal agents, and are mainly obtained by catalytic alkylation of aromatic amines by methanol [5–7].

This article presents the results of research of the reaction of alkylation of 2-methylaniline by methanol in the presence of ferrite catalytic systems.

Experiments on alkylation were conducted in the laboratory reactor with a permanent study area with a layer of catalyst, the volume of which was  $10 \text{ cm}^3$ . The products of alkylation were condensed in the fridge-separator and analyzed by method of gas-liquid chromatography on the chromatograph Chrom. 5 with the use of a packed column (3.6m x 4mm), containing 60% of SE-30 (silicone

elastomer) on the chromoton N-AW (0.16–0.20mm) by flame ionization detection. The analysis was conducted at the programming of the temperature with the velocity of  $8 \text{ }^\circ\text{C}/\text{min}$  within the range of 80–180  $^\circ\text{C}$ . Helium served as carrier gas, the consumption of which was 60 ml/min. Relative error at chromatographic analysis does not exceed 3.2%.

Ferrites of magnesium, zinc, ferrum and copper were obtained by method of collective subsidence of nitrite salts of respective bivalent metals on the aluminium oxide with further drying (at 100–160  $^\circ\text{C}$ ) and calcination at 450  $^\circ\text{C}$  for 4 hours. Herewith, atomic correlation of bivalent metal to ferrum (M: Fe) was equal to 1:2.33. Catalysts had specific surface of 100–160  $\text{m}^2/\text{g}$ , and their mechanic strength was not less than 97.0%.

#### Experimental part

Firstly, catalytic activity of ferrite catalysts of different composition in the reaction of alkylation of 2-methylaniline by methanol was studied. 3 batches of every ferrite catalyst with the concentration of active mass of  $\text{M Fe}_2\text{O}_4$  15.0 mass% (A), 20.0 mass% (B) and 30.0 mass% (C) were examined.



Total output of the products of N-alkylation and C-alkylation of amine calculated using reacted (selectivity) and missed (activity) o-toluidine were selected as comparative criterion.

As it is seen from Table 1,  $\text{MgFe}_2\text{O}_4$  is the worst catalyst subjecting 2-methylaniline to conversion, whereas the ferrites of zinc and copper are the best catalysts. In all cases with the increase of active mass in the catalyst, the conversion of initial amine reduces, which is accompanied with the increase of selectivity of formation of N-, 2-dimethylaniline and reduction of the output of 2,6-xylidine calculated using reacted 2,6-dimethylaniline. In the case of  $\text{ZnFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3$ , the selectivity of formation of 2,6-xylidine is only 1.0%, whereas it almost doesn't form in the case of copper ferrite catalyst. The increase of active mass in the ferrite catalysts from 20.0 mass% to 30.0 mass% sharply increases the velocity of mono N-alkylation of o-toluidine and, herewith, the selectivity of formation of N-, 2-dimethylaniline increases to 85.0–96.0%. However, with the increase of the share of active mass in the composition of a catalyst, the consistent N-methylation of aromatic amine reduces in almost all cases.

Taking into account the fact that the activity of ferrite catalysts in the reaction of alkylation of 2-methylaniline by methanol is based at the output of N-, 2-dimethylaniline on the missed amine, the figure shows comparative criteria for different ferrite catalysts. Comparing these indicators, a range of the activity of ferrites in the synthesis of this product of N-alkylation of amine is drawn.  $\text{CuFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3 \geq \text{FeFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3 > \text{ZnFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3 > \text{MgFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3$ .

In the case of copper ferrite catalyst, the activity is 71.0–77.4%, over  $\text{FeFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3$  it is equal to 65.5–73.9%. During the alkylation

of 2-methylaniline by methanol, over zinc and magnesium ferrite catalysts, the output of N-alkylation products on the missed aromatic amine is respectively equal to 63.8–68.8% and 33.0–50.0%.

Considering high catalytic properties of copper and ferrite catalyst, detailed researches of the interaction of 2-methylaniline methanol in the presence of C sample of this contact have been presented. As it is seen from Table 2, the influence of the temperature on the indicators of the reaction is ambiguous. The main products of the reaction of N-2-dimethylaniline, 2,6-dimethylaniline, N, N, N-2-trimethylaniline and other isomers of xylidine are formed with different outputs, and selectivity of their synthesis depends on the temperature a lot.

It is apparent that at 320 °C, the main direction of the process is mono-N-alkylation (95.3%) and di-N-alkylation (3.0%) of o-toluidine. With the increase of temperature, the selectivity of formation of N-, 2-dimethylaniline reduces, first, to 60.0% (at 350 °C), and then, to 30.0% (at 380 °C). Herewith, the selectivity of formation of N-, N-2-trimethylaniline first grows to 20.0% (at 350 °C), then to 30.8%.

The growth of the temperature increases the velocity of selective formation of C-alkylating products, particularly, 2,6-dimethylaniline and other xylidines. The growth of the temperature from 320 °C to 350 °C increases the share of C-alkylating products in alkylates, namely, the output of 2,6-dimethylaniline calculated using reacted amine from 1.0% to 20.0%, and, at 380 °C, 26.0% is reached. Herewith, the growth of selectivity of formation of other isomers of xylidine is observed. At 350 °C, the selectivity of their formation reaches 5.5% and 11.2% at 380 °C.

Table 1. – The results of the reaction of alkylation of 2-methylaniline by methanol in the presence of ferrite catalysts  
Conditions of the reaction: Temperature — 320 °C, specific load 1.0 h<sup>-1</sup>, molecular ratio 2-methylaniline: methanol = 1:4

Name	Catalyst composition											
	$\text{MgFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3$			$\text{ZnFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3$			$\text{FeFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3$			$\text{CuFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3$		
	A	B	C	A	B	C	A	B	C	A	B	C
Output of the products of reaction calculated using reacted 2-methylaniline, % — including:												
N-, 2-dimethylaniline	80.5	90.0	93.0	74.0	81.0	85.0	84.0	92.0	95.0	78.0	91.0	95.2
N, N-, 2-trimethylaniline	5.0	3.5	3.0	18.5	16.5	13.0	2.0	0.5	–	10.0	7.7	3.0
2,6-dimethylaniline	8.5	5.0	2.5	5.0	2.0	1.0	9.5	6.5	3.5	10.0	1.0	1.0
Other xylidines	5.0	–	–	1.5	–	–	4.0	–	–	1.0	–	–
Conversion of 2-methylaniline	62.0	50.0	35.5	93.0	83.0	75.0	88.0	80.0	69.0	91.0	85.0	79.0

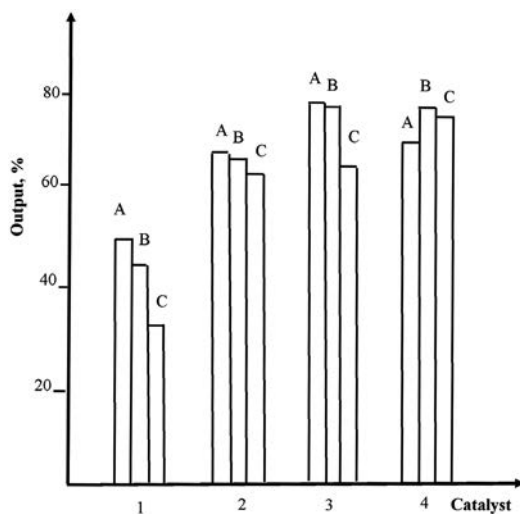
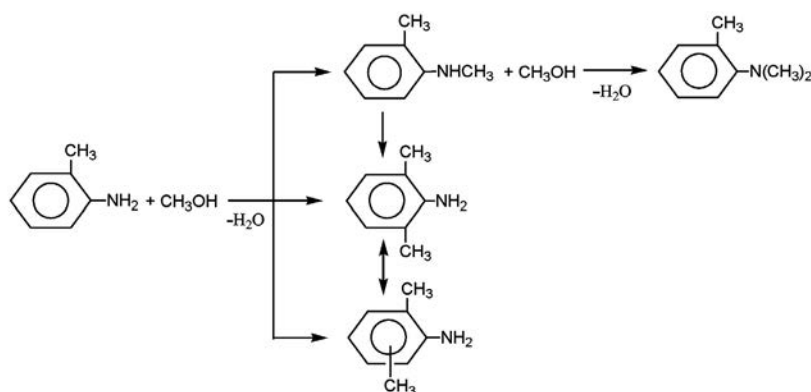


Figure 1. Activity of ferrite catalysts in the reaction of alkylation of 2-methylaniline by methanol  
1.  $\text{MgFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3$  2.  $\text{ZnFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3$  3.  $\text{FeFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3$  4.  $\text{CuFe}_2\text{O}_4 \cdot \text{Al}_2\text{O}_3$

In the catalytic process, the following conversions apparently take place. At low temperature (320 °C), mono N-alkylation of 2-methylaniline prevails. With the increase of temperature, its di-N-alkylation and partial isomerization into the products of C-alkylation of amine,

particularly, by xylidines, strengthens. However, the increase of temperature enhances the velocity of C-alkylation of amine and, apparently, this direction is primary in the obtaining of xylidines. Schematically, these conversions can be presented as follows:



Considering mean acidic properties of copper ferrite catalyst, the flow of such conversions as isomerization and disproportionation of N-alkyl- and C-alkyl derivatives in the catalytic environment is hardly possible.

The increase of specific load to 1.5 h<sup>-1</sup> is favorable to N-alkylation of amine, the general selectivity of which reaches 98.8%. Here-with, mono-N-alkylation prevails. As it is seen, the selectivity of N-, 2-dimethylaniline is equal to 97.0% (Table 2).

The increase of time of contact has a negative effect on N-alkylation of o-toluidine, particularly, its N-methylation, the share of which reduces to 80.8% in the catalytic process.

An interesting peculiarity of copper ferrite catalyst lies in the fact that the reduction of partial pressure of methanol from four-time to two-time as well as its increase to six-time in the initial mixture is not favorable for the selective synthesis of N-,2-dimethylaniline, because the deterioration of the output of this product calculated using reacted amine is observed in both cases. In the latter case,

despite the increase of conversion of 2-methylaniline, its certain part is consumed on consistent methylation with the formation of N-, N-,2-trimethylaniline. The increase of partial pressure of alcohol enhances its side conversions with the formation of formaldehyde, methyl formate and products of their condensation, which sharply reduces the output of products of the reaction calculated using reacted alcohol.

Thus, the studies of catalytic properties of ferrite catalysts in the reaction of alkylation of 2-methylaniline by methanol established their activity and selectivity in the catalytic process.

It was established that the best catalytic properties are shown by copper ferrite catalyst with the concentration of active mass (Cu Fe<sub>2</sub>O<sub>4</sub>) in the catalyst of –30.0 mass%.

In the obtained conditions of reaction (T–320 °C, v –1.0 h<sup>-1</sup>, v –1: 4 mol/mol), in the presence of this catalyst, it is possible to obtain N-,2-dimethylaniline with the output on reacted and missed 2-dimethylaniline of 95.3 and 75.8% respectively.

Table 2. – Results of the reaction of alkylation of 2-methylaniline by methanol in the presence of Cu Fe<sub>2</sub>O<sub>4</sub> Al<sub>2</sub>O<sub>3</sub>

Conditions of reaction			Conversion of 2-methylaniline	Output of products of the reaction calculated using reacted amine, %			
T °C	v, h <sup>-1</sup>	v, mol/mol		N-,2-dimethyl-aniline	2.6-dimethyl-aniline	Other xylidines	N-, N-,2-tri-methylaniline
320	1.0	1:4	79.5	95.3	1.0	–	3.0
350	1.0	1:4	88.5	60.0	12.0	5.5	20.0
380	1.0	1:4	94.0	30.0	26.0	11.2	30.8
320	0.5	1:4	87.9	80.8	8.9	2.2	7.7
320	1.5	1:4	65.9	97.0	1.2	–	1.8
320	1.0	1:2	52.0	87.0	3.3	1.0	3.3
320	1.0	1:6	93.3	94.0	1.3	–	4.5

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## Section 14. Economics and management

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-259-261>

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### The potential of private labels in the development of electronic trade

**Abstract:** The modern trade is directly connected with the use of the opportunities of the Internet. In its turn the competition in the e-commerce is higher than in the traditional trade. In the result the trade organizations have to search for new ways to improve their competitive position. The problem is that a number of intangible resources, which can be used for this purpose, belong to the commodity manufacturers. The article deals with the private labels and their role in enhancing the efficiency of the economic activity of the e-commerce organizations.

**Keywords:** trade, retail trade, electronic commerce, electronic trading, private label.

The growing role of intangible resources is one of the current trends of the trading industry development. The problem of assessing the impact of the intangible resources on the business of traders is generally considered in the works of Ivanov G. G. [1], Mayorova E. A. [2] and others. As shown in these works, the notion of intangible resources is broader than the concept of intangible assets. In the current economic conditions, in which information is one of the key commodities, the role of intangible resources in all industries is multiplied.

The works of many authors are dedicated to the analysis of the composite aspects of intangible resources in trade. In particular, the work of Mukhina M. M. [3] analyzes the impact of brands onto the efficiency of trade organizations.

The work of Leonova Yu. G. [4] is dedicated to the influence of market research results onto the economic trade organizations efficiency.

The development of the system of market relations in the world economy has gradually led to the increasing role of intangible resources in trade. The market research results play an important role in enhancing the trade organization performance. In the planned economy system the volume and assortment of goods being on sale was determined by the plan tasks received from the parent organizations, but in the current conditions of market trade and tough competition the trade organizations independently form their own assortment policy.

At the end of the twentieth century there was a rapid development of the Internet-forms in the modern trade [5]. E-commerce is characterized by a high degree of competition [6]. It is caused by both the wider consumer choice among a large number of online stores and by the fact that the e-commerce subjects have enough broad possibilities for the analysis of economic activities of competitors. In these circumstances the price of goods being on sale is an important factor in the competition for the buyer. However, the lower entry barriers are the distinctive feature of electronic commerce, which has led to the emergence of a large number of un-

scrupulous traders, which, in its turn, has led to an increase in the role of intangible resources, in particular, the image in the electronic commerce. Often the buyer fears to purchase goods in an unknown online store, which makes the role of the business reputation of a trade organization very important.

When deciding where to purchase a buyer is mainly guided by the reviews in the social networks, Internet forums, and conferences. Thus, the competitive position of a trade organization operating in the Internet is mainly determined by its image and established business reputation. Many buyers prefer to purchase goods using e-services. However, the upkeep of a pick-up point, especially in conditions of a small flow of orders, considerably increases the costs of an Internet-shop. The legislation of distance selling gives the buyer the right to return a purchased item. However, the e-commerce business scheme often presupposes the absence of any points with the convenient transport accessibility.

The Internet forms of commerce allow the manufacturers selling the goods directly to end consumers without forming their own trade network. In this situation the manufacturer initially possess such intangible resource as the guarantee of the high quality products declared company and the absence of counterfeit goods. This resource allows setting the slightly higher prices, arranging a minimum number of pick-up points, offering relatively long delivery terms, but the existence of such a resource, as the quality guarantee, allows such shops gaining a large enough flow of customers.

The development of network forms of trade has led to the widespread dissemination of private labels. This allows the networks managing the intangible resources associated with the existing goods leaving to the manufacturer the production function alone. A trading network on its own conducts a campaign forming the competitive advantages and preserves them in the event of a change of manufacturer. Thus, in modern trade the organizations form not only the resources that are specific to the trade sector, but also use a part of the resources directly related to the product. The own trademarks are such resource. An own trademark, un-

like the manufacturers' brands, is a resource totally owned by the trading network. A trading chain initiates the creation of a unique product, which will make it stand out among many others. It is worth noting that own trademarks are the intangible asset and the intellectual property of a trading network, which is protected by law, so other stores have no right to sell the products under someone else's own brand.

The goods subsequently sold under its own brand can be manufactured by the sales network and by the independent manufacturers. In view of the limited resources of a trade network the costs onto the non-profile activity are often inexpedient. In this regard, the mechanism of private labels is designed for outsourcing, i. e. a network orders a product under its own brand from an independent manufacturer in the volumes and on the criteria, which it considers fit. Usually the small private enterprises are such manufacturers.

As has been mentioned earlier, in electronic commerce the price competition has an important role. It defines the important competitive advantages of the Internet units of trade networks.

On the other hand, a high price competition leads to the need to search for the new competitive advantages. Such competitive advantages may be formed with the help of intangible resources. It should be noted that in case of sale of goods under the brands of the manufacturers an Internet company has no rights to them and cannot make full use of this resource in its activity. In this regard, the use of own trade marks is very promising.

In their turn the benefits of own trade marks for the trading network, which carries out its activity using the Internet, include the right to manage this resource. A trading network can differentiate suppliers, including increasing the sales volume, if necessary, by engaging new ones. The private labels are becoming such a popular and efficient method to enhance the customer loyalty that some networks have several kinds of private marks. It should be noted that the private labels are not only the products, which can be seen on the websites of a particular network, but also its own brand and business reputation. In this regard, the quality of the goods sold under own trade marks must be carefully monitored, because it has a strong impact onto the customer loyalty [7].

Currently the private labels are also undergoing a transformation and the brands, which in the premium segment stores several times exceed the actual purchase price, appear, but at present it is rather an exception to the rule. Accordingly, the development of private labels in the high price segment is very promising.

In this situation it is reasonable for the organizations of the Internet commerce to use in their product matrix several private labels, which are positioned in different consumer segments. In particular, other methods of sales promotion, rather than price incentives, shall be applied to such trade marks. It would be reasonable to include the creation of a relative image of such trade mark among the consumers into such methods. To this end, it is important to use the positive reputation of trading network in the promotion of a private label. Such brand must be differentiated from the commodities of the lower price segments. A trade organization shall carefully monitor the quality of such products, including using the mystery shopper

method. A deterioration in the quality of products sold under such brand leads to the loss of business reputation of a trade network.

In most countries, in accordance with the law, the seller must provide the buyer with the basic information about the product and about itself. However, many buyers wish to obtain the additional information, which cannot be attributed to the basic information. This task is particularly important in the premium segment. The distance selling is characterized by the fact that the buyer has no direct contact with the product purchased and has the opportunity to get acquainted with the product only through the description on the site. Although the obligation to provide the consumer with the main properties of the goods is stipulated by the law, the buyer wants to receive some information, which is necessary for him/her personally by virtue of the expected specific features of use of the goods. Such information can be obtained only by the direct contact, but as of ordering the goods are at the seller's place and such contact can be provided only by the seller. The sale of goods under own trade marks provides the assortment stability, which makes it easier to advise the buyer, characterizes the prospects for promoting not only the store, but also the product in social networks.

A customer can't obtain such information in another shops, which solves the problem of the possibility that the buyer seeking the information in another store can buy the product there, if is offered the most advantageous conditions. Thus, the absence of any information on this product reduces the competitiveness of the store, which is a significant problem. On the other hand, the high-quality advice, which can't be obtained from other trade organizations, stimulates the transition from viewing information about the goods to purchasing them. It should be noted that a poor consultation by the members of an online store adversely affects the competitiveness, which makes requirements to the personnel tougher. Different categories of buyers prefer different ways of obtaining such advice, a number of buyers prefers the "live chat" with the consultants and other customers — the communication in writing. To reduce the costs of the buyer a seller may use the special free phone numbers or callback service.

Not only employees of the online store, but also other users on the network may inform the buyers. In this case, there is no need for additional staff costs and training, and the buyers usually have greater trust to the reviews such buyers as themselves. The guest book may have the same function. In this case the online store faces the dilemma how to deal with the negative feedback. On the one hand, their presence negatively affects the reputation of the store, on the other hand, the presence of only positive feedback dramatically reduces the confidence of buyers in such reviews. The correct reaction of the store to the negative feedback may solve this problem. In this regard the description of positive characteristics of the goods, which in the sale of own trade marks form the image online store in general is very promising.

As a conclusion, it can be said that the use of own trade marks is very promising for the development of manufacture and for the enhancement of all areas of business and of trade networks efficiency. The introduction of trade marks of high price segments is the most promising due to their low prevalence at present.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-261-264>

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## **Quality as a determinant factor of increased competitiveness and export growth (Case study: Kosova)**

**Abstract:** The main purpose in drafting of this paper is to empirically analyses and treat the quality and in enhancing of the competitiveness and export companies exporting in Kosovo. The records that are used in the paper are the primary data, namely through the questionnaires in a particular sample of exporting businesses in Kosovo. The quality nowadays is understood as a process that should be developed steadily, whereas the acquired data during this process serves to improve the products and services in the future, so that the current products and services will remain sustainable for customers aiming to return the t customers who have lost the confidence in those products and to obtain new customers. The general conclusion of the paper is that the management of the quality is a determining factor in the growth of exports in the exporting companies in Kosovo.

**Keywords:** Quality, Export, Performance, Product, Safety, Certification.

### **1. Introduction**

The manufacturing businesses are oriented in the strategic quality of management, where the quality is an integral part of strategic planning and in agreement with the entire management of the organization. This provides benefits, which is a strong competitive weapon, but increasingly being oriented towards the requirements of the clients (users) who should be satisfied. In many sectors, the economy of the countries in the region is not able to be a serious competitor, whereas the sector of the food industry, countries such as Kosovo, Macedonia and Montenegro have potential and can produce a large domestic consumption and to make attempts for entry into the European market. However, the challenges and obligations in this regard are very difficult. The European market is very strict toward the quality and meeting of standards for products and to enter into this market, they should initially fulfill of these conditions, even though many companies from these countries have already witnessed such a demand has been is fulfilled and can penetrate freely in the European market, this is evidenced with achieved engagements for export of these products.

According to the ISO 9000 standards, the quality is comprised of the characteristics of the product or service that meets the appropriate requirements [7]. Compliance with standards and norms management opportunities are preserved and developed and production costs are reduced. Thus the requirements of customers and the market to increase toward the quality and raise of the staff ethics, which also results in a higher quality product or service. Effective quality management can enhance competitive abilities of the organization and provide strategic advantages, whether it will reflect the perception of the management quality [5].

The competitive ability of the company in the market largely determines the level of the quality of the product, regardless of whether it is being produced for the already familiar or unfamiliar

buyer. For this reason, it is very important the link between the sales department (which is best familiar with market opportunities) and services of the preparation for production and which with its solutions should try to resist more the existing competition in the market. The quality control is essential for organizational success and brings in the improving profitability benefits, such as; the satisfying clients and increasing competitive advantage [11]. In this sense, the link of technological systems is important where the constructive ideas of market products are implemented, because on the contrary, it could increase the cost of the quality, and cause a higher price of the product, and a drop the competition. On the other hand, lower quality compared to competitive products offered for specific products, usually causes progressive decline in open market price. Therefore, it is necessary to establish a level of quality that will be balanced with the price offered by the market for the quality [8].

It should be further noted that Kosovo has made significant progress in terms of infrastructure quality in the recent years. The lack of awareness about the importance of certification, and other elements of quality infrastructure and drag in the adoption of international standards that directly leads to the fact that the products in Kosovo are not in line with EU standards, or a very small number of them. By continuously monitoring the process, the manufacturing organisation could prevent defect items to be processed in the next stage and to take immediate corrective action once a process is found to be out of control [9]. On the other hand, the constituting and the development of quality infrastructure is one of the important steps toward EU affiliation. Competition in Kosovo is a major problem for many businesses, for the simple fact that in many sectors and the activities it appears as unfair, which means that the risk of competition is over the normal range. Another element worth mentioning here is great concentration of many businesses in few sectors.

## 2. Literature Overview

A manufacturing company before deciding to start with the manufacturing of a product, it must formulate first what it is going to produce and offer to the market. This means that, at the same time, the enterprise must have a position on the external appearance of the product, its price, product performance, product application areas, and so on. Many companies have traced the quality of finished goods to the quality of incoming supply in order to prevent adverse outcomes [12]. The choice of level quality product is of particular importance, which is an economic problem. One of the best ways to increase and expand the trade activities in each country is to enhance the level of quality [6]. Thus, when selecting not only the market should be familiar, but also the technical capabilities of the product. The evolution of the main factors of competitiveness that indicate in the first half of the twentieth century, the competitive advantage of companies was represented by lower prices achieved on account of a cheaper workforce. Competitiveness is synonymous with a firm's long-run profit performance and its ability to compensate its employees and provide superior returns to its owners [2]. Starting with the 1950s, another factor of competitiveness becomes decisive, namely automated production. In parallel with this, two other factors increase in significance: the ability of the company to adapt to market demands and quality products and services, respectively [14]. Namely, if the enterprise produces relying on the order of the buyer, the level of product quality is determined by the applicant, whereas the enterprise should have a duty to maintain the required level of the quality. However, it is very important, particularly when it comes to the production for familiar buyers, who do not hold up the required approval for the quality of the product, without prior knowledge of the technological capabilities of production systems, because, in this case, there's the possibility of large losses due to the inability to offer quality that is agreed, which more often manifests itself through slow delivery of the shipment through higher prices for products, and ultimately, loss of the company reputation [4].

At the present time, the buyer in the export market expects an excellent quality product, with the intention to pay only the price that is more favorable than the competition. The definition of quality by author Stevenson is acceptable and says: „Quality is the ability of products and services that consistently meet or exceed customer expectations“. The concept of quality can be examined in terms of products, services and processes [13]. Qualitative characteristics products, affecting the competitive advantage through differentiation of products of a particular manufacturer's product competitors. The economic restructuring process cannot be designed without taking into account the criteria and costs of quality. Considering the consequences of poor quality, it can be stated that “quality is free” [10]. The cost of poor quality varies from one firm to another. Practically, non-quality management consists in optimizing the effectiveness of the company by treating the causes of anomalies [3].

The quality of products is a major market challenge that manufacturers face in our country. On the markets of developed countries, low cost, mainly so far our main export product is no longer the dominant factor of competitiveness. What the modern market conditions enables the successful sale of the product is its quality, safety, design and so on. Also, on the world market, can be placed specific product categories, only if they are made in accordance with the so-called. Harmonized standards. The advantages of product evaluation and certification consist in [1].

- providing confidence for leadership, customers or the authorities that the products satisfy the requirements of safety and qual-

ity by providing the opinion of objective and impartial third party certification body;

- analysing the characteristics of the products, particularly those that can influence the health and safety of users in all phases of the product lifecycle (from design to after-sales service);
- Continuous improvement of product, as body and procedures apply to schemes which take account of existing legislation and standards;
- identifying weaknesses related to manufacturing and testing by competent and impartial persons;
- optimizing the quality/price ratio, reducing the risk of non-compliances due to regular surveillance quality.

## 3. Methodology of the paper

The methodology of the paper is oriented from the primary data source, through the questionnaire. The collected data were obtained from a random sample in the entire territory of Kosovo, which are included in this research activity 51 exporting companies. The questionnaire is oriented towards the building of research needs; where in some questions we have used the linker scale (1–4), to determine the importance of several factors in exporting activity. The questionnaire provides sufficient data to address the problem presented in the paper, which included the sizes of companies in three categories, small, medium and large, in order to ensure data from all sizes of business, where the number of workers is also categorized, according to applicable legislation for businesses in Kosovo, whereas the rest of the questionnaire provides data on the role of quality management in export growth and the improvement of staff and products.

## 4. Hypotheses

Hypotheses are set up on the basis of theoretical and empirical literature and which will be based on the results of the questionnaire. The hypothesis of this paper is:

**H1** – *Performance of exporting companies is affected by the number of employees;*

The number of employees is a fundamental prerequisite in creating of s exporting products channel and services, particularly in Kosovo, where businesses face a lack of professional staff.

**H2** – *Certification of products with international standard increases production quality;*

In the contemporary world, the need for certification of products with international standards it is a basic requirement, because the market of the European Union as a basic requirement for acceptance of imported products, requires relevant certification in certain areas, and also for exporting companies in Kosovo it is a necessity of exporting activity.

**H3** – *Enhancing of quality of products increases the safety of consumer;*

Consumer safety is one of the vital points of quality assurance in an exporting company, so it is as domestic demand, as well as external customer demand.

**H4** – *Enhancing of export firm is affected by the implementation of the system of quality management*

The system of quality management is a prerequisite for exporting companies to succeed in the foreign market, because the market of the Balkans and Europe has a “wild” in offering of similar products, but what will differ the certain product against other products is the development of quality management system.

## 5. Empirical measurement

The data used in the paper are from the developed questionnaire by exporting companies to Kosovo, where to treat the paper hypotheses we have used parametric tests, namely the F-test statistics and correlation, which are treated in statistical software program V.20 SPSS.

## 6. Results of empirical tests

In treating of analyses we have used 3 scales of significance level  $\alpha = 0.001$ :  $\alpha = 0.05$ , and  $\alpha = 0.10$ , or  $\varepsilon = 1\%$ ;  $\varepsilon = 5\%$  and  $10\%$ .

Table 1. F-test analysis in economic variables between “performance” and “Number of Employees, where the level of signifi-

cance is .000 or at the level of 1%, which supports the performance hypothesis of exporting companies by number of affected employees, that is for the exporting companies in Kosovo to achieve a better performance in exercising of exporting activity, they should have a sufficient number and qualitative staff employees.

Tabela 1. – Anova test (F-test)

Performance	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	29.034	3	9.678	60.841	.000***
Within Groups	7.476	47	.159		
Total	36.510	50			

Source: Calculation in SPSS.

Note: \* Significant in 10%; \*\* Significant in 5%; \*\*\* Significant in 1%.

Tabela 2. – Correlate (Bivariate)

		Performance	Quality of products	Certification of products	Consumer Safety
Performance	Pearson Correlation	1	.844	.842	.900
	Sig. (2-tailed)		.000	.000	.000
	N	51	51	51	51
Quality of products	Pearson Correlation	.844	1	.844	.893
	Sig. (2-tailed)	.000		.000	.000
	N	51	51	51	51
Certification of products	Pearson Correlation	.842	.844	1	.854
	Sig. (2-tailed)	.000	.000		.000
	N	51	51	51	51
Consumer Safety	Pearson Correlation	.900	.893	.854	1
	Sig. (2-tailed)	.000	.000	.000	
	N	51	51	51	51

Source: Calculation in SPSS.

Table 2. There is a correlation between 4 economic variables: performance, quality of products, product certification and safety of consumers. In Table there is a reflection of how these variables interact with each other, in the interaction correlation part between certification product and quality of products, where we have found a positive correlation, indicating that the growth of certification of products increases the quality of products, as the bond correlation is .844, which approves the hypothesis 2 The certification of products with international standards increases the quality of products, which is an indicator showing that the need

for certification of products with international standards increases the quality of products during the application phase in Kosovo and is an important part in exporting products. Positive correlation between the variables of quality product and safety of the consumer (.893), 3 approves the hypothesis that the increasing the quality of products increases safety of the consumer. Table 2 From all positive correlation links, the strongest correlative link is between performance and safety of the consumer, which shows that by increasing the performance we'll have the increase in safety of the consumer.

Tabela 3. – Anova test (F-test)

SN exports increase	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.744	2	1.372	12.529	.000***
Within Groups	5.256	48	.110		
Total	8.000	50			

Source: Calculation in SPSS.

Note: \* Significant in 10%; \*\* Significant in 5%; \*\*\* Significant in 1%.

Table 3. F-test analysis between the “export growth” and “quality management system”. The results show that growth of exports affected by QMS (Quality Management System), because significance level is at the rate of 1%, respectively.000. The results in this table show that QMS (Quality Management System) is a determining factor in the growth of exports in exporting Kosovo companies.

## 7. Conclusions

In this paper we have analyzed the empirical data from the questionnaire with exporting companies in Kosovo, where this sector in Kosovo has begun to undertake the first steps of development, after many blocking economic processes and other uneconomic factors and in this way we are able to conclude from the analyzed data with parametric tests that management of quality is determining

factors in the growth of exports in Kosovo, where the exporting companies in Kosovo should achieve this through the application of certification of products with international standards and to increase the performance, which shall affect the growth of quality product and safety of the consumers.

In the current socio-economic context, product quality has become the determinant of the competitiveness of enterprises as it ensures adaptability to increasingly dynamic market requirements. Product quality is expressed by a set of features made either by contracts, orders or requests in direct relationships between customer and producer, it is explained by standards or rules or exists as a state of affairs caused by similar products present at a given time on the market.

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## Section 15. Science of law

DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-265-268>

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### The system of ways of neutralization of counteraction to investigation in the sphere of narcotics

**Abstract:** The article is dedicated to a relevant matter of crime investigation in the sphere of narcotics, namely, the system of way of neutralization of counteraction to the viewed kind of crimes.

**Keywords:** narcotics, drug business, counteraction, criminalistics characteristics of crimes.

As the sources tell, «... such criminal activities as contract murder, kidnapping, organized blackmailing, narcotics, crimes in bank-credit sphere are wide-spread today. It is generally accepted that any criminal offense against a person is a significant threat for the society in the whole, and the above mentioned socially-dangerous doings are not an exception. It is not accidental that the world statistics confirms that these kinds of crimes, having occupied firm positions in the international arena, have become one of the elements of international criminal activity. Herewith, presence of a range of negative phenomena in post-Soviet states (instability in the economy, low level of life, income inequality of the population, quite high percentage of unemployment) have significant effect on the change of the form of organized crime and absence of tendencies for its reduction» [1, P. 127].

Against a backdrop of such situation, it is expected that the crimes in the sphere of illegal drug trafficking become threatening not only on the territory of a separate state, but in the world scale.

It should be underlined that, in our opinion, the specifics of counteraction performed by criminal groups, operating in the sphere of illegal drug trafficking, is determined by the following factors:

Criminal cases with regard to crimes of this category are instituted only in case of detection and seizure of drugs.

The advancement of crimes related to illegal drug trafficking by organized groups is covered by several constitutions. Herewith, in the majority of cases, the activity of an organized criminal group is in either way oriented to the selling of drugs.

The peculiarity of crimes related to illegal drug trafficking committed by organized groups, as it is shown not only by our study

but also by the analysis of special literature, lies in the engagement of law enforcement officials for the purpose of counteraction. The criminals use all methods of impact: bribe, blackmail, infiltration. Bribe, blackmail and even elimination of the witnesses for the prosecution is specific.

*The ways of overcoming the counteraction during the execution of investigative activities should include procedural measures, various tactical ways directly specified in the norms of criminal and criminal procedure legislation and developed by the criminalistics, use of technical means.*

It is recommended to overcome the counteraction to the investigation from the side of such participants as witnesses to the search, specialist, expert, interpreter, legal representatives of the underage suspects (accused), defense attorney with the methods of general purpose. Primarily, it implies strict adherence to lawfulness during the conduct of investigative activities and other procedural actions. Such setting should become a tactical task for the investigators.

Any deviation from the order of conduct of preliminary investigation established by the law, regardless the reasons of it (objective or subjective), will immediately provoke response actions from the side of the defense. A professional attorney acts as defense, who knows well the legislation, its «weak spots»; they know its methods and means used by the subjects of investigation. They can evaluate not only the quality of evidence obtained by the investigator, but also make the process of its obtaining more difficult. Hence, from the position of the defense, such method as the use of any errors and lapses of the investigator with regard to the discrediting of evidence available in the case will, most probably, be a norm. Thus, the sub-

jects of investigation are not entitled to create favorable conditions for the situation of counteraction to the investigation [2, P. 11].

As it has been shown in practice, *tactical methods of neutralization of counteraction to the investigation*, related to the illegal drug trafficking will include: proper organization of the conduct of investigative activity, choice of place and time of its conduct, preparation of its participants and planning of the course of investigative activity.

We assume that the ability of the investigator to benefit maximally from the very investigative action and its participants is the indicator of the level of organization of the investigative action in terms of obtaining evidence. Here, everything and everyone should be subjected to the solution of tasks set before the investigation.

For the effective overcoming of counteraction to the investigation, the investigator should forecast the actions of all participants involved in the criminal court proceedings for further neutralization of the acts of counteraction from their side. On the assumption of the analysis of literature sources, we reckon that the system of ways on the neutralization of counteraction to the investigation of crimes related to illegal drug trafficking committed by organized groups can be presented based on the following provisions:

1. imposing liability on separate participants of the criminal court proceedings for the prevention of execution of justice and conduct of preliminary investigation as well as other unlawful doings specified in the article 31 of the Criminal Code of the Kyrgyz Republic «Crimes against justice», if their actions contain the features of such crimes, including organization of runaways of persons providing evidence, stealing of case materials, physical evidence etc.;
2. use of coercive measures in respect of the participants of criminal court proceedings in accordance with section IV of the Criminal procedure Code of the Kyrgyz Republic for the breach of requirements established by the criminal procedure legislation;
3. use of a combination of tactical ways specified in the norms of criminal procedure legislation as well as recommendations developed by criminalistics during the conduct of separate investigative actions and tactical combinations in the investigation of drug-related crimes.

As the analysis shows, the employees of the investigative bodies have weak comprehension of theoretical basics of criminalistics, the knowledge of which would increase the efficiency of crime investigation. Thus, it is emphasized that «... criminalistic characteristic of the crime (hereinafter — CCC), unlike the criminal legal one, is not an integral part of the general understanding of crime and is of auxiliary nature; and it is a system (complex) of description of criminalistically important features of the type of group and separate crime manifested in the peculiarities of the way, mechanism and environment of its advancement, which gives notion of the crime, personality of its subject and other circumstances, of certain criminal activity and has a purpose to ensure successful solution of tasks of solving crimes, investigation and prevention of crimes. It should be underlined that the importance of CCC for the method of investigation of separate kinds of crimes lies in the following. *Firstly*, revealing the typical peculiarities of the preparation, commitment and concealment of this type of crimes, criminalistic characteristic helps find most effective tactical ways and technical means of solving them. *Secondly*, it is a source of information about the tendencies of changes in criminal practice. This information is successfully used in organization and planning of investigation of crimes and it is particularly important in setting out investigative versions. *Thirdly*, it defines the main direction of investigation» [3, P. 139].

The above stated indicates the importance of CCC. Knowledge of the concepts of conflict investigation is not less important in the conduct of investigative activities. It is especially relevant in the con-

sidered case, when the crime is committed with the participation of an organized criminal group. In this respect, K. A. Isaeva emphasizes «... the development of methods of overcoming of a conflict based on the modern psychological studies in this sphere is absolutely necessary because the exclusion of a possibility of counteraction to the process of investigation from the system of established investigative situations can cause one-sidedness of another nature. The presumption of conflict as well as the proposition of absence of conflict, which are not based on the diagnostics of real situations arising in the process of investigation, can lead only to one-sidedness in obtaining, examination and check of evidence. In the event of the presumption of absence of conflict, the investigator remains unarmed facing a situation when other participants of the criminal court proceedings prevent the establishment of objective truth in criminal case [4, P. 23].

4. solving of issues related to the conduct of forensic enquiry as well as use of non-traditional methods and ways of criminalistics and other sciences.

A lot of difficulties come up in respect of traditional types of studies in this sphere regarding their results in the assessment of conducted expertise from the side of both the investigator and the court. It is proved by repeated requests from either party to conduct repeated investigations. The position of the participants of criminal court proceedings is ambiguous in the conduct of non-traditional studies, for instance, related to the study of the person's character based on their handwriting [192]. Such examination is one of the basic and significant elements of physiological structure of a personality and its characteristics playing important role in the investigation of organized blackmail. As, often, it is related to the need of conduct of forensic psychiatric examinations according to the materials obtained by investigative bodies; herewith, it is significantly different from currently available traditional author studies. The difficulties of use of such information may come up in the event of obtaining unjustified data, which will be used as orientation information and then, the whole investigation of blackmail will follow in the wrong direction. At the same time, the more information is available at the disposal of investigative bodies, including non-traditional objects, the more chances to solve a modernized blackmail with the exposure of the entire circle of involved persons are there.

Thus, the question of use of a polygraph in crime investigation remains current. In this situation, things are ambiguous. For instance, K. A. Isaeva puts emphasis on the following circumstances: «... at present time, there are quite many recommendations on the ways to deceive a polygraph, which are in abundance on the Internet; i. e. polygraph, like other machines, is not an ideal means and may also give an inaccurate response. Herewith, considering the conditionality of the proposed division, one should note a deep interrelation of the problems included in the specified groups, their certain «inclusion» one in the other like «matryoshka», when one problem inevitably causes other problems, and, vice-versa, successful solution of one of them creates conditions for overcoming the other ones. For instance, without solving the problem of achievement of required validity and reliability of results obtained with the polygraph at psycho-physiological level, we will not be able to qualitatively solve the problem of correct methodical provision of its use, because good methods can be created and work effectively only based on correct understanding and competent consideration of underlying psycho-physiological laws and regularities. In turn, without creating appropriate methodical base, we will not be able to correctly organize the inclusion and positioning of the technology of use of the polygraph into a unified system of measures of studying of the persons of interest or ensuring the safety within the law-

enforcement or human resource activity. Finally, without reliable, methodologically ensured, lean organizational system, we cannot create a full-fledged legal regulation both from the point of initiation of considered procedure and realization of results obtained during its course. Legal regulator (legislator), before writing the rules and conditions of use of the polygraph, should be absolutely sure that this procedure is actually useful and reliable and will not fault and lead to abuses» [5, P. 24].

There are problems of economic nature during the appointment of expertise, i. e. when special knowledge is not used sufficiently, not only due to the qualification of investigative bodies, but also with the problem of payment for special expertises. Some authors write about it [6].

It should be taken into consideration that the underage are often involved in the commitment of considered type of crimes. As rule, the investigators are limited to the establishment of age of chronological character, which is not admissible in our opinion. In this respect, it is noted in the legal literature that «... one cannot not pay attention to the fact that to establish the age of an underage person, one should define the age not only of chronological order, but also of psychological character, which is undoubtedly relevant in the conditions when, on the one side, there is acceleration of the underage, on the other side, there is a delay in the development of teenagers. It is no coincidence that in the forensic practice, there are often situations causing the need to conduct forensic-medical expertise to identify the age of the underage» [6, P. 93].

5. use of measures in order to prevent neutralization of the persons participating in the investigation, employees of the law-enforcement bodies, victims, witnesses, other accused (suspects) etc., including on the motive of revenge and with the purpose of neutralization of other persons;

6. use of measures aimed at non-disclosure of the data of preliminary investigation during the check of reports about a drug-related crime, plans of conduct of investigative activities, course of their conduct and content;

7. execution of events aimed at revealing and elimination of the influence (by way of threats, bribe, persuasions) on the investigator, prosecutor, judge from the side of officials of the authority, management and law-enforcement bodies, related to the persons who committed crimes in the sphere of illegal drug trafficking or their relatives, in order to prevent falsification of case materials and making of illegal decisions in favor of a certain person or a group of persons from their side;

8. prevention of the influence on the witnesses to the search, witnesses, victims and members of their families, in order to change earlier provided evidence in favor of a certain person (or persons) as well as refusal of it, given by them during questioning in the course of drug-related crime investigation;

9. ensuring of the measures of safety for the participants of the criminal process;

10. use of measures in order to prevent false public opinion and tensed environment of case consideration, preparation of false publications in the media aimed against both the investigation of drug crimes in the whole and discrediting of the participants;

11. solving the matters concerning international cooperation in the sphere of counteraction to drug business. In this respect, we divide the opinions of the scientists as of today: «... there are some other problems, which haven't been solved fully at the moment; it refers to such issues as the conformity of the procedure order and procedure of conduct of procedural actions to the national legislation of the party in question; definition of the responsibility of the persons avoiding personal appearance for giving testimony or refusal to do so without any reasonable excuse, for providing false testimony deliberately, for prevention of the execution of (investigative) procedural actions; issues regarding the expenses related to the conduct of procedural actions in the whole and with the help of video communication in particular should be solved. There are many disputes concerning such aspects of international cooperation as use of preventive measures towards persons to make them criminally liable, concerning the matters of releasing of a citizen to another state, creation and activity of joined investigation groups during the investigation of transnational organized crime etc., which indicates the need of further joined activity of interested states in this directions, as well as the implementation of a range of agreements in the national legislation» [1, P. 135].

However, this doesn't solve problems, which also appear before the states.

To conclude this article, let us pay attention to its main theses. *Counteraction to investigation*, as scientific category, can be defined as the activity on counteraction in any form to the conduct of all-sided, complete and objective investigation. The content of the notion «counteraction to investigation» should be filled with the information of exclusively criminalistic importance, concerning all possible forms, types, ways and methods on creation of difficulties and hurdles for investigation of a criminal case.

Such knowledge should be laid in the foundation of methodical recommendation for persons performing the investigation, on the choice and use of technical and tactical-criminalistic ways: during the formation of the system of evidence, prevention of conflict situations, development of means and ways designed to solve conflict situations, overcoming of different difficulties accompanying the investigation, minimization of negative consequences in the events of appearance of conflict situations or different difficulties accompanying the investigation in the formation of the system of evidence.

Counteraction to investigation acts as an independent structural element of private method of investigation of crimes related to illegal drug trafficking committed by organized groups. This phenomenon is associated with not only the crime itself but also the process of its investigation. On *the one side*, knowledge about the forms, types, kinds, ways of counteraction to investigation and its subjects is required for the program of investigation of crimes related to illegal drug trafficking committed by organized groups in a concrete investigation situation. On *the other side*, this knowledge applicable to concrete circumstances of the case, personality of subjects of counteraction to investigation allows developing scientific-methodical recommendations on neutralization of actions aimed at counteraction to solving the private tasks of investigation and, in the whole, conduct of all-sided, complete and objective investigation.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-268-270>

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## **Problems of improvement of legislation on the state youth policy in the Republic of Kazakhstan**

**Abstract:** In article the legal bases of the state youth policy of the Republic of Kazakhstan are revealed, stages of formation of the legislation in the sphere of the state youth policy are allocated, the scientific analysis of the current legislation is carried out, recommendations are offered.

**Keywords:** youth, state youth policy, legislation, volunteer activities.

The youth is a special social age-related group, which acquires important functions, such as educational, professional, cultural, etc. The youth differs not only by age, but also by the social status in society. The youth is an object of youth policy and state programs. The youth are citizens of the Republic of Kazakhstan aged from fourteen up to twenty-nine years.

Let's mark out features of youth. The youth quicker perceives all latest information and material developments, scientific discoveries. The youth confidently takes places of adults, eliminates unfashionable, conservative views, representations, changes valuable installations. The youth chooses different vital strategies. It is possible to distinguish certain contradictions from the Kazakhstan youth:

- Highly educated youth and illiterate youth;
- aspiration to self-realization and complete inactivity;
- youth subcultures and countercultures;
- cult of sport and alcoholism and drug addiction;
- rich youth and poor youth.

The youth creates personal system of hierarchies of values, chooses priorities from a number of alternatives, at the same time

relying also on the traditional and modern values that are necessary for them to achieve vital success.

The Spanish culturologist H. Ortega-i-Gasset marked value of the principle of individualism. He believed that new generation is not simply group of unique persons, not combination of circumstances where random individuals age-mates gathered together, but it is qualitatively new efficient “vivifying” force without which socio-historical process can't develop. The thinker considered that it is necessary to bring up generations of the extraordinary, active persons ready to positive changes aimed at perception to something unlike and new. The younger generation should not live only with settled stereotypes, with classical reference points in activities, it shall introduce “something” new, individual, personal.

Thus, the youth is best of all adapted for implementation of innovative projects and technologies in various spheres of activity. The youth is aimed to reception of new knowledge and implementation in life of the new ideas. The youth is mobile and full of strength for construction of the life. These qualities distinguish the Kazakhstan youth. For this reason, the youth is perceived as the main strategic resource of our country today. Let's quote words of the

President of Kazakhstan about youth. “I address our youth. You are the embodiment of all our hopes for the future. You will determine a further way of the country. Your new independent thinking is a factor which will lead the country to the new purposes seeming to us today far and inaccessible” [1].

Let’s bring quantitative indices about youth in RK. So, according to Committee of statistics of the Ministry of National economics all young people in RK are 4,3 million people. From them 2,2 million are busy youth; 105,5 — jobless youth; 1,8 million — studying youth [2].

Today in structure of youth of Kazakhstan the most numerous is the group at the age of 24–28 years. Let’s note that at turning moments of existence of society the youth appears as the most unprotected category of the population which stands in a such unique valuable and spiritual vacuum.

For this reason, the youth is a subject to influence of various negative ideas. Let’s quote words of the famous scientist K. Mankheyn: “Penetration into society from the outside forces youth to sympathize to dynamic social movements which cause discontent to the current situations for absolutely other reasons. The youth still has no interests fixed by the law, either the economic, nor value-conscious, that are available for the majority adults. The fact that in youth many act as jealous revolutionaries and reformers is explained by this, later when they have permanent job and a family they turn into defense and support to preserve statusquo” [3].

For the purpose of protection of youth, and also in connection with instability of youth as social group accurately verified state youth policy is necessary.

Let’s address to the legislation of youth policy. On June 28, 1991 the first law in the sphere of youth policy was adopted. — “About the state youth policy in the Kazakh SSR” [4].

This law didn’t reflect public requirements. Many regulations of this law remained formal, not feasible. For this reason, it required to determine the conceptual ideas of new youth policy. Therefore, in 1999 the new Concept of the state youth policy was accepted. In this Concept, main approaches of activities of state bodies directed to increase social status and economic situation of youth of the country were pledged. Based on this concept the Law “About the State Youth Policy in the Republic of Kazakhstan” [5] was adopted on July 7, 2004.

The public relations quickly change. Respectively the directions of the state youth policy change. For this reason in February 2013 the following Concept of the state youth policy “Kazakhstan 2020: way to the future” was adopted. [6]. On February 9, 2015, the new, current Law of the Republic of Kazakhstan “About the state youth policy” was adopted [7].

The youth is citizens of the Republic of Kazakhstan from fourteen to twenty-nine years [9]. Thus, in the law there is no division of youth into groups taking into account economic, mental, emotionally and spiritual development of youth.

In our opinion, it is necessary to divide and enshrine in paragraph 3 of Article 1 of the Law of the Republic of Kazakhstan “About the state youth policy” the following groups:

The 1st group — 14–17 years. It is youth that study at day comprehensive schools, specialized schools, boarding schools and other organizations equal to them. This group is most subjected to outside influence, is emotionally and psychologically unstable, has no settled vital values and reference points.

The 2nd group — 18–23 years. It is the youth studying in the organizations of the high and secondary special education. This group is the most social and active, but at the same time “is unstable” in political and economic relations.

The 3rd group — 24–29 years. It is the youth performing a labor activity, or getting professional postgraduate education.

In our opinion, this ranging will allow to realize more effectively the state youth policy considering economic, psychological, spiritual and emotional development of youth of each group.

In addition, we believe possible to offer the following recommendations.

1. In the Law of the Republic of Kazakhstan by February 9, 2015 “About the state youth policy” there is no accurate strategic priority in solving problems of youth. In our opinion, it is necessary to expand and bring specific purposes and tasks in chapter 3. Mechanisms of forming and implementation of the state youth policy;

2. It is necessary to review the principle of implementation of youth policy, the youth should not be object of activities, they should participate actively in implementation of the Law — should become subject. It is necessary to expand and make additions to article 20. “Republican and regional forums of youth”. It is necessary to expand powers of consultative and advisory bodies;

3. In the Law of the Republic of Kazakhstan from February 9, 2015 “About the state youth policy” there are no adequate mechanisms of inclusion of the youth in the solution of social problems in the sphere of work and employment, etc. With respect, thereto we believe that it is necessary to enter into the law measures of stimulation in participation of youth in the solution of social problems;

In our opinion, it is necessary to stimulate development of volunteer activities in regions, widely propagandize institute of volunteers by media, to render assistance and to encourage activities of volunteers.

4. Also we suggest adding to article 29 the following paraphrases:

- Volunteer activities are performed on the principles: publicity, legality, voluntariness, gratuitousness.

- The citizen of RK who reached 18 years after registration in territorial division of authorized body can become the person performing volunteer activities. The person who does not reached this age have the right to be involved in volunteer activities with a written consent of parents, guardians, trustees;

- The person that performs volunteer activities is obliged: to realize activities in compliance with laws and other regulatory legal acts of the Republic of Kazakhstan; not to violate the rights and legitimate interests of citizens; to fulfill requirements and restrictions of authorized body; not to disclose the data received in the course of implementation of volunteer activities; not to set before itself the purpose of receipt of benefit for implementation of volunteer activities; to report following the results of the work in territorial subdivisions of authorized body.

- The person performing volunteer activities has the right: at any time to stop occupation of volunteer activities; to participate in actions within implementation of the state youth policy; to earn rewards, awards, the state awards, letters of acknowledgement for fair implementation of volunteer activities.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-270-272>

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## Legal basis of anti-corruption in the Republic of Kazakhstan

**Abstract:** In this article the legal mechanism of anti-corruption in the Republic of Kazakhstan is revealed. Here the analysis of legal status of subjects of anti-corruption is carried out; contents of the legal basis of anti-corruption in RK are disclosed.

**Keywords:** corruption, anti-corruption legislation, anti-corruption, subjects of anti-corruption.

From the moment of independence Kazakhstan purposefully and step by step follows a rate on creation of effective, conforming to the international standards institutes and mechanisms on anti-corruption. Corruption as the social phenomenon is a serious problem for any society today. Corruption arises together with the state and closely connected with the government, with a possibility of access to financial resources of the state, with an opportunity to apply forced methods and means to achieve personal purposes.

Corruption is characteristic of most states of the world as developed and developing states too. High level of corruption leads to decrease efficiency of public administration, reduces level of social and economic development and investment appeal of the country. According to the information that was given by the Institute of economy of Committee of Science of the Ministry of Education of the Republic of Kazakhstan, damages caused to Kazakhstan because of corruption crimes since 1994 to 2013 are assessed at more than \$7,5 billion. According to data of the Prosecutor General's Office of RK from 2006 to 2016 100 billion tenges are exported from Kazakhstan.

On November 18, 2015 the law of RK “About Anti-corruption” [1] was adopted. According to this law, corruption is illegal use by the persons holding a responsible state position, the persons authorized on accomplishment of the state functions, the

persons equated to the persons authorized on accomplishment of the state functions, official persons of their (office) full powers and the related opportunities for the purpose of obtaining or extraction personally or through intermediaries of the property (non-property) benefits and dividends to themselves or third parties, and equally in bribery of these persons by provision of the benefits and dividends.

For anti-corruption the anti-corruption policy is pursued. It is the legal, administrative and organizational measures directed to decrease corruption risks, increase in trust of society to activities of state bodies. In addition, we will open a concept of anti-corruption. Here activities of subjects of anti-corruption within the powers according to the prevention of corruption are meant. Here it is possible to refer actions for forming of anti-corruption culture in society, identification and elimination of the reasons and conditions that promote making of corruption offenses and identification, suppression, disclosure and investigation of corruption offenses and elimination of their consequences [1].

In the presidential decree approved on December 26, 2014 the Anti-corruption strategy of the Republic of Kazakhstan for 2015–2025 the key directions of anti-corruption were determined. This anti-corruption actions in the sphere of public service; implementation of institute of public control; anti-corruption in a quasi-public

and private sectors; the prevention of corruption in judicial and law enforcement agencies; forming of level of anti-corruption culture; development of international cooperation in the sphere of anti-corruption [2].

The anti-corruption mechanism is enshrined in the legislation of RK. Here it is possible to carry the following elements.

1. Anti-corruption monitoring — activities of subjects of anti-corruption for collection, handling, generalization, the analysis and assessment of information concerning efficiency of anti-corruption policy, condition of law-enforcement practice in the sphere of anti-corruption, and also perception and assessment of level of corruption by society;

2. The analysis of corruption risks — identification and studying of the reasons and conditions that promote making corruption offenses;

3. Forming of anti-corruption culture — activities performed by subjects of anti-corruption within the competence on preserving and strengthening in the society of the value system reflecting intolerance to corruption;

4. Identification of corrupt genic regulations in case of production of legal examination according to the legislation of the Republic of Kazakhstan;

5. Forming and observance of anti-corruption standards. Anti-corruption standards — the system of recommendations directed to the prevention of corruption installed for the isolated sphere of the public relations;

6. Financial control (declaration on assets and liabilities; declaration on the income and property);

7. Anti-corruption restrictions. The restrictions connected with implementation of the activities not compatible to accomplishment of the state functions concern to them. It is inadmissibility of joint service (work) of close relatives, spouses and cousins-in-laws. A prohibition on use of the office and other information which is not subject to official distribution for the purpose of obtaining or extraction of the property and non-property benefits and dividends. Also, acceptance of gifts in connection with execution of office powers according to the legislation of the Republic of Kazakhstan;

8. Prevention and conflict resolution of interests;

9. Anti-corruption measures in the sphere of entrepreneurship. Here the following measures belong. It is — establishments of the organization-legal mechanisms that provide accountability, submission to control and transparency of procedures of decision making; respect of the principles of a fair competition; prevention of conflict of interest; acceptance and observance of regulations of business ethics; taking measures to forming of anti-corruption culture; interactions with state bodies and other organizations for the prevention of corruption;

10. Identification, suppression, disclosure and investigation of corruption offenses; message about corruption offenses;

12. Elimination of consequences of corruption offenses;

13. Forming and publication of the National report of anti-corruption. The national report of anti-corruption — the document containing the analysis and assessment of a condition and tendency of distribution of corruption at the international and national levels, offers on forming, implementation and enhancement of anti-corruption policy [1].

Implementation of these mechanisms in compliance with the Law is assigned to subjects of anti-corruption within their powers. Such subjects are:

- 1) authorized body on anti-corruption.
- 2) other subjects of anti-corruption — state bodies, subjects

of quasi-public sector, public associations and also other physical persons and legal entities [1].

In the Republic of Kazakhstan authorized body on anti-corruption is the National bureau of anti-corruption of Agency of the RK for public service and to anti-corruption [3]. Also all state bodies including subjects of quasi-public sector are subjects. Subjects of quasi-public sector it is the state entities, limited liability partnerships, joint-stock companies, including national managing holdings, national holdings, the national companies, the founder, participant or the shareholder of which is the state, and also the affiliated, dependent and other legal entities who are affiliated with them according to legal acts of the Republic of Kazakhstan [4] and also all commercial and non-commercial legal entities and physical persons (citizens, stateless persons, oralmans, foreigners) of the Republic of Kazakhstan.

The operational investigative divisions of authorized body on anti-corruption that perform activities directed to the prevention, identification, suppression, disclosure and investigation of corruption crimes [1] are referred to anti-corruption service. The staff of these divisions in case of execution of service duties by them has powers established by the Law of the Republic of Kazakhstan “About law-enforcement service” [5].

According to Transparency International Kazakhstan takes the 123rd place in the Index of perception of corruption (The Corruption Perceptions Index). It specifies a high rate of prevalence of corruption in a public sector [6]. Let us give an example. So, in the first half of the year 2016 1 644 facts of corruption offenses are elicited. Criminal cases on 1 038 of the specified facts are directed to courts.

Structure of the registered crimes following:

- assignment of confidential someone else’s property – 238;
- fraud – 63;
- pseudo-entrepreneurship – 8;
- making of the actions connected with creation of invoices for outstanding works and undelivered goods – 2;
- legitimation of money and other property received in the criminal way – 4;
- economic smuggling – 1;
- abuse of ex-officio full powers – 14;
- illegal participation in business activity – 4;
- preventing of legal business activity-5;
- taking of a bribe – 377;
- bribery – 114;
- mediation in bribery – 15;
- office forgery – 323;
- failure to act on service – 4;
- authority misuse – 10.

On complete criminal cases on corruption crimes the amount damage, put to the state, constituted 9,5 billion tenges [7].

Of course, all these negative indicators reduce level of credibility of citizens to the state. With respect thereto new mechanisms of counteraction and fight against corruption are developed and take root. It is possible to carry the following to new mechanisms of fight against corruption.

1. Carrying out the next and extraordinary certifications for separate categories of employees. At the same time not only knowledge of the legislation, but also both personal and professional competence of officials are estimated;

2. Step-by-step pay rise by the government to employees;

3. Implementation of system of estimation of achievements of the government employee and his awarding on the basis of these indicators;

4. Enhancement of an electronic clerical work, control and monitoring of activities of government employees;

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-272-274>

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## Problems of realization of the principle of competitiveness and equality of rights in separate countries of the CIS at modern stage

**Abstract:** based on the analysis of different points of view considering the experience of separate CIS countries, the article reveals the problems of realization of the principle of competitiveness and equality of rights of the parties at modern stage.

**Keywords:** principles of competitiveness, national legislation, criminal process, attorney, attorney investigation.

As it is correctly indicated, «... the provisions about the rights and freedoms of a person are defined by the Constitution of any democratic state. Hence, the rights and freedoms of the man are considered the supreme value of the society and the state in the Constitutions of Kyrgyzstan (article 16), Russia (article 16) etc. No one argues that this institution is one of the fundamental bases of the specified states. Modern standards in the sphere of rights and freedoms of the person reflected not only in the norms of international law but also in the national legislation ensure the protection from unlawful external interference and promote the strengthening of the status of the individual themselves. It should be noted that in the course of a long confrontation between the person and the authority, there is a search for an optimal model of their interrelation; the volume of rights and freedoms of the citizens of the states was changing under the effect of that fact. And this most difficult perpetual problem remains unsolved till date due to various reasons of both objective and subjective nature» [1, P. 338–339].

Thus, on the assumption of today's realities, we deem correct that the critical rethinking requires the principle stated in the Constitution of CIS states that «Legal proceedings are performed on the basis of competitiveness and equality of rights of the parties», which is a guarantee of the protection of rights and freedoms of the citizens' interests. This provision became a new stage in the development of the criminal process.

Currently, the analysis of different sources shows that the opinion of scientists is divided both in the understanding of the very mechanism of realization of the principle of competitiveness and in the issue of its circulation at the stage of the criminal process.

T. T. Shamurzaev emphasizes correctly: «... the development of competitive beginnings in the criminal legal proceedings in the Kyrgyz Republic is related to a range of problems. These problems

are determined by inappropriate legal regulation of the principle of performance of legal proceedings based on the competitiveness and equality of rights of the parties as result of wrong understanding of the essence of this principle by the legislator. The consequence of it is the respective wrong realization of criminal procedure norms in the practice of law application, which implies the breach of rights and legal interests of the participants of the criminal process» [2, P. 44].

For instance, speaking about the drawbacks of the activity of investigative authorities during the procedure of criminal cases in the sphere of finances and credits, it is underlined that «... often, investigative authorities make baseless decisions on an investigated case due to the following circumstances: a) the limitation of the period of decision-making about the institution of criminal proceeding at the stage of pre-investigation check, where the examination of available materials and its evaluation are carried out; b) difficulties are also related to the wrong evaluation of the action of the participants of a criminal event by the investigator at the stage of the institution of a criminal proceeding; c) low knowledge of the investigators in the sphere of finance and credit relations and weakening of professional nucleus (including the conduct of numerous «sponsored» reforms); d) uneven distribution of load on investigators, which leads to the procrastination of the investigation period as well as groundless termination or suspension of the legal proceeding [3, P. 34]. Nevertheless, such situation is typical for the other category of cases investigated by the investigative authorities, which cannot not affect the realization of the considered principle as result of which the rights of the citizens are breached.

The analysis of the provisions of criminal procedure legislation of the CIS countries shows that in these countries, the criminal proceeding process is mainly mixed, i. e. at the stage of pre-trial proceedings, it has investigative character with the elements of competitive-



ness, and the principle of competitiveness applies to the trial stage.

For instance, the Criminal Procedure Code of the Republic of Belarus presents mixed type of criminal process, where the notion of competitiveness refers only to trial proceedings, namely, there is a prosecution party and a defense party. As for the employees of the bodies of preliminary investigation, investigation, prosecution service, which carry out prosecution service, the Belarusian legislator does not refer them to the defense party. Hence, concerning these employees of state bodies and officials, there is a principle of comprehensiveness, completeness and objectivity of research of the circumstances of a criminal case, which is specified in the Criminal Procedure Code of the Republic of Belarus.

However, such position of the Belarusian legislator causes contradiction with the principle of competitiveness, because, in such approach, the investigator bears both the function of prosecution and defense. Such uncertainty of the procedure status of the investigation bodies, naturally, implies significant impairment of the person as well as generates doubts about the objectivity of real enforcement of rights of the personality involved in the sphere of criminal proceedings. This is typical for other CIS countries as well (Kazakhstan, Kyrgyzstan and Russia).

S. M. Darovskikh [4, P. 62] and I. L. Trunov [5, P. 190] reckon that the principle of competitiveness shall affect both the stage of trial proceeding and the stage of preliminary investigation. Herewith, the indicated authors do not consider that at the stage of pre-trial proceedings, the prosecutor and the defense party, including the accused, cannot have equal rights because of the specifics of the function laid on the specified participants by the criminal process. Hence, a different degree of expressiveness of their participation in the proving with regards to the investigated case is observed. Thus, the inequality of parties at this stage and the presence of the elements of competitiveness only in this case are noted in legal literature sources [6, P. 11–13].

Undoubtedly, the stage of pre-trial proceedings for the recognition and realization of the principle of competitiveness is being subjected to an attempt to implement different component into it by the attorneys. Thus, the main proposals include: a) introduction of a parallel investigation; b) expansion of judicial control at the given stage, or the establishment of the institute of court investigators.

The very idea of a parallel investigation provoked ambiguous reaction among scientists; there are both supporters and opponents of such «innovation». Analyzing the opinion of Russian and Belarusian scientists, namely the supporters of attorney investigation, it can be noted that their main arguments had the following provisions: *firstly*, the order of collection of evidence by the attorney should be confirmed by the legislation, which provides the ground to recognize them as applicable and hence, answers the procedure criterion of evidence; *secondly*, since, according to the Criminal Procedure Code, the defense attorney is an independent participant of the criminal process, they can collect the evidence for the case independently; *thirdly*, independent collection of evidence for a criminal case should be a procedure activity of the defense attorney.

The analysis conducted by us showed that the main positions of the supporters of such idea are the following propositions:

- establish the norms in the CPC providing an opportunity to carry out private investigations by the parties, including private detectives; herewith, for the purpose of ensuring the guarantees of legitimacy in the collection of evidence, stipulate the participation of an investigation body as official observer;
- introduce a chapter «Conduct of a private investigation» in the CPC, and, in order to create guarantees of authenticity of the data collected by the attorney, stipulate the responsibility for them in case of their falsification;

- entrust the defense party with the preparation of acquitting verdict with the respective conclusions or verdict with the grounds for the reduction of responsibility of the client;
- attorney's necessity to conduct a private investigation in the interests of protection of the accused's rights, but, herewith, one should not lay an obligation on them to establish objective truth;
- include the provisions changing the content of admissibility of evidence in the norms of the CPC, because the conditions of their admissibility, collected by the investigation bodies, will differ from the collection of evidence by the defense party (for instance, the defense attorney cannot apply coercive measures in the course of such procedure activity).

At the same time, the critics of the parallel investigation were against the empowerment of attorneys with such powers [7, P. 46]. S. A. Sheifer believes that the conduct of «private investigative activities» contradicts the basics of proving established in the criminal process [8, P. 97–103].

Thus, having studied the main arguments of the opponents of the introduction of norms stipulating the behavior of a parallel attorney investigation into the CPC, the following vulnerable aspects of its inconsistency can be outlined: *firstly*, forcible implementation of such construction into the norms of criminal procedure law at the stage of pre-trial proceedings without real absence of such prerequisites today (social, economic, legal) will not lead to a result expected by the state (including legal community); *secondly*, it can lead to an unhealthy competition, including inequality in respect of protection of persons involved in the sphere of criminal prosecution due to different financial abilities; *thirdly*, it should be taken into consideration that evidence for the case obtained by the attorney in the course of such investigation creates prerequisites for their selective reflection in the acquitting verdict, because they can also have a prosecutorial bias. Moreover, separate ones will be excluded due to the doubt of the defense attorney in respect of possible evaluation and interpretation of the documents obtained by them by the court; *fourthly*, compulsory active direct participation of the defense attorney will prevent the conduct of necessary urgent investigative activities; *fifthly*, the difficulty: a) in the ensuring of guarantees on the authenticity of evidence obtained by the defense attorney; b) provision of authoritative powers to the attorney, which are sometimes required in the course of collection of evidence (in the application of coercion); c) impossibility to reproduce the conditions under which such procedure actions were performed after the attorney obtains required evidence; d) their activity on the collection of actual material implies the empowerment of them with the properties, both relevancy and inadmissibility of evidence, because such activity of the defense attorney is performed in a way typical for them.

It is correct that from the moment of collapse of socialistic system, in the CIS countries, a need to build unique legal systems based on the principles of observance of rights and freedoms of the man and the citizen, especially in the sphere of criminal procedure relations, came up. It is consistent that the governments of CIS countries tried to minimize negative consequences of conducted and planned legal reforms, for the purpose of which, the nuances of the structure of law of already successful states were carefully studied, and there were attempts to implement a range of provisions from the foreign legislation [9, P. 130].

One of such directions was, as it is known, the implementation of competitiveness of the legal process widely used in the far-abroad countries. However, at the same time, there are still problems today, some of which were considered by us, and further scientific studies and search of optimal variants of its implementation are required.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-274-277>

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## **Attorney's activity in the mechanism of ensuring of rights and freedoms of a personality in the conditions of competitiveness of criminal procedure**

**Abstract:** The article is dedicated to the attorney's activity aimed at the ensuring of rights and freedoms of a personality in the conditions of competitiveness of criminal procedure. The article presents the analysis of the legislative base of Kyrgyzstan and the debate of points of view of the scientists in respect of the problem considered in the article is conducted.

**Keywords:** attorney, rights, freedoms, personality, criminal procedure, principle of competitiveness.

It is a correct position that «... from the moment of collapse of socialistic system, in the CIS countries, a need to build unique legal systems based on the principles of observance of rights and

freedoms of the man and the citizen, especially in the sphere of criminal procedure relations, came up. It is consistent that the governments of CIS countries tried to minimize negative consequences

of conducted and planned legal reforms, for the purpose of which, the nuances of the structure of law of already successful states were carefully studied, and there were attempts to implement a range of provisions from the foreign legislation. At the same time, in our opinion, neither state-participant of the CIS succeeded in carrying out an essential reform, which would deliver of repressive order of application; counter manifestations of corruption; establish the control of crime and, herewith, ensure real observance of constitutional rights and freedoms of the man and the citizen fully. The procedure provisions of defense attorneys specified in the CPC of the considered countries, their powers, do not allow the realization of such important principle as competitiveness of the criminal procedure and equality of rights of the parties etc. to the full extent, which prevents from ensuring the rights and freedoms of the man and standards of just trial proceedings» [1, P. 130–131].

Undoubtedly, the guarantee of the attorney's freedom is an important aspect for successful realization of the principle of competitiveness and equality of rights of the parties. For instance, N. B. Sonkin emphasized the fact that the attorney should be free of the outside pressure in their activity, including from the side of the law enforcement bodies and state in the whole [2, P. 148].

Professor Smanaliev K. M., speaking about the need to expand the legal status of attorneys highlighted that «... it is required to formalize criminal prosecution for the interference in the attorney's actions performed in accordance with the law, professional duties and ethical norms; interdict the intrusion in the sphere of attorney activity through methods used in the law enforcement activity by guaranteeing the immunity of correspondence, documentation, telephonic negotiations, service premises and houses» [3, P. 41]. This matter concerns the society because a growth of indicators certifying about the breach of attorneys' rights is observed, which cannot not affect the efficiency of protection of the rights and legal interests of a suspect and an accused. Hence, as it is noted in a different source, if one considers from the modern point of view, what is «... a postulate, that the institute of rights and freedoms of personality constantly gains new manifestations and properties, herewith, becoming more and more a constructive element of the state legal system» [4, P. 338].

V. N. Burobina lists main illegal actions from the side of state bodies aimed at, primarily, obtaining information from the attorney, which is a secret that is not subject to disclosure. For instance, the indicated author included illegal actions related to: summon for questioning on the client's case; their «security check», including within the frames of attorney proceedings; conduct of investigative work; use of physical abuse in order to force them to disclose an attorney's secret or remove them from the case; institution of criminal proceedings against the attorney in order to obtain information that is of interest for state bodies; breach of the atmosphere of confidentiality in prison during the attorney's communication with their client [5, P. 80–88].

The analysis of legal literature sources shows the ambiguous approach to the disclosure of attorney's secret.

Unspoken investigative actions specified in the CPC of Kazakhstan, the consideration of which requires the conduct of a separate examination, are of special relevancy. At the same time, according to the article 232 of the CPC of RK «Conditions and grounds of the conduct of unspoken investigative actions», it is noted in part 8 of the specified article that «it is interdicted to conduct unspoken investigative actions in respect of the attorneys performing professional help, with the exception of the cases when there are grounds to assume that they are preparing to commit or have com-

mitted grave or especially grave crime» [6]. This position of the legislator is correct, but from our point of view, the responsibility of persons allowing the abuse from the side of officials, including for illegal actions in respect of the defense attorneys in the whole, should be enhanced.

No fewer questions arise during the use of a polygraph in respect of the client. Unfortunately, it is not always taken into account that «... polygraph test is performed only after willful consent of the tested person, which should be confirmed with a written note. In the course of a polygraph test, no question can be asked without their preliminary discussion with the tested person. The question should be constructed in such way to exclude the feeling of humiliation and insult in the tested person [7, P. 22].

Thus, it is reasonably noted that «... today, a myth of super efficiency of a polygraph circulates in the society. Unfortunate errors are attributed to insufficient qualification of separate specialists, but the very reliability of the technology is almost unquestionable. On the pages of different publications, one can read «competent data» about the fact that the reliability of checks on the lie detector is 90–95% or even greater. This myth is mightily supported by both polygraphists and other interested parties. Firstly, it is done for the purpose of advertising to create commercial demand for such services. They are expensive and bring good profit to specialized firms. Secondly, it is done to create psychological effect on the tested people depriving them of the will to resist and thus, increase the results of the checks. Figuratively speaking, such approach helps ensure victory before the battle. Thirdly, there are deeper socio-psychological aspects of this phenomenon» [7, P. 23].

Certainly, competitive beginnings at the stage of pre-trial proceeding in the matters of evidence material should be implemented in the norm of the CPC, which will promote the protection of rights of a personality in the course of trial proceedings. In such situation, the attorney's activity should be built taking into account the forensic knowledge allowing ensuring effective protection at the stage of pre-trial proceedings.

Hence, it should be taken into consideration that «... conflicts during the preliminary investigation play noticeable role in the definition of the tactics of conduct of investigative activities. Essentially, the choice of methods of influence aimed at revealing, obtaining and fixation of evidence information depends on the conflict (absence of conflict) of the developing situation» [8, P. 21]. In the other source, the attention is drawn to the fact that «... in the process of conflict, one subject undertakes activities contradicting the interests of the other subject. Herewith, the participants of the conflict either cannot or do not want to solve the conflict with the help of legal norms or by way of lawful behavior due to objective or subjective reasons related to the unlawfulness of the very dispute, influence of criminal mentality, traditions or convictions that it is impossible or unreasonable to solve this disputable situation by other ways» [9, P. 141].

Many disputes arise with regard to the circumstances in proof at the stage of pre-trial proceedings. For instance, as it is known that «... the establishment of the exact age of the underage person involved in the preliminary investigation is required to solve a range of important issues and, primarily, the issues about the presence of grounds for criminal prosecution, or, on the contrary, it can be a sufficient reason to refuse to institute or terminate a criminal case; the order of criminal case investigation, use of additional procedural rules as well as peculiarities of use of these or those criminal legal norms concerning the terms, types and limits of punishment, circumstances mitigating and aggravating punishment as well as co-

ercive measures of correctional impact depend on it» [10, P. 89].

Moreover, presence of only judicial control at the stage of pre-trial proceeding proposed by some authors cannot automatically take it into the competitive category. It should be taken into account that formal appearance of court at this stage, where it has other functions, does not mean the realization of the considered principle. It is quite justified that a few authors state the impossibility of use of the principle of competitiveness at the stage of preliminary investigation.

As some scientists emphasize, the strict differentiation of the function of protection, accusation and solution of a case cannot deliver the court of a responsibility to perform justice, because it will deform the authentic sense of competitiveness. In unison with the stated, Yu. K. Orlov notes that if the court is suspended from the circle of subjects of proving, it will significantly reduce the possibilities to establish truth in the case and, hence, to serve as guarantee for its achievement [11].

Other authors also specify that the very principle of competitiveness implies the court's activity. As N. A. Vlasova indicates, «... the court should not be limited with the role of unemotional and lacking initiative arbiter indifferent to the truth, but should take all measures to establish the truth, especially given the insufficiency or unsoundness of the evidence provided by the parties. The fact that the court should not take the side of the prosecutor, substitute the prosecutor, does not mean that it cannot actively participate in the examination of evidence and react to the facts of crimes revealed in the course of trial proceedings» [12, P. 44].

At the same time, as the analysis shows, the main argument of the opponents of extension of the principle of competitiveness to pre-trial stages includes, as a rule, the following circumstances: *firstly*, on the basis of the provisions of the Constitution, it follows that the term «court proceedings» presupposes only judicial examination, hence, «competitiveness» does not extend to pre-trial stages [12, P. 45]. *Secondly*, there cannot be competitiveness at the stage of involving a person as the accused, because at this stage, to avoid exposure and consequently punishment, they undertake various measures. Such position presupposes the involvement of the defense attorney only after the presentation of accusation.

Thus, the principle of competitiveness should extend only to court proceedings, but it should be taken into account that, *firstly*, it is required to provide the defense attorneys with the powers that would allow them conducting a «parallel» investigation at the stage of law enforcement investigation, but under judicial control (in its narrower sense). *Secondly*, the working out of an organized legal mechanism allowing maximally creating the con-

ditions for the defense party. For collection of and obtaining evidence both in the bodies of investigation and other institutions, where the information important for the case can be received. Herewith, the balance between the interests of the suspect, the accused and the state, the main task of which is the protection of rights and freedoms of the victim, should be preserved. *Thirdly*, the court should keep the function related to the establishment of the truth with regard to the case; herewith, given the ensuring of equal rights of the parties, in the course of judicial proceeding, the court should exhibit maximal activity. Furthermore, at all stages of criminal investigation, the court should not bear the functions of the prosecutor. *Fourthly*, in the conditions of competitiveness, the court should be empowered with the right to take measures to fill the gaps in the investigation with regard to the case, regardless the parties participating in them, namely, the prosecution and the defense. For instance, it is referred to the conduct, if necessary, of certain judicial actions in order to check their authenticity and admissibility of evidence provided by the parties; opportunity to study available evidence with regard to the case provided by the parties; demand for any data that can ensure correct qualification of the crime committed by the person and appointment of fair punishment. *Fifthly*, such approach is grounded also because: the level of corruption of law enforcement bodies is quite high; professional qualification and competence of the prosecution party and defense party often do not correspond to the set requirements, which reduces the possibility of ensuring of protection of the rights of the persons involved in the criminal procedure. *Sixthly*, the peculiarity of procedural functions of the participants of the process determined by their role purpose at different stages of criminal court proceedings has significant impact on the specifics of the effect of the considered principle. Herewith, it is important to strive for such legal regime and mechanism of its regulation, at which different participants of the procedure would have maximal opportunity to stand for and protect the rights of the personality before court. *Seventhly*, it is important to consider that the division of functions into prosecution, defense and solution of the case cannot have strict boundaries because the bodies of prosecution can perform not only accusatory but also other functions (take measures on the ensuring of civil claim, make decisions about the termination of the investigated case, collect evidence of the crime and evidence that can mitigate a person's responsibility etc.).

The above mentioned certifies about the need of change of the structure and content of criminal procedure legislation, which, in our opinion, the CIS countries are not ready for due to objective and subjective reasons.

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DOI: <http://dx.doi.org/10.20534/ESR-16-9.10-277-280>

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## Use of non-traditional methods of research in criminalistics during the investigation of crimes at modern stage

**Abstract:** The article considers the peculiarities of use of non-traditional methods of investigation of crimes at modern stage on the example of use of a polygraph as well as in conflict situations.

**Keywords:** investigation, investigative actions, crime, polygraph, organized criminal group.

K. A. Isaeva is right, when she writes that, at modern stage, there has been a combination of economic and general criminal offence crimes at different level. Herewith, criminal formations appear and function consistently at the very junction of such directions of criminal activity as drug business, kidnapping of people with the purpose of further sale for sexual exploitation or other purposes, organized blackmail with the purpose of taking control of entire industries of the economy and investing material means obtained from drug business into these industries; if required, they resort to the termination of rivals or persons preventing the realization of their illegal activity. The binding of these criminal directions, which were not interrelated before, determines a completely new qualitative content of socially dangerous offences that have left the borders of one country [1, P. 130]. Such situation cannot not have effect on the criminalistic methods of research during the investigation of such especially dangerous crimes.

Thus, the means of acoustic control used for discrete listening and (or) fixation of a conversation between the participants of the event, as well as a different acoustic control of other sounds that pose interest for the bodies of investigation, are used quite widely in the solving and investigation of crimes with the participation of organized criminal groups (hereinafter, OCG).

At the same time, the investigative bodies do not possess sufficient information due to the non-traditional nature of the research of objects. For instance, it should be taken into consideration that work with the sound given the modern development of information technologies is taken to a completely different qualitative level.

Current software allows processing the sound and changing parameters of voice: tonality, voice timbre, pitch of voice, as well as cutting any text of the human's speech according to the printed alphabet, thus, making words and sentences. Herewith, during «cutting» and «binding» of the sound, there are no signs of combining at the places of integration, which, undoubtedly, makes the conduct of investigation difficult. In addition, further rerecording of such records on regular tapes and discs makes expert examination helpless. In such case, an expert can only answer a question about the presence of digital processing of the examined sound. Such function as cleaning of speech from the external environment sounds and, on the contrary, superimposing of any required foreign noises is available.

It is more difficult for a speaker to give intonation and emotional coloring to the speech, but it is now possible in the presence of respective special software. Based on the above stated, one can

acknowledge highly qualified programmers should be engaged in the investigation of organized crimes. Unfortunately, today, the investigator cannot get answers of his interest due to obvious impossibility of it in the course of investigation.

At the current stage, such activity refers to non-traditional researches in a great degree and is named as «information-program expertise» of digital sound, which the big hopes are placed on in Kazakhstan and Kyrgyzstan, and which has been successfully carried out in the Russian Federation.

One of the problems lies in the definition of the method of expertise of computer means. Rapid coverage of the population of the most part of the world by information technologies has led to the use of such means for criminal purposes.

The following arguments are presented as example: «... significant importance is given to the rapid development based on the high technologies of financial-transnational information space, which, *firstly*, simplifies the conduct of various «contracted» and «not contracted» financial operations, because such way stimulates free movement of funds through national borders and creates the conditions for the weakening of intra-state control of currency transit; *secondly*, it contributes to the integration and creation of super-market of multi-functional banking services, multi-profile of the activity destroys transnational barriers between financial institutions and this is often accompanied with the reduction of fair practice and quality of provided services; *thirdly*, liberalization of banking system in the whole, which is the consequence of globalization of world economy, promoted the development of off-shore zones, including the appearance of favorable conditions for the functioning of separate directions of the world industry, which are financially difficult to control by the supervision authorities of these states; *fourthly*, it provides massive opportunities for organized criminal activity, because cyber space used by them allows performing illegal banking activity not only by the members of the given organized crime, but also with the help of other criminal groups on the territory of other states; *fifthly*, it creates conditions for the appearance of extra-national financial monopolies, the criminal activity of which is supported through quite complex mechanisms of commercial operations, through which the border between illegal and legal financial activity fades away» [2, P. 30–31].

The use of special knowledge during the use of polygraph raises many questions. It is correctly noted that «... The science of criminalistics does not exist separately from other sciences. The sciences closely interrelated with it include medicine, particularly physiology, which the work of polygraph is based on» [3, P. 21]. As K. A. Isaeva indicates, «... The other side of the practice of use of polygraph is forensic-physiological expertise. Thus, psycho-physiological expertise with the use of polygraph was formed and is successfully applied in the modern forensic investigative practice in Russia. This type of expertise is appointed in the presence of irremovable contradictions in the testimonies of the participants of the process (witnesses, victims, accused, suspects) or in the event of a contradiction between the testimonies and other evidence in the case» [3, P. 21]. At the same time, the author indicates that «... it is appropriate to remind that the main task of applied psycho-physiology, regardless the goals of its use, is always the evaluation of the importance of the studied stimuli (irritants), and its main tool is the measurement of psycho-physiological reactions arising in response to the presentation of stimuli» [3, P. 22].

Attention should be paid to statistical and mathematical studies that have gained traction in the recent years. The essence of these methods lies in the revealing and evaluation of the signs of any

objects with the presentation of final tables. In our opinion, these methods are applicable during the investigation of blackmail with the participation of OCG, where it is required to detect the illegal trafficking of securities, currency means etc. A group of expert studies with the use of neutron, spectral, laser analyzers, new electric-technical installations gained wide spread in separate CIS countries.

At modern stage, such non-traditional expert researches, which can be used in the investigation of an organized blackmail, are not less promising. They include photo and video fakes; study of a fake of tape-recorder sound records (based on the traces of joining the tape of tape-recorder carrier); dermatoglyphic examinations etc. It should be taken into account that blackmail can be accompanied with not only the use of psychological pressure on the victim, but also physical effect, as well as rape or taking the life of the victim or persons close to them (biological traces left at the scenes by the members of criminal formations). Thus, in this respect, it is important to use advanced medical developments and implement them into the practical activity of medicolegists.

Studying the given problem, a Kyrgyz scientist U.Sh. Erkinbaev writes justly: «... The results of examination of blood, discharges and other biological objects, which is conducted in Russia, Kazakhstan and Belarus, are often crucial in the establishment of the involvement of a person in the committed crime, investigation of circumstances and place of the accident, definition of crime instruments».

Based on the analysis of other sources, it follows that it is necessary to further develop such methods as examination of hair in order to define sex and age, detection of various diseases and other forms of functional features of the man. In this respect, such scientists as R. S. Yusifli, N. A. Eiyubova, M. O. Bunyatov can be especially noted. V. N. Zvyagin, A. N. Karpunichev, G. A. Vedenyapin, G. V. Ananyev have contributed significantly to the production of forensic medical expertise, where, today, its scientific and technical base that doesn't provoke any doubts is formed.

Criminalistic explosion study, which plays a big role in the investigation of some crimes such as contracted murder, terrorism, blackmail etc., is not less current.

It is justly stated that «... a circle of questions solved by forensic explosive-technical expertise is wide. These questions can be divided into the following groups: related to the preparation of an explosion; related to the process of explosion; related to the explosive device; related to the occurred and possible consequences of the explosion» [4].

No one argues that «... one can judge about the commitment of a contracted murder according to some typical signs: on the assumption of the situation at the scene of accident; time when the crime was committed; method of murder; presence of signs of criminal-professional ways; establishment of the facts of threats towards the victim prior to their murder; establishment of the facts of interrelation of the victim with the criminal world» [5, P. 140]. Moreover, in this case, use of the explosive device for murder can certify about the contracted nature of crime.

The examinations in the sphere of forensic psychiatry and psychology, where the conduct of expertise for this category of cases is important, are the most difficult (it refers to both the participants of OCG and victims of the crime). Its results also affect the practice of conduct of investigative activities. As K. A. Isaeva emphasizes, «... the development of the methods of overcoming the conflict based on the modern psychological researches in this sphere is very necessary because the exclusion of the opportunity of counteraction to the process of investigation from the system of

established investigative situations can imply the one-sidedness of another nature. The presumption of conflict as well as the presumption of absence of conflict, which are not based on the diagnostics of real situations, arising in the process of investigation, can lead only to one-sidedness in obtaining, investigation and check of evidence. In the event of the presumption of absence of conflict, the investigator is left unarmed facing the situation when other participants of criminal court proceeding prevent the establishment of the objective truth in the criminal case» [6, P. 22].

The conduct of forensic psychiatric expertise of different participants of the process is equally important. For instance, many questions arise in respect of the underage and, provided correct interpretation of its system-based properties, one can see typical important features, the consideration of which affects the quality of the conduct of investigative actions. In this situation, it is justly stated that «... the role of forensic psychiatric expertise lies in the definition of psychiatric state of the underage. It should be taken into account that the defects in the psychic of the underage can be the results of both chronic disease, intellectual impairment and temporal disorder of mental activity. In this situation, there is a need to conduct a complex forensic psychological-psychiatric expertise, the main task of which is to define the level of psychical development as well as the solution of the issue about the age-related mental derangement of the teenager. The state of psychic of the underage is subject to changes and it is related to their constant development as well as psycho-physiological immaturity of the organism. Main psychical functions take place in the teenage years» [7, P. 93].

In this regard, we cannot not share the opinion of V. V. Maltsev, who indicates that «... unfortunately, many non-traditional identification studies «suffer» from the uncertainty of decisions and their presumptive character. It speaks about the fact that the use of non-traditional methods of identification of expert examination should be performed in single cases and in the conditions of complete scientific proof to avoid the possibility of answers with the definition of equal type and kind groups. In this respect, we reckon it necessary to determine that when the investigator appoints a non-traditional identification expertise, they should first obtain the information in the consultation order from the respective specialist — expert about identification possibilities of the research» [8, P. 124].

At the same time, rights and freedoms of the personality should not be infringed as result of conducted studies. Undoubtedly, «... the globalization plays a big role against the backdrop of the developing processes and problems that are difficult to solve in the world, in the wake of which there is a slow-down of the mechanisms ensuring the rights and freedoms of the personality. One cannot not notice the efforts of the CIS countries to take the care about personal im-

munity of the persons involved in the criminal court proceedings under special control. This is proved by the reformation approaches undertaken by the legislators of the specified states in this aspect» [9, P. 346]. In the unison with the above said, it should be noted that used methods should be applied provided the adherence to the conditions specified in the legislation.

Thus, it can be stated that the conclusion of the expert or specialist is a more appropriate variant of immense importance in the investigative activity of the investigator including the investigation and solving of organized crimes.

Based on the conducted research, the following positions should be outline:

1. The notion of spatial and internal relations of the object of investigation with the surrounding investigative environment (for instance, dropped notes, calls etc.) is formed at the very analytical stage, where general signs of searched objects of investigation, which can be expressed in its different combinations, are analyzed. At the second stage of the methods of comparison, the analysis and selection of quantitative and qualitative signs allowing both describing the essence and explaining the research object are performed. At the final stage of object research, firstly, the outlining of the most important signs is performed; secondly, the explanation of separate facts can be found, which are for some reason beyond the general picture of crime; thirdly, it provides grounds to set forth separate versions, including concerning the conditions and character of possible and occurred consequences as result of committed deed; fourthly, the synthesis of data obtained as result of examination of different objects by the specialists of different spheres of knowledge (for instance, materials of substances and items, forensic medicine, objects of phonoscopy, documentation management etc.) is performed.

2. Use of polygraph in the solving and investigation of organized crimes allows, from our point of view, solving the following criminalistic and diagnostic tasks: firstly — to evaluate possible participation of the suspected member of OCG as well as their accomplices in the preparation and commitment of crime; secondly — based on the psycho-physical reaction of the questioned person, to determine possible whereabouts of a kidnapped person, and, in some cases, place where the body is hidden, which is often accompanied with the commitment of considered event with the participation of OCG; thirdly — to establish the circle of persons possibly involved in or informed about committed crimes with the participation of OCG; *fourthly* — to evaluate the obtained information from the questioned persons in order to correct the investigative version on the investigated crime; *fifthly* — to conduct a diagnostics of authenticity of the obtained information for every separate circumstance of the event and for the accident in the whole.

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