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Section 1. Biology

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AGROTOURISM AND GEOGRAPHICAL POSSIBILITIES OF ITS DEVELOPMENT IN UZBEKISTAN

Abstract: In the article agrotourism problems and developing factors in the territory of Uzbekistan are given and analyzed national holidays belong to every season.

Keywords: agrotourism, holidays, income, production, tourism, farming, rural, agriculture, travel, quality, resting.

Introduction

The tourism is one of the speed developing and income branches of the public economy. Today it forms one of 9 worker places in production, attracts of 11% international investment embedding and forms 1/10 parts of the world gross product. In all over the world on profitability the tourism occupies 3rd place after oil business and auto car industry. For many countries of the world tourism became forward economical factor, moreover income from tourism are growing every day. In 2006, on ITO data an annual financial turn in the world formed about 846 billion USA dollars and this branch provided the workers places about 385 million people. The whole amount of tourists has formed about 876 million people. By tourism in addition in every minute about 24 persons are provided with work.

Results and discussion

In the first years of independence in Uzbekistan, that in 1992 it was organized tourist company of "Uzbektourism", which stimulated the development of all branches of the tourism in the country. The legal aspects of the development of the tourist business, the market of the tourism were worked out, it was determined the forms of the tourist service and subject of the tourism. For protection of the consumer rights of tourists and subjects of the tourist business on April 15, 1999 were accepted a state program of "Development of the tourism in Uzbekistan until 2005", but on August 20, 1999 it was accepted the law of "About tourism", that stimulated the formations more than 600 tourist companies, 100 private hotels and holiday hotels.

The republic is proud of the tourist complexes and bases of "Chimgan", "Beldersay", "Sanzar" and "Kumushkan". Uzbekistan became as the member of international touristic organization — ITO, including of 120 countries of the world, as well as enters into filial of European commission in this organization.

The speed growing of the touristic business in Uzbekistan has brought the new types of tourism. In regions, possessing with biodiversity of natural complexes, the eco tourism became to develop in places with valuable of oro hydrological conditions — an extreme tourism. But in spite of the century-old traditions in the field of agriculture, a new type of the tourism — agrotourism is still not developed.

Uzbekistan possesses the enormous possibility for formation and development of agrotourism. Firstly, it is an agrarian country, where more than 60% population lives in the village. Secondly, amount of farming economy exceeds to 43,7 thousands and they possess about 889,7 thousands/hectare of irrigated lands. Thirdly, the economic transformation in agriculture has been taken broad scales. So, for instance, agro section gives about 30% VVP, ⅓ of currency arrivals, on its share it is about more than 70% internal trade turnover. Together with that factor of the ploughed fields on per head it forms whole 0,16 hectare, that it is one of the most low rate amongst countries of ICC. The job placement of the population in agrarian sector it is also low from all branches of the economy of the country. So development of the tourism sphere and services in the village are being developed in the row of the actual national problems (The state program of the development and improvement to 2009 year).

Uzbekistan is one of the ancient centers of the agriculture. In the territory of the Republic three thousand years ago corn, melon, grapes were already cultivated. The high culture of the agriculture had conditioned the appearance of an original public holidays and customs, in accordance with agricultural production. These traditions are national pride and, naturally, can attract attention not only people of the country, but also foreign tourists.

Agrotourism as special type of the tourism began to develop in 70-s years of XX century. In Italy, in 1985 even the special law was accepted

about formation and development of agrotourism. A position about supporting of farming economy, concerning with agrotourism was strengthened in the law. So, for instance, for them it was created a condition for free reception of information, favorable taxation. That is why, the agrotourism branch developed quickly. If the farming economy accepted about 550 thousands tourists in the province of Italy in 1985, and in 1999 their quantity increased to 2 million people. Clear profit from agrotourism formed about 350 million USA dollars. This gave an appreciable push for formation an independent branch of agrotourism and promoted its development in the Western Europe — Germany, France and Ireland, then in the east its part is Poland, Czech, Bulgaria, Ukraine and Russia.

On the terminology, the term of "agro" belongs to the land, land usage. It is used in the regulation of land attitudes. But in practice it is not so. Some researchers (Fransua Muane, 1993) name the agro tourism as a rural, farming or farmer tourism, that it is not a large mistake. In the determined situations some elements change their own interpretations and contents. For instance, this may be geography, which was originally understood as scene of the Land or its surface. On modern understanding, it is not only expressed as the terrestrial surface, but also studies the complex processes and phenomena of climatic, hydrologic, geologic particularities.

Many researchers (Tuchliev, Abdullaeva, 2006) separate the agro tourism into two parts — rural and farming. The rural tourism — to introduce travelers with long distant villages and auls and others. But farming tourism is a location of tourists in the houses of farmers. With such interpretation it is impossible to agree, that to classify the tourism with residence is not accepted (Yakubjanova, 2009).

In our opinion on narrow notion, an agrotourism is travelling to the agrarian sectors. On the broad notion, the agro tourism is a travelling as the aim of resting, health restoration, to deal with sports, whole upbringing tasks, to introduce with agriculture producing, realization of production and cultured plants in village conditions.

The purpose of agro tourism is to use widely from touristic possibilities in the agriculture. For realization of these purposes in Uzbekistan, it is necessary to solve the following tasks in the field of agrotourism:

– studying of the international experience;
– making the legal basis;
– to create the national conception of the development;
– working out the state programs of the development and plan of practical realization;
– development of universally recognized scientific bases;
– creation of state standards of continuously education and upbringing;
– creation of enlightenment and spirituality;
– strengthening of economical bases;
– formation of the credit system;
– development of mechanisms of control;
– formation of propagandas and advertisements;
– creation the web sites in Internet.

As a object of agrotourism which attracting tourists and causing their interests to journey, it is possible to bring the followings: ethnographic phenomena, connected with rural labor and products of the agriculture; technology of producing the cultures, collection, keeping and realization of products; national particularities, connected with vital activity of the rural population (holidays, customs, culture); a special way of the realization of products; agrofirms, agrarian factories, and the forms of their works.

The objects of agrotourism must answer the following requirements: to be connected with production, conversion and realization of agricultural products; has a special type; has a possess to possibility of the spending the night and employment of travelers for 24 hours.

To object of agrotourism we can say that agrocomplexes, including arable lands, cattle-breeding complexes, including fishing, bee keeping, poultry farming. The special interest of agro tourists presents the national holidays and celebrations. To such celebrations, it is possible to refer: holidays of "Navruz" (the new day), "Sumalak holiday", connected with renovation of the nature and coming of the spring time; "Water holiday", "Mulberry holiday", connected with tradition of the spring time and summer, "Mehrjon", "Hosil (harvest)", "Melon holiday", "Grape holiday", "Pomgranate holiday", signifying fertility and abundance; "Sust khotin", "Bibi sehanba", connected with superstition and religious beliefs. During the many ages these holidays are celebrated in Khorezm, Baysun, Karshi, Zamin, Farish and other regions of the country. Respect of water objects, as the source of living in arid (desert) conditions, is celebrated in holidays of "Kuli Kubbon" in Shakhimardan, "Peshkiron" in Namangan, "Water springs (Suv chashmalari)" in Urgut.

To particularities of agrotouristic objects we can show the followings: beauty of national customs in rural locality; the special types of irrigation and melioration; cultivating of unusual agricultural cultures; keeping, processing, and realization of products; the relationship of agrotourism with the other types of touristic activity.

Each locality saves its own traditions on agriculture. Rice is grown in Karakalpakistan and Khorezm regions. Kenaf is cultured in Chirchik valley, tobacco in Urgut district of Samarkand region. Particularly, valuable in the world auctions, that каракул skin is from "Surkhon suri", black "Jongeldi" is from Bukhara region, "Zarmalla" is from Nurata district, "Janbaskal'a" is from Karakalpakistan are received from Uzbekistan sheep.

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Section 2. Mathematics

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ON A CERTAIN PROBLEM OF NONLINEAR OPTIMAL CONTROL ON DISCONTINUOUS TRAJECTORIES

Abstract: On the example of an elementary nonlinear optimal control problem with scalar differential connection and discontinuous trajectories with a small parameter in the derivative and without limitations on control, using the methods of contrast structures in the theory of singularly perturbed boundary value problems, the possibility of the appearance of fast internal phase transitions in the optimal discontinuous trajectory was shown.

Keywords: optimal control, nonlinear functional, discontinuous trajectories, singular perturbations, phase transition, asymptotic approximations.

Introduction

Nowadays, active investigations of the phenomena of contrast structures in singularly perturbed problems are being carried out [1, 3–10; 2, 4–32; 3, 799–851; 4, 41–52], also in [5, 1381–1392; 6, 104–118], for a singularly perturbed optimal control problem, a step-type solution is considered that undergoes a sharp change in a small neighborhood of some transition point within the considered interval.

In this article it is shown the possibility of occurrence of fast phase transitions in the case when the trajectories are optimal and discontinuous, i. e. the possibility of the emergence of the process of forming the optimal solution for such type trajectories.

1. Statement of the problem

Let consider the problem

$$J[u] = \int_0^T F(x,t,u)\,dt \to \min_u,$$

$$\varepsilon \frac{dx}{dt} = \begin{cases} A_1(t) + B_1(t)u, & 0 \le t \le t_0, \\ A_2(t) + B_2(t)u, & t_0 \le t \le T, \end{cases} \tag{1}$$

$$x(0,\varepsilon) = x^0, x(T,\varepsilon) = x^T.$$

The analysis will be carried out taking into account the following requirements.

1) Let the function $F(x,t,u)$ — double continuously differentiable in the domains

$$D_1 = \{(x,t,u) : |x| \le l, u \in R, l > 0, 0 \le t \le t_0\}, B_1(t) > 0,$$

$$D_2 = \{(x,t,u) : |x| \le l, u \in R, l > 0, t_0 \le t \le T\}, B_2(t) > 0.$$

2) Let the function $F_{u^2}(x,t,u) > 0$ when $(x,t,u) \in D_1, D_2$.

Let introduce the Hamilton functions

$$H_j(x,t,u,\gamma) =$$

$$= -F(x,t,u) + \varepsilon^{-1}\gamma(t)\left[A_j(t) + B_j(t)u\right], j = 1, 2$$

where $\gamma(t)$ — the corresponding conjugate variable, from the necessary conditions can be obtain

$$\varepsilon x' = A_j(t) + B_j(t)u,$$
$$\gamma' = -F_x(x,t,u), \tag{2}$$
$$\varepsilon F_u(x,t,u) + \gamma B_j(t) = 0,$$
$$x(0,\varepsilon) = x^0, x(T,\varepsilon) = x^T.$$

The **1)** and **2)** conditions let to find from (2) follow singularly perturbed boundary value problem for extremals

$$\varepsilon x' = A_j(t) + B_j(t)u,$$

$$\varepsilon u' = F_{u^2}^{-1}\begin{bmatrix} F_x B_j(t) - F_{xu}\left[A_j(t) + B_j(t)u\right] - \\ -\varepsilon\left[F_{ut} + F_u B_j(t) B_j^{-1}(t)\right] \end{bmatrix}, \tag{3}$$

$$x(0,\varepsilon) = x^0, x(T,\varepsilon) = x^T.$$

Such a representation (2) emphasizes that both the trajectory and control are fast variables, i. e. can contain fast change zones.

If in the original variational problem put $\varepsilon = 0$, then a degenerate problem

$$\overline{J} = \int_0^T F(\overline{x}, t, \overline{u}) \mathrm{d}t \rightarrow \min_{\overline{x}, \overline{u}}, \qquad (4)$$

$$\overline{u} = -A_j(t^*) B_j^{-1}(t^*)$$

3) Let here exist two disjoint functions $\overline{x} = \theta_1(t)$ and $\overline{x} = \theta_2(t)$ such that

$$\min_{\overline{x}} F(\overline{x}, t, \overline{u}) = \begin{cases} F(\theta_1(t), t, \overline{u}), & 0 \le t \le t^*, \\ F(\theta_2(t), t, \overline{u}), & t^* \le t \le T \end{cases}$$

and the transition point t^* is defined by the equation

$$F(\theta_1(t^*), t^*, \overline{u}) = F(\theta_2(t^*), t^*, \overline{u}),$$

and the condition is satisfied

$$\frac{\mathrm{d}}{\mathrm{d}t} F(\theta_1(t^*), t^*, \overline{u}) \ne \frac{\mathrm{d}}{\mathrm{d}t} F(\theta_2(t^*), t^*, \overline{u}).$$

From **3)** it follows $F_x(\theta_j(t), t, \overline{u}) = 0$, $F_{xx}(\theta_j(t), t, \overline{u}) \ge 0$, $0 \le t \le T$.

In this paper, the existence of an extremal with an internal transition layer on discontinuous trajectories on the basis of the following statement will be established.

Theorem 1 [7, 1401–1411] Let in the boundary-value problem for the system of two first-order differential equations

$$\begin{cases} \varepsilon \dfrac{\mathrm{d}x}{\mathrm{d}t} = G_1(x, t, u, \varepsilon), \\ \varepsilon \dfrac{\mathrm{d}u}{\mathrm{d}t} = G_2(x, t, u, \varepsilon), \end{cases}$$

$$x(0, \varepsilon) = x^0, x(1, \varepsilon) = x^1$$

the following requirements are completed.

4) Degenerated system

$$\begin{cases} G_1(\overline{x}, t, \overline{u}) = 0, \\ G_2(\overline{x}, t, \overline{u}) = 0 \end{cases}$$

has two isolated roots $x_j = \theta_j(t), u_j = \psi_j(t), j = 1, 2$.

5) On the phase plane $(\tilde{x}, \tilde{u})$ points $P_j(\theta_j(t), \psi_j(t)), j = 1, 2$ are the rest saddle points for ancillary system, where $\overline{t}$ — parameter and

$$\begin{cases} \tilde{x}^{\cdot} = G_1(\tilde{x}, \overline{t}, \tilde{u}), \\ \tilde{u}^{\cdot} = G_2(\tilde{x}, \overline{t}, \tilde{u}) \end{cases}$$

and this system has the first integral $\sum(\tilde{x}, \overline{t}, \tilde{u}) = \sum_j(\theta_j(\overline{t}), \overline{t}, \psi_j(\overline{t}))$, which goes through the ${}^jP_j$.

6) Equations $\sum(\tilde{x}, \overline{t}, \tilde{u}) = \sum_j(\theta_j(\overline{t}), \overline{t}, \psi_j(\overline{t}))$ are solvable with respect to ${}^ju$:

$$S_{P_j} : \tilde{u}^{(\mp)} = V(\tilde{x}, \theta_j(\overline{t}), \psi_j(\overline{t}), \overline{t}).$$

7) Equation $H(\overline{t}) = \tilde{u}^{(-)} - \tilde{u}^{(+)} = 0$ has the solution $\overline{t} = t^*$ and $\mathrm{d}H(t^*)/\mathrm{d}\overline{t} \ne 0$.

2. Existence of the solution

Let show that the Euler's equation system has step-type solution. In order to do it is necessary to compare the first passage to the limit theorem with optimal conditions.

It can be observed that attached system can be written as

$$\frac{\mathrm{d}u}{\mathrm{d}\tau} = B_j(\overline{t}) F_x F_{u^2}^{-1} - F_{xu} F_{u^2}^{-1}[A_j(\overline{t}) + B_j(\overline{t})u], \qquad (5)$$

$$\frac{\mathrm{d}x}{\mathrm{d}\tau} = A_j(\overline{t}) + B_j(\overline{t})u.$$

Lemma 1. Let the requirements **1)**–**3)** completed. Then attached system (5) has two special saddle type points $P_j(\theta_j(\overline{t}), \overline{u}), j = 1, 2$ and $\overline{u} = -A_j(\overline{t}) B_j^{-1}(\overline{t})$.

Proof. It is obvious than there are two isolated degenerated system's solutions $B_j(\overline{t}) F_x F_{u^2}^{-1} - F_{xu} F_{u^2}^{-1}[A_j(\overline{t}) + B_j(\overline{t})u] = 0, [A_j(\overline{t}) + B_j(\overline{t})u] = 0$ and when $\overline{t} \in [0, T]$ is fixed on the phase plane $(\tilde{x}, \tilde{u})$, these points $P_j(\theta_j(\overline{t}), \overline{u}), j = 1, 2$ — special saddle-type points, because of the structure of general functional matrix for the system (5)

$$\begin{pmatrix} \overline{G}_{1u} & \overline{G}_{1x} \\ \overline{G}_{2u} & \overline{G}_{2x} \end{pmatrix}, \qquad (6)$$

and characteristics equations $\lambda^2 - (\overline{G}_{1u} + \overline{G}_{2x})\lambda + \overline{G}_{1u}\overline{G}_{2x} - \overline{G}_{1x}\overline{G}_{2u} = 0$ it follows that the eigenvalues of the matrices (6) for any special point have different signs because their multiplication is $\lambda_1\lambda_2 = -B_j^2(\overline{t}) F_{x^2} F_{u^2}^{-1} < 0$ and these special points have saddle type.

Lemma 2. Attached system (5) has the first integral

$$[A_j(\overline{t}) + B_j(\overline{t})u] F_u(x, \overline{t}, u) - B_j(\overline{t}) F(x, \overline{t}, u) = C_j, \quad (7)$$

when $\overline{t} \in [0, T]$ and $C_j, j = 1, 2$ — are constants.

Proof. Let rewrite equations in (5)

$$F_{u^2}(x, \overline{t}, u)u' = B_j(\overline{t}) F_x(x, \overline{t}, u) - F_{xu}(x, \overline{t}, u)[A_j(\overline{t}) + B_j(\overline{t})u]. \qquad (8)$$

Using the second equation from (5) instead of (8)

$$\frac{\mathrm{d}}{\mathrm{d}\tau} F_u(x, \overline{t}, u) - B_j(\overline{t}) F_x(x, \overline{t}, u) = 0.$$

Considering $x'' = B_j(\overline{t})u'$ it can be obtained

$$\frac{\mathrm{d}}{\mathrm{d}\tau}[x' F_u(x, \overline{t}, u) - B_j(\overline{t}) F(x, \overline{t}, u)] = 0.$$

As the result it can be observed for (5)

$$[A_j(\overline{t}) + B_j(\overline{t})u] F_u(x, \overline{t}, u) - B_j(\overline{t}) F(x, \overline{t}, u) = C_j.$$

Lemma 3. Let the requirements **1)**, **2)** completed and $u \ne -A_j(\overline{t}) B_j^{-1}(\overline{t})$. Then the first integral (7) can be explicitly resolved when $\overline{t} \in [0, T]$ is fixed.

Proof. Let $\overline{A}_j = A_j(\overline{t}), \overline{B}_j = B_j(\overline{t})$ and

$$f(x, \overline{t}, u) = [\overline{A}_j + \overline{B}_j u] F_u(x, \overline{t}, u) - B_j(\overline{t}) F(x, \overline{t}, u) - C_j.$$

By the existence theorem for an implicit function the equation $f(x, \overline{t}, u) = 0$ can be resolved related to u:

$$u = \{h(x, \overline{t}, C_j)\}, (x, \overline{t}) \in D_j, \qquad (9)$$

where $D_j = \{(x, t) : |x| \le l, \overline{t} \in [0, T]\}, j = 1, 2$, since $f_u = [\overline{A}_j + \overline{B}_j u] F_{u^2} \ne 0$ because of **2)** and $u \ne -A_j(\overline{t}) B_j^{-1}(\overline{t})$.

Obviously two separatrices $S_{P_j}, j = 1, 2$ going through saddles

$P_j, j = 1,2$ are existed and satisfy equations $S_{P_j}: \left[\bar{A}_j + \bar{B}_j u \right] F_u \cdot$
$\cdot\left(x, \bar{t}, u\right) - \bar{B}_j F\left(x, \bar{t}, u\right) = -\bar{B}_j F\left(\theta_j\left(\bar{t}\right), \bar{t}, \bar{u}\right)$.

From (9) it can be obtained $u^{(\mp)}\left(\tau, \bar{t}\right) = h^{(\mp)}\left(x^{(\mp)}, \theta_j\left(\bar{t}\right), \bar{t}\right)$.

Let $H\left(\bar{t}\right) = u^{(-)}\left(0, \bar{t}\right) - u^{(+)}\left(0, \bar{t}\right) = h^{(-)}\left(\chi\left(\bar{t}\right), \theta_1\left(\bar{t}\right), \bar{t}\right) - h^{(+)}\left(\chi\left(\bar{t}\right), \theta_2\left(\bar{t}\right), \bar{t}\right)$, where $x^{(-)}\left(0\right) = x^{(+)}\left(0\right) = \chi\left(\bar{t}\right) = \left(\theta_1\left(\bar{t}\right) + \theta_2\left(\bar{t}\right)\right)/2$.

Lemma 4. If the requirements **1)**–**3)** are completed, then the expressions can be written $h_x\left(\theta_j\left(\bar{t}\right), \bar{t}\right) = \pm\sqrt{\bar{B}_j F_{x^2}\left(\theta_j\left(\bar{t}\right), \bar{t}, \bar{u}_0\left(\bar{t}\right)\right) F_{u^2}^{-1}\left(\theta_j\left(\bar{t}\right), \bar{t}, \bar{u}_0\left(\bar{t}\right)\right)}, j = 1,2$.

Proof. From differentiating the implicit function it was obtained

$$h_x\left(x, \bar{t}\right) = \frac{du}{dx} = \frac{\bar{B}_j F_x - \left(\bar{A}_j + \bar{B}_j u\right) F_{xu}}{\left(\bar{A}_j + \bar{B}_j u\right) F_{u^2}}.$$

Applying the L'Hopital rule here in the neighborhood of special points it was found $h_x\left(\theta_j\left(\bar{t}\right), \bar{t}\right) = \pm\sqrt{\bar{B}_j F_{x^2}\left(\theta_j\left(\bar{t}\right), \bar{t}, \bar{u}_0\left(\bar{t}\right)\right) F_{u^2}^{-1}\left(\theta_j\left(\bar{t}\right), \bar{t}, \bar{u}_0\left(\bar{t}\right)\right)}$.

$$z\left(t, \varepsilon\right) = \begin{cases} x\left(t, \varepsilon\right) = \sum_{k=0}^{\infty} \varepsilon^k \left(\bar{x}_k\left(t\right) + \prod_k x\left(\tau_0\right) + Q_k^{(-)} x\left(\tau\right)\right), \\ u\left(t, \varepsilon\right) = \sum_{k=0}^{\infty} \varepsilon^k \left(\bar{u}_k\left(t\right) + \prod_k u\left(\tau_0\right) + Q_k^{(-)} u\left(\tau\right)\right), \end{cases} \quad 0 \le t < t^*, \quad (10)$$

$$z\left(t, \varepsilon\right) = \begin{cases} x\left(t, \varepsilon\right) = \sum_{k=0}^{\infty} \varepsilon^k \left(\bar{x}_k\left(t\right) + Q_k^{(+)} x\left(\tau\right) + R_k x\left(\tau_1\right)\right), \\ u\left(t, \varepsilon\right) = \sum_{k=0}^{\infty} \varepsilon^k \left(\bar{u}_k\left(t\right) + Q_k^{(+)} u\left(\tau\right) + R_k u\left(\tau_1\right)\right), \end{cases} \quad t^* < t \le 1, \quad (11)$$

where $z = \left(x, u\right), \tau_0 = t/\varepsilon, \tau = \left(t - t^*\right)/\varepsilon, \tau_1 = \left(t-1\right)/\varepsilon, \prod_k x\left(\tau_0\right)$ — left boundary function in the $t = 0$ neighborhood, $R_k x\left(\tau_1\right)$ — right boundary function in the $t = 1$ neighborhood and $Q_k^{(\mp)} x$ — left and right boundary functions that form phase transition in the $t = t^*$ neighborhood. Decompositions (10), (11) are substituted to (1) and the same ε order elements from the left and right part are equated. To determine the coefficients of all the series written out, we must substitute (10), (11) into (1) and minimize the expansion coefficients of the functional in a series in integral powers in the elements of the asymptotics

$$\inf_x J\left[x\right] = \inf_{x_0} J_0\left(x_0\right) + \sum_{i=1}^{n} \varepsilon^i \inf_{x_i} \tilde{J}_i\left(x_i\right) + \ldots.$$

To define general element $\left\{\bar{x}_0\left(t\right), \bar{u}_0\left(t\right)\right\}$ of the regular asymptotics series it was found degenerated problem (4)

$$J_0\left(\bar{u}_0\right) = \int_0^T F\left(\bar{x}_0, \bar{u}_0, t\right) dt \to \min_{\bar{u}_0},$$

$$A_j\left(t\right) + B_j\left(t\right) \bar{u}_0 = 0.$$

From the condition **3)** was found

$$\bar{x}_0^* = \begin{cases} \theta_1\left(t\right), t < t_0, \\ \theta_2\left(t\right), t > t_0, \end{cases} \quad \bar{u}_0^* = -A_j\left(t\right) B_j^{-1}\left(t\right).$$

Was encountered then $\bar{B}_j > 0$, $F_{x^2}\left(\theta_j\left(\bar{t}\right), \bar{t}, \bar{u}_0\left(\bar{t}\right)\right) > 0$, $F_{u^2}^{-1}\left(\theta_j\left(\bar{t}\right), \bar{t}, \bar{u}_0\left(\bar{t}\right)\right) > 0$.

In the article $\left[5, 1381-1392\right]$ were formulated and proved two lemmas **5** and **6** where the conditions **1)**–**3)** and $F\left(t_0\right) = 0$ are completed then the equation $F\left(\theta_1\left(t_0\right), t_0, \bar{u}\right) = F\left(\theta_2\left(t_0\right), t_0, \bar{u}\right)$ also completed and $dH\left(t_0\right)/d\bar{t} \ne 0$ expression can be used if and only if $F_t\left(\theta_1\left(t_0\right), t_0, \bar{u}\right) \ne F_t\left(\theta_2\left(t_0\right), t_0, \bar{u}\right)$.

Lemma 7. Let the conditions **1)**–**3)** are completed. Then it is existed moment $\bar{t} = t_0$ such that in attached system (5) Separatrix that connects saddles $P_j\left(\theta_j\left(t^*\right), \bar{u}\right), j = 1,2, \bar{u} = -A_j\left(t^*\right) B_j^{-1}\left(t^*\right)$ existed. This expression follows directly from the second and the fifth lemmas.

Thus, for boundary problem (3) all the requirements of the first passage to the limit theorem are completed. It means that the problem (1) has extremal $x\left(t, \varepsilon\right)$ with contrast step-type structure.

3. Asymptotics of the formal solution

It is necessary to construct formal asymptotics solution of the problem (1) using direct solution scheme. As it was shown in $\left[5, 1381-1392\right]$, asymptotic solution is found as

Then to define $\left\{Q_0^{(\mp)} x, Q_0^{(\mp)} u\right\}$ general elements of boundary series in the neighborhood of phase transition point when trajectories are discontinuous were found

$$Q_0^{(\mp)} J = \pm \int_{-\infty(0)}^{0(+\infty)} \Delta_0^{(\mp)} F\left(\tilde{x}^{(\pm)}, \tilde{u}^{(\pm)}, t_0\right) d\tau \to \min_{\tilde{u}^{(\mp)}},$$

$$\frac{d\tilde{x}^{(\mp)}}{d\tau} = A_j\left(t_0\right) + B_j\left(t_0\right) \tilde{u}^{(\mp)},$$

$$\tilde{x}^{(\mp)}\left(0\right) = \chi\left(t_0\right), \tilde{x}^{(\mp)}\left(\mp\infty\right) = \theta_{1,2}\left(t_0\right).$$

After substitution

$$d\tau = \frac{d\tilde{x}}{A_j\left(t_0\right) + B_j\left(t_0\right) \tilde{u}^{(\mp)}}$$

it was found that the functional does not depend on τ:

$$Q_0^{(\mp)} J = \int_{\theta_1(t_0)[\chi(t_0)]}^{[\chi(t_0)]\theta_2(t_0)} \frac{\Delta_0^{(\mp)} F\left(\tilde{x}^{(\mp)}, \tilde{u}^{(\mp)}, t_0\right)}{A_j\left(t_0\right) + B_j\left(t_0\right) \tilde{u}^{(\mp)}} d\tilde{x} \to \min_{\tilde{u}^{(\mp)}\left(\tilde{x}^{(\mp)}\right)}.$$

The necessary condition for a minimum of integrand is

$$\left[A_j\left(t_0\right) + B_j\left(t_0\right) \tilde{u}^{(\mp)}\right] F_{\tilde{u}} - B_j\left(t_0\right) F\left(\tilde{x}^{(\mp)}, \tilde{u}^{(\mp)}, t_0\right) = -F\left(\theta_j\left(t_0\right), \bar{u}_0^*, t_0\right).$$

Using (9) was obtained that $\tilde{u}^{(\mp)} = h\left(\tilde{x}^{(\mp)}, t_0, \theta_j\left(t_0\right)\right)$ is minimum point because

$$\frac{\partial^2}{\partial \tilde{u}^2}\left(\Delta_0^{(\mp)}F\right)\left[A_j(t_0)+B_j(t_0)\tilde{u}^{(\mp)}\right]^{-1}+$$

$$+\left(\Delta_0^{(\mp)}F\right)\frac{\partial^2}{\partial \tilde{u}^2}\left[A_j(t_0)+B_j(t_0)\tilde{u}^{(\mp)}\right]^{-1}+$$

$$+2\frac{\partial}{\partial \tilde{u}}\left(\Delta_0^{(\mp)}F\right)\frac{\partial}{\partial \tilde{u}}\left[A_j(t_0)+B_j(t_0)\tilde{u}^{(\mp)}\right]^{-1}=$$

$$=\left[A_j(t_0)+B_j(t_0)\tilde{u}^{(\mp)}\right]^{-3}\left[\left[A_j(t_0)+B_j(t_0)\tilde{u}^{(\mp)}\right]^2 F_{\tilde{u}^2}\right]>0.$$

The last is true because on the plane $(\tilde{x},\tilde{u})$ when $\tilde{x}$ changes from $\chi(t_0)$ to $\theta_j(t_0)$ in (12) the functions $A_j(t_0)+B_j(t_0)\tilde{u}^{(\mp)}, j=1,2$ are positive.

Thus, to define $Q_0^{(\mp)}x$ in the neighborhood of transition point differential equations were obtained

$$\frac{dQ_0^{(\mp)}x}{d\tau}=B_j(t_0)h\left(\theta_j(t_0)+Q_0^{(\mp)}x,t_0\right).$$

As it was formulated in $[5, 1381–1392]$ the condition **8)** tells that the equations (12) with initial conditions $Q_0^{(\mp)}x(0)=\chi(t_0)-\theta_j(t_0)$ have continuously differentiable solutions $Q_0^{(\mp)}x(\tau)$, $0<t_0<T$, $-\infty<\tau<\infty$.

To define $\{R_0x(\tau),R_0u(\tau)\}$

$$R_0J=\int_0^\infty\Delta_0F\left(\theta_2(T)+R_0x,\overline{u}_0^*(T)+R_0u,T\right)d\tau_0 \rightarrow \min_{R_0u},$$

$$\frac{d}{d\tau}R_0x=A_2(T)+B_2(T)\left[\overline{u}_0^*(T)+R_0u\right],$$

$$R_0x(0)=x^T-\theta_2(0),R_0x(\infty)=0.$$

To define $\left\{\prod_0 x(\tau),\prod_0 u(\tau)\right\}$

$$\prod_0 J=\int_{-\infty}^0\Delta_0F\left(\theta_1(0)+\prod_0 x,\overline{u}_0^*(0)+\prod_0 u,0\right)d\tau_1 \rightarrow \min_{\prod_0 u},$$

$$\frac{d}{d\tau_1}\prod_0 x=A_1(0)+B_1(0)\left[\overline{u}_0^*(0)+\prod_0 u\right],$$

$$\prod_0 x(0)=x^0-\theta_1(0),\ \prod_0 x(-\infty)=0.$$

As it was formulated in $[5, 1381–1392]$ condition **9)** tells that boundary conditions $x^0-\theta_1(0),x^T-\theta_2(T)$ in the problems $\prod_0 J,R_0J$ are located in the neighborhood of origin.

Thus, it can be written minimum value for functionals $J_0^*,\prod_0 J^*,Q_0J^{(\mp)*},R_0J^*$:

$$J_0^*(\overline{u}_0)=\int_0^T F\left(\overline{x}_0^*,\overline{u}_0^*,t\right)dt,$$

$$Q_0J^{(\mp)*}=\int_{\theta_1(t_0)[\chi(t_0)]}^{[\chi(t_0)]\theta_2(t_0)}\frac{\Delta_0^{(\mp)}F\left(\tilde{x}^{(\mp)},\tilde{u}^{(\mp)},t_0\right)}{A_j(t_0)+B_j(t_0)\tilde{u}^{(\mp)*}}d\tilde{x},$$

$$\prod_0 J^*=\int_{x^0}^{\theta_1(0)}\frac{\Delta_0F\left(\tilde{x}^*,\tilde{u}^*,0\right)}{A_1(0)+B_1(0)\tilde{u}^*}dx,$$

$$R_0J^*=\int_{\theta_2(T)}^{x^T}\frac{\Delta_0^{(\mp)}F\left(\tilde{x}^*,\tilde{u}^*,T\right)}{A_1(T)+B_1(T)\tilde{u}^*}d\tilde{x}.$$

As it was formulated in $[5, 1381–1392]$ if the conditions **1)**–**3)**, **8)**, **9)** are completed then when $\varepsilon>0$ a formal asymptotic approach to step-type for (1) extremals $x(t,\varepsilon)$ existed and has such asymptotic expression:

$$x(t,\varepsilon)=\begin{cases}\theta_1(t)+\prod_0 x^*(\tau_0)+Q_0^{(-)}x^*(\tau)+O(\varepsilon),\ t<t_0,\\ \chi(t_0),t=t_0,\\ \theta_2(t)+R_0x^*(\tau_1)+Q_0^{(+)}x^*(\tau)+O(\varepsilon),\ t>t_0,\end{cases}$$

$$u(t,\varepsilon)=\begin{cases}\overline{u}_0^*(t)+\prod_0 u^*(\tau_0)+Q_0^{(-)}u^*(\tau)+O(\varepsilon),t<t_0,\\ \chi'(t_0),t=t_0,\\ \overline{u}_0^*(t)+R_0u^*(\tau_1)+Q_0^{(+)}u^*(\tau)+O(\varepsilon),t>t_0\end{cases}$$

and $J^*[u]=J_0^*+\varepsilon\left[\prod_0 J^*+Q_0^{(-)}J^*+Q_0^{(+)}J^*+R_0J^*\right]+O(\varepsilon^2)$.

4. Example

Let consider the problem

$$J[u]=\int_0^\pi\left[\frac{1}{8}x^4-\frac{1}{2}x\cos t-\frac{1}{4}x^2+t^2-u^2\right]dt \rightarrow \min_u,$$

$$\varepsilon\frac{dx}{dt}=\begin{cases}-4t+2u,\ 0\le t\le\pi/2,\\ 4t+2u,\ 0\le t\le\pi,\end{cases}$$

$$x(0,\varepsilon)=0,x(\pi,\varepsilon)=1.$$

Here

$$F(x,u,t)=\frac{1}{8}x^4-\frac{1}{2}x\cos t-\frac{1}{4}x^2+t^2-u^2,$$

$$\overline{u}=\begin{cases}2t,0\le t\le\pi/2,\\ -2t,0\le t\le\pi\end{cases}$$

and

$$\min_{\overline{x}}F(\overline{x},t)=\begin{cases}-\frac{1}{8}+\frac{1}{2}\cos t,0\le t\le\pi/2,\\ -\frac{1}{8}-\frac{1}{2}\cos t,0\le t\le\pi.\end{cases}$$

General element of the transition point $t_0=\pi/2$ is defined by the equation $\cos t_0=0$. Where

$$\frac{d}{dt}F\left(\theta_1(t_0),\overline{u},t_0\right)\ne\frac{d}{dt}F\left(\theta_2(t_0),\overline{u},t_0\right),$$

because $\frac{d}{dt}F\left(\theta_1(t_0),\overline{u},t_0\right)=-\frac{1}{2},\frac{d}{dt}F\left(\theta_2(t_0),\overline{u},t_0\right)=\frac{1}{2}$.

In such case the first integral (7) is

$$4(u\mp 2\overline{t})(\overline{t}-u)-\frac{1}{4}x^4+x\cos\overline{t}+\frac{1}{2}x^2=C_j,j=1,2,$$

where C_j — constants. Separatrix S_{P_j} which go through the saddles $P_j(\overline{t})$ and when value of $\overline{t}\in[0,\tau]$ will be $S_{P_j}:u^{(\mp)}=\sqrt{x^{(\mp)}-1}\sqrt{4-\left(x^{(\mp)}-1\right)\left(x^{(\mp)}+1\right)^2}$. Because $x^{(-)}(0)=x^{(+)}(0)=0$ was found $H(t_0)=u^{(-)}(0,t_0)-u^{(+)}(0,t_0)=0$.

To construct left part of transition lay in the zeroth approximation was obtained next variational problem:

$$Q_0^{(-)}J=\int_{-\infty}^0\frac{1}{4}Q_0^{(-)2}x\left[\frac{1}{2}Q_0^{(-)2}x-1\right]-Q_0^{(-)}u\left[2\pi+Q_0^{(-)}u\right]d\tau \rightarrow \min_{Q_0^{(-)}u},$$

$$\frac{d}{d\tau}Q_0^{(-)}x = 2Q_0^{(-)}u,$$

$$Q_0^{(-)}x(0)=1, Q_0^{(-)}x(-\infty)=0$$

with solution

$$Q_0^{(-)}x^*(\tau)=\frac{e^{\frac{\sqrt{2}}{2}\tau}}{1+e^{\frac{\sqrt{2}}{2}\tau}}, Q_0^{(-)}u^*(\tau)=\frac{\sqrt{2}e^{\frac{\sqrt{2}}{2}\tau}}{\left(1+e^{\frac{\sqrt{2}}{2}\tau}\right)^2},$$

$$Q_0^{(-)}J^*=\frac{\sqrt{5}}{4}, \tau<0.$$

Similarly it can be found

$$\left\{Q_0^{(+)}x^*(\tau), Q_0^{(+)}u^*(\tau)\right\}, \left\{\prod_0 x^*(\tau_0), \prod_0 u^*(\tau_0)\right\},$$

$$\left\{R_0 x^*(\tau_1), R_0 u^*(\tau_1)\right\}.$$

$$Q_0^{(+)}x^*(\tau)=-\frac{e^{-\frac{\sqrt{2}}{2}\tau}}{1+e^{-\frac{\sqrt{2}}{2}\tau}}, Q_0^{(+)}u^*(\tau)=$$

$$=\frac{\sqrt{2}e^{-\frac{\sqrt{2}}{2}\tau}}{\left(1+e^{-\frac{\sqrt{2}}{2}\tau}\right)^2}, Q_0^{(+)}J^*=\frac{\sqrt{5}}{4}, \tau>0,$$

$$\prod_0 x^*(\tau_0)=\frac{e^{-\frac{\sqrt{2}}{2}\tau_0}}{1+e^{-\frac{\sqrt{2}}{2}\tau_0}}, \prod_0 u^*(\tau_0)=-\frac{\sqrt{2}e^{-\frac{\sqrt{2}}{2}\tau_0}}{\left(1+e^{-\frac{\sqrt{2}}{2}\tau_0}\right)^2},$$

$$\prod_0 J^*=\frac{\sqrt{5}}{4}, \tau_0>0,$$

$$R_0 x^*(\tau_1)=\frac{e^{\frac{\sqrt{2}}{2}\tau_1}}{5-e^{\frac{\sqrt{2}}{2}\tau_1}}, R_0 u^*(\tau_1)=\frac{7e^{\frac{\sqrt{2}}{2}\tau_1}}{\left(5-e^{\frac{\sqrt{2}}{2}\tau_1}\right)^2},$$

$$R_0 J^*=\frac{\sqrt{5}}{2}, \tau_1<0.$$

As a result, the formal asymptotic representation takes the form

$$x(t,\varepsilon)=\begin{cases} -1+\dfrac{e^{-\frac{\sqrt{2}}{2}\tau_0}}{1+e^{-\frac{\sqrt{2}}{2}\tau_0}}+\dfrac{e^{\frac{\sqrt{2}}{2}\tau}}{1+e^{\frac{\sqrt{2}}{2}\tau}}+O(\varepsilon), t<\pi/2, \\ 0, t=\pi/2, \\ 1+\dfrac{e^{\frac{\sqrt{2}}{2}\tau_1}}{5-e^{\frac{\sqrt{2}}{2}\tau_1}}-\dfrac{e^{-\frac{\sqrt{2}}{2}\tau}}{1+e^{-\frac{\sqrt{2}}{2}\tau}}+O(\varepsilon), t>\pi/2. \end{cases}$$

$$u(t,\varepsilon)=\begin{cases} 2t-\dfrac{\sqrt{2}e^{-\frac{\sqrt{2}}{2}\tau_0}}{\left(1+e^{-\frac{\sqrt{2}}{2}\tau_0}\right)^2}+\dfrac{\sqrt{2}e^{\frac{\sqrt{2}}{2}\tau}}{\left(1+e^{\frac{\sqrt{2}}{2}\tau}\right)^2}+O(\varepsilon), t<\pi/2, \\ -2t+\dfrac{7e^{\frac{\sqrt{2}}{2}\tau_1}}{\left(5-e^{\frac{\sqrt{2}}{2}\tau_1}\right)^2}+\dfrac{\sqrt{2}e^{-\frac{\sqrt{2}}{2}\tau}}{\left(1+e^{-\frac{\sqrt{2}}{2}\tau}\right)^2}+O(\varepsilon), t>\pi/2 \end{cases}$$

and $J^*[u]=-\dfrac{1}{8}+\dfrac{5\sqrt{5}}{4}\varepsilon+O(\varepsilon^2)$.

For example, when $\varepsilon=0.01$, the functional will have value $J^*[u]\approx-0.09705$.

Conclusion

Using the example of an elementary control problem, it is shown that by constructing a quality functional for the control problem of an object with fast motions, one can achieve presence in the optimal discontinuous trajectories along with boundary fast dynamics, boundary layers on the boundary of fast internal dynamics as well such transition layer in the neighborhood of the inner point of the control interval.

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Section 3. Materials Science

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MEASUREMENT OF THE COEFFICIENT OF THERMAL CONDUCTIVITY AND FINITE ELEMENT ANALYSIS OF THE STRESS AND DEFORMATION OF THERMAL BARRIER COATINGS

Abstract: Thermal barrier coatings (TBCs) are widely used on different components of gas turbine engines especially in the combustion chamber where so much thermal energy is expended. During thermal cycling, stresses develop and this directly affects the durability of the coatings. In this study, an experimental procedure was followed in finding the λ, coefficient of thermal conductivity of the TBC-an important parameter in calculating the values of stresses, deformations and the temperature field along the thickness of the TBC coating, the finite element method (FEM) implemented in the ANSYS application package, was used.

Keywords: thermal, barrier coating, base material, zirconia, ceramic, cycling, stress, substrate.

1. Introduction

Thermal barrier coatings (TBCs) used in the combustion chamber of gas turbine engine and other hot components increase engine efficiency and performance [2; 3]. The schematic diagram of a typical TBC system is shown in Fig 2. The durability and performance of thermal barrier coatings is affected by several structural factors such as porosity in the ceramic and stress developed in the TBC system especially during thermal cycling in the engine. Let us consider the nature of thermal stresses in the ceramic layer. In most cases, the destruction of the coating can occur for three reasons.

1. Due to high interfacial tangential stress, σ_{xy} by shear mechanism.

2. Due to high normal stresses, σ_x by detachment mechanism.

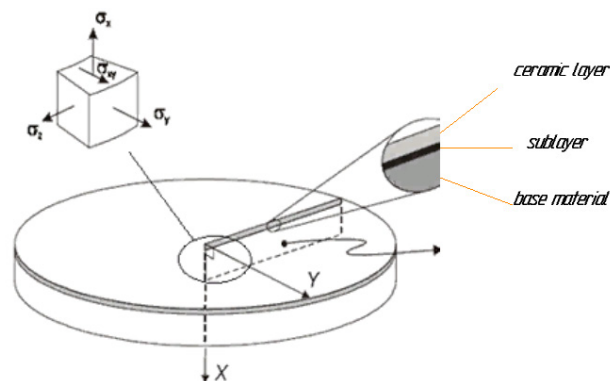3. Due to high compressive stresses σ_y, by the mechanism of longitudinal bending [4; 5; 6].

Figure 1. Geometry of the model. The radial direction is denoted by 'y', the normal direction is 'x'

When the coated sample is heated from room temperature T_a to the operating temperature T_P 1523 K, due to the difference in the coefficients of thermal expansion, a stress σ_a arises, which is expressed by the relation:

$$\sigma_\alpha = \frac{E_K(\alpha_M - \alpha_K)(T_P - T_\alpha)}{1 - \mu_K} \quad (1)$$

where:

E_k – Young's modulus of the ceramic;

α_M, α_κ – average coefficient of thermal expansion of metallic layer and ceramics in the temperature interval of $T_p - T_a$;

μ_κ – Poisson's ratio of the ceramic.

The outer layers of the ceramic layer tend to stretch, while the inner layers, which are colder, is hardly compressed. As a result, biaxial compressive and radial tensile stresses develop. Under the action of these stresses, the ceramic layer tends to bend and separate from the substrate, thereby causing destruction of the ceramic layer [7].

As observed from formula (1), the more the thermal stresses as a result of rapid heating, the larger the temperature gradient over the thickness of the ceramic coating.

The finite element method (FEM), implemented in the ANSYS application package, was used to calculate the values of stress and deformations in the layers "ceramic coating — sublayer — base".

2. Materials and methods

The thermal barrier coating used in the simulation consist of three layers. The outer ceramic layer of yttria-stabilized zirconia (YSZ), which has a low thermal conductivity. Under the ceramic layer is a heat-resistant layer (substrate), which protects the base metal from oxidation and contributes to increasing the strength of adhesion of the ceramic layer to the substrate. The three layers of the TBC including the base material are assumed to be homogeneous. Thermal and elastic-plastic properties of the substrate and ceramic materials (temperature, young's modulus, thermal expansion coefficient, thermal conductivity and Poisson's ratio) were considered in the analysis. The coefficient of thermal conductivity of the YSZ coating used were obtained in the experiment described in (2.1). The material properties such as the strength and density, which may vary during thermal cycling, have been neglected in this study. Their values as a function of temperature are given in Tables 1 to 3 [14; 15; 16].

The analysis was carried out with the temperature on the ceramic surface at 1523 K. These results in the highest temperature gradient in the radial direction and, accordingly, the maximum stresses appear in the system. However, in a short while, these stresses relax, due to deformation of the sublayer.
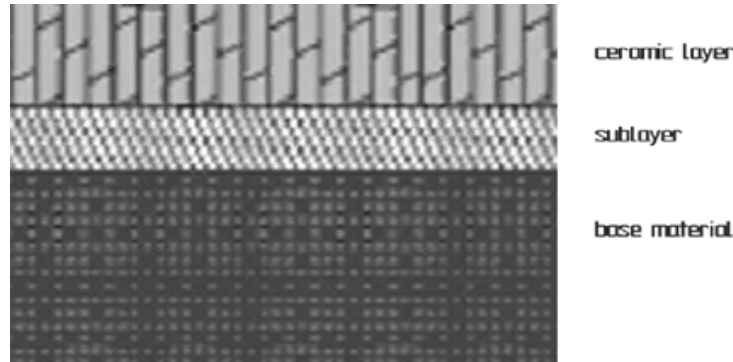
Figure 2. Layers of a thermal barrier coating (TBC)

Table 1. Characteristics of the base material (Ni-Cr-W-Mo)

Temperature	293 K	873 K	1073 K	1173 K	1273 K
E (Pa)	1.95×10^{11}	1.66×10^{11}	1.41×10^{11}	1.3×10^{11}	1.20×10^{11}
μ	0.3	0.3	0.3	0.3	0.3
$\alpha \times 10^{-6}$ (1/K)	11.0	14.01	15.8	16.3	21.1
λ (W/mK)	10.9	21.4	24.3	25.1	26.9
Thickness, mm	2.0				

Table 2. Characteristics of the substrate (Ni-Cr-Al)

Temperature	473 K	873 K	1073 K	1173 K	1273 K
E (Pa)	1.9×10^{11}				
μ	0.3				
$\alpha \times 10^{-6}$ (1/K)	13.3	14.6	15.7	16.3	18.9
λ (W/mK)	13	14	14.3	14.5	15
Thickness, mm	0.1				

Table 3. Characteristics of the material of the ceramic layer (YSZ).

Temperature	473 K	873 K	1073 K	1173 K	1273 K	1373 K
E (Pa)	$3.2*10^{10}$					
µ	0.27					
$\alpha \times 10^{-6}$ (1/K)	9	10.2	11	11.4	11.8	12.1
Thickness, mm	0.3					

2.1 Calculation of the thermal protection efficiency of the Thermal Barrier Coating of optimum thicknesses

It is important to know the measure of thermal protection of the thermal barrier coating in the thickness range 260–460 µm (A range in which no damage is observed in the test). An important physical parameter of the thermal barrier coating is the coefficient of its thermal conductivity, λ, which is necessary in calculating the temperature and heat stress within the coatings. The coefficient of thermal conductivities of the ceramic layer with varying cycles as seen in table 4 obtained from the experiment is described below.
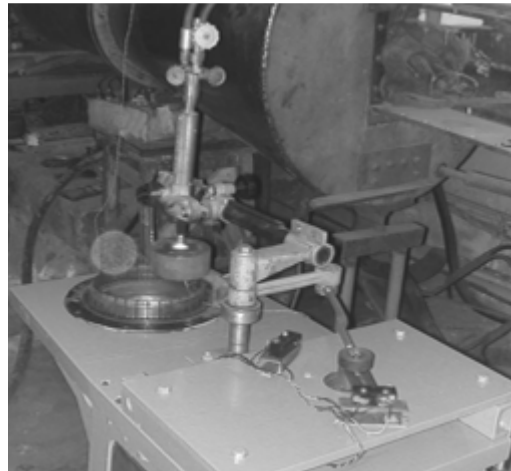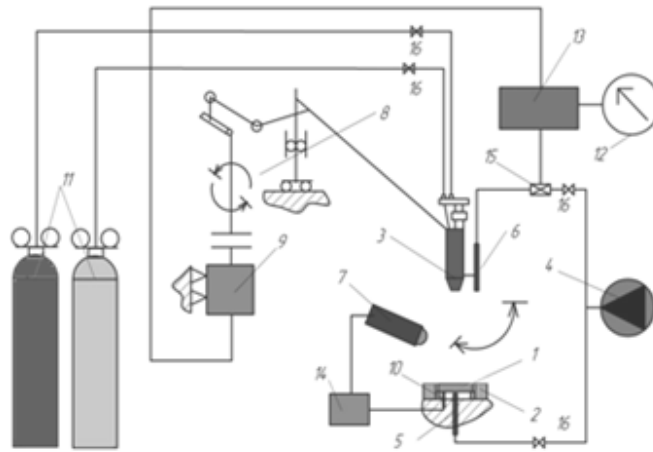

Figure 3. View of the experimental setup

Figure 4. Schematic Diagram of the experimental setup; 1 – sample; 2 – sample clamp; 3 – burner; 4 – air compressor; 5 – fixed cooling nozzle; 6 – movable cooling nozzle; 7 – pyrometer; 8 – swivel mechanism; 9 – gearmotor; 10 – thermocouple; 11 – propane and oxygen; 12 – timer; 13 – electronic unit; 14 – potentiometer; 15 – solenoid valve; 16 – control valves

It is important to note that, in the experiment, the coefficient of thermal conductivity was not calculated over the entire thickness of the sample (the base material-substrate-ceramic), but its value directly in substrate and ceramic layer. Since the thickness of the base material in this case is not included in the calculation of the thermal conductivity coefficient, on the basis of the results obtained, it is possible to calculate the value for any thicknesses and configurations of the wall of the base material. Continuous recording of temperature on the surface of the coating and the reverse side of the samples during the thermocycling tests allowed the creation of a data bank on the basis of which calculation and numerical modeling of the thermal state of the TBC was performed.

It is necessary to calculate the coefficient of thermal conductivity in a one-dimensional setting in view of the large values of the specific heat flux produced by the propane-butane and oxygen flame on one side and the inflow of a cooling air jet on the other. Based on the use of a two-layer wall (ceramic– substrate) under the condition of an ideal thermal contact of the layers, the absence of internal heat sources in the materials, we write for the thermal conductivity coefficient of the ceramic layer thus:

$$\lambda_c = q\, \delta_c / (T_h - T_c - \delta_s\, q/\lambda_s)$$

Where q is the specific heat flux through the wall of the ceramic and substrate δ_c and δ_s are the thickness of the ceramic and substrate respectively T_h and T_c are the temperatures of the wall surfaces when heated from the side of hot gas and cooling air respectively as measured in the experiment

λ_c and λ_s is the coefficient of thermal conductivity of the ceramic and the substrate respectively.

In formula (1), the actual pass through heat flux q is measured by an internal heat flux gauge via an embedded thermocouple [1]. The values of the average thermal conductivity of the ceramic layer is seen table 4.

Table 4.

Number of cycles (min)	λ (W/м K)
0	0.865
100	0.89
200	0.90
500	0.91
1000	0.89

3. Results and Discussions

As the duration of the thermal alternating heat load (heating and cooling) increases, a nonmonotonic change in the TBC is usually observed, which can be associated with structural changes in the coating [1]. Overall, there is an increase in the conductivity of the ceramic except when it was exposed to 1000 cycles of heating and cooling, there was a decrease the coefficient of thermal conductivity from 0.91 to 0.89 (W/м K). This is because at the 1000th minute, the ceramic has experienced the most sintering and densification [17].

Sample of TBC before experiment 200x Sample after 400 cycles 200x

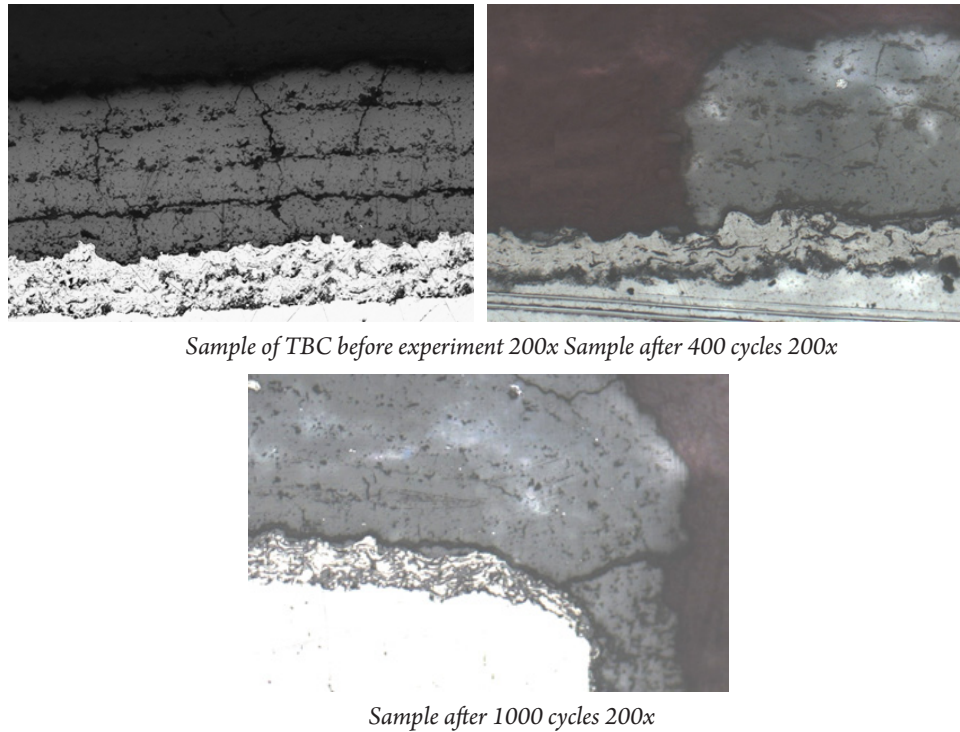*Sample after 1000 cycles 200x*
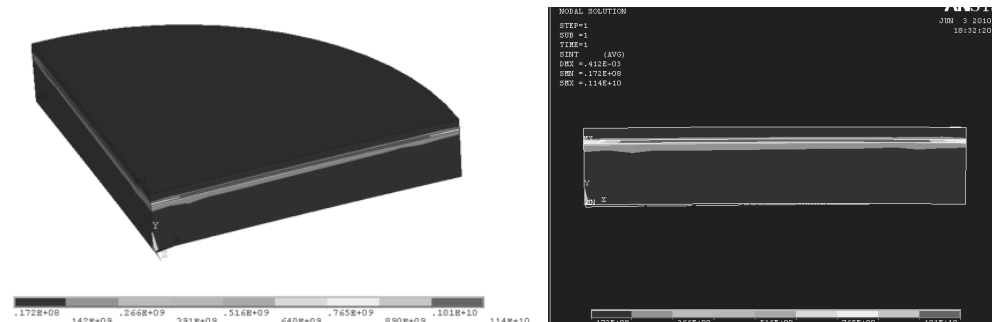Figure 5. Structural changes within the ceramic layer with varying cycles

Figure 6. The numerical model of thermal stresses arising in the coating with the greatest temperature gradient
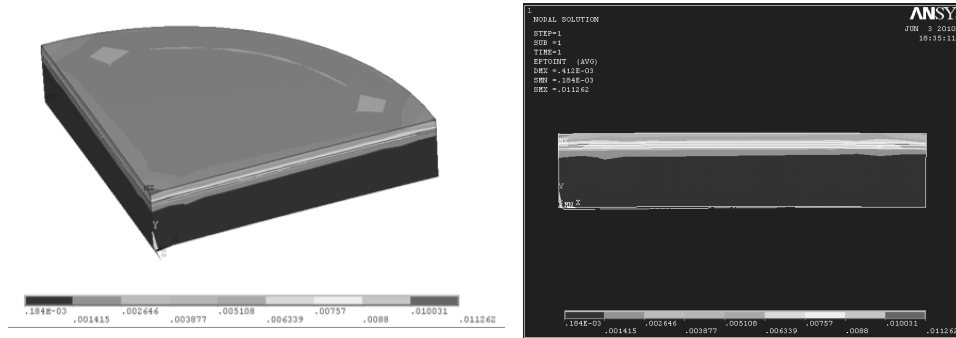
Figure 7. A numerical model of deformations arising in a coating at the time of the greatest temperature gradient

Using the data in Tables 1–3, we obtained that the tensile stress of about 188–190 MPa is acting in the ceramic layer (fig. 6). With subsequent cooling, due to the difference in the coefficient of thermal expansion of the substrate and the ceramic layer, compressive stresses will appear in the latter. This stress is localized near the sub layer. Under the influence of this stress, the ceramic coating is cracked, but it will not lose adhesion to the sublayer and the substrate, the bonding metal coating is very plastic and the stresses arising in it quickly relax within a few seconds [12]. They will intensively increase when the coating temperature becomes lower than 1073 K. The occurrence of thermal stresses causes deformation. The greatest deformations predominate in the sublayer, closer to the edge of the ceramic (Fig. 7). This is explained by the fact that usually in the coating there are small residual stresses, which depend on the thickness of the coating and on the stress difference in the upper layers and the lower layers of the coating adjacent to the sublayer [13].

a)

b)

c)
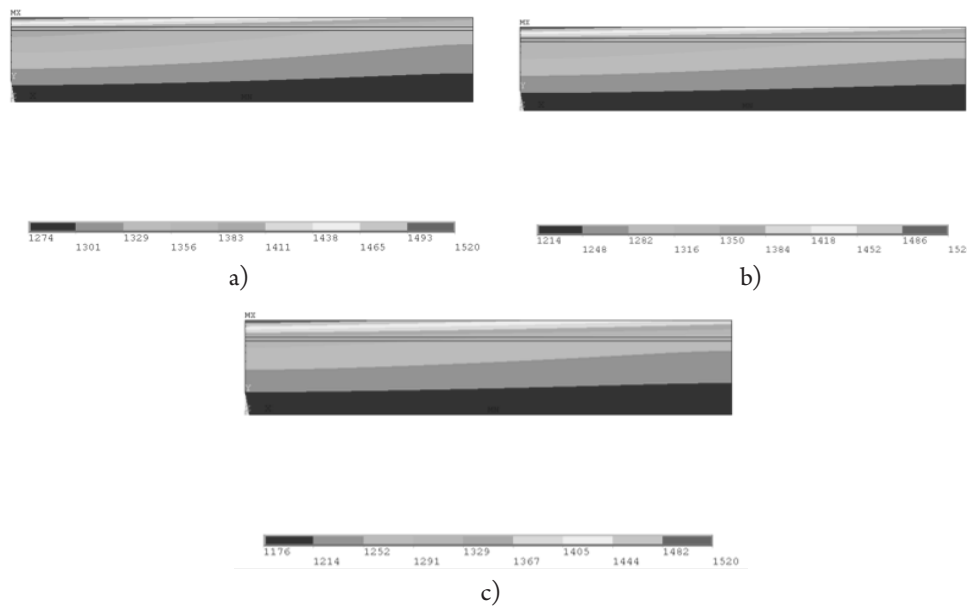
Figure 8. The temperature field over the cross section of the sample with varying thickness (260 μm, 300 μm and 460 μm respectively) of the ceramic layer

The results indicate that with an increase in the thickness of the ceramic layer from 260 μm to 460 μm, the temperature at the boundary with the sublayer is reduced by 100 degrees. In this case, the intensity of the temperature decrease along the thickness of the ceramic layer is approximately the same for different thicknesses and is 0.45–0.57 K/μm. The results of the analysis are further summarized in table 5.

Table 5. Temperature change along the thickness of the TBC

Thickness of ceramic layer, δ (μm)	Temperature on the surface of the ceramic layer K	Temperature of the ceramic layer on the boundary with the sublayer, K	ΔT along the thickness of the ceramic layer, K	ΔT/δ
260	1523	1382	138	0.53
300	1523	1348	172	0.57
460	1523	1313	207	0.45

4. Conclusion

In general, there was an increase in the coefficient of thermal conductivity of the ceramic layer from 0.865 to 0.91. There was a decrease at the 1000th minute of thermal cycling due to ceramic densification and sintering.

The finite element analysis was carried out to study stress build-up and deformation in a thermal barrier coating under thermal cycling. The thickness, plastic-elastic and the thermal properties of the layers were considered during the analysis. The stress and deformation test were carried out in order to understand the durability properties of TBCs.

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Section 4. Medical science

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RISK ASSESSMENT AND FORECASTING OF COMPLICATIONS OF CORONARY ENDOVASCULAR INTERVENTIONS IN PATIENTS WITH ISCHEMIC HEART DISEASE

Abstract: The article examines the issues of research and development of prognostic criteria for complications of coronary endovascular intervention, which is the most common and highly effective method for treatment of ischemic heart disease.

Keywords: myocardial revascularization, forecasting of outcomes, stents, risk assessment, restenosis, endovascular interventions.

Ischemic heart disease (IHD) is characterized by a wide prevalence and high mortality among the population. According to the World Health Organization (WHO), 5 million 825 thousand people died from IHD in 2002 in the world. The maximum number of deaths from IHD accounted for India (1 531 534 people), China (702 925 people) and Russia (674 881 people). According to the latest data, 3.8 million men and 3.4 million women, i. e. 7.2 million people in total, die from ischemic heart disease every year in the world. According to WHO forecasts, this figure can reach 11 million by 2020. It is expected that 82% of the global increase in mortality from IHD will account for developing countries.

The main social factors, which predispose to the massive spread of cardiovascular diseases in these countries, include urbanization, industrialization, economic backwardness and medical illiteracy of the population.

In most cases additional risk factors are malnutrition, sedentary lifestyle, smoking [1; 2; 7].

In recent years the trend towards the decrease in mortality from coronary heart disease has been observed in some developed countries. This is connected with improvement of preventive measures (increase in the level of medical literacy of the population, fight against smoking, reduction of average values of blood pressure and cholesterol), as well as with wide introduction of new effective methods for diagnostics and treatment of IHD. Despite the improvement of survival indexes in the US, about 4 million people suffer from ischemic heart disease in this country and more than 650,000 people die every year. According to the forecasts of American scientists, about 36% deaths will account for cardiovascular diseases by 2020 [3]. According to the National Institute of Health, the cost for treatment of coronary atherosclerosis is about $60 billion a year.

In connection with the abovementioned, the fight against IHD has a great social and economic importance. This is one of the top-priority tasks that face the medicine of the XXI century.

One of the most important achievements of cardiology in the last century was Andreas Grünzig's development of the transluminal balloon coronary angioplasty (TBCA), which allows to eliminate the constrictive lesion of coronary artery by endovascular intervention with minimal surgical trauma.

Primarily, the use of balloon angioplasty was quite often accompanied by development of cardiac complications. According to different authors, the incidence of AMI (acute myocardial infarction) during the procedure and immediate postoperative period was

2–10% [2]. It was possible to forecast the success of endovascular procedure with a high probability ratio only with a local concentric lesion of the coronary artery [1, 5]. The low probability of success, as well as the high incidence of TBCA complications in the case of more complex types of lesion could not help but affect the scale of its use in clinical practice. By the end of the 1980s the indications for TBCA were limited by isolated stenosis of one coronary artery. In the presence of multivessel lesions of the coronary bed, the preference was given, as a rule, to cardiac surgeons.

Practical interest in interventional cardiology increased significantly with the appearance of coronary prostheses or stents. Application of the stenting method in the case of unsatisfactory angiographic results of TBCA (residual stenosis or coronary artery dissection) significantly reduced the incidence of complications of endovascular treatment of IHD. In the course of stent implantation a solid enthetic frame of coronary artery is formed, which squeeze the fragments of the atherosclerotic plaque and intimas to its wall [4; 6]. With the appearance of stents experts in the field of invasive cardiology got the opportunity to eliminate constrictive lesions of different morphology, including a complicated one, which led to the expansion of indications for medical endovascular procedures. So, in the United States 32 300 coronary angioplasty procedures were performed in 1983, and in 1994 — already about 400 000.

Today stenting has a dominant position among other endovascular methods for treatment of IHD. The proportion of stenting procedure from all cardiac interventions is on average 70% [2; 5; 7; 9]. At the same time the incidence of serious hospital cardiac complications when using stents in most centers does not exceed 1% [2; 3; 5].

Introduction of the stenting procedure significantly improved not only immediate but also medium long-term (half-year) results of endovascular treatment of IHD in comparison with balloon angioplasty. Thus, the incidence of the coronary artery restenosis development decreased on average by 50% and now according to the data of different authors it amounts to 10–20% [2; 6; 7; 12; 15]. Nevertheless, the incidence of repeated revascularizations with regard to restenosis remained high and was associated with excessive proliferation of vascular endothelium.

At the beginning of the century stents with an antiproliferative coating were developed and introduced into clinical practice. According to the results of numerous studies, the use of these stents significantly reduced the incidence of restenosis in comparison with the use of conventional coronary prosthesis (without coating), which led to a rapid growth of their popularity among interventional cardiologists [6; 8]. Appearance of drug-coated stents made it possible to significantly reduce the likelihood of restenosis in the previously stented segment and, as a consequence, the number of repeated interventions in the long-term postoperative period [1].

Few disadvantages of stents with antiproliferative coating include the hypersensitivity of some patients to drug components, the likelihood of late thrombosis development (due to disorder of neo-endothelization), the need for appointment of disaggregants for a long time, and high cost [6].

At present time the study of long-term effectiveness of endovascular treatment of IHD is of special interest, in particular the stenting of coronary arteries. Unfortunately, there are very few papers devoted to this issue and most of them refer only to clinical results, whereas the study of angiographic results of endovascular procedures is given a secondary importance. In large-scale long-term studies scientists are limited usually by determination of incidence of adverse clinical events, such as fatal outcome, myocardial infarction, repeated myocardial revascularization [11; 12; 13]. At the same time there is no detailed analysis of morphological causes of these complications. In this regard, today specialists have diverse opinions regarding the long-term effectiveness of endovascular treatment of IHD.

The question of long-term clinical and angiographic results of repeated endovascular interventions remains to be not more clarified (therefore no less interesting). As most authors think, the disease prognosis is unfavorable in the case of endovascular treatment of coronary artery restenosis, i. e. in the future there is a high risk for renewal of angina and indications for repeated myocardial revascularization [9; 15].

Myocardial revascularization becomes reasonable if its potential positive impact on survival and progress of the disease (symptoms, functional status and/or quality of life) exceeds possible negative consequences of the procedure [2; 8]. Thus, risk assessment plays a significant role in modern clinical practice.

Modern cardiology in recent years has gained great momentum due to the advances of evidence-based medicine. Multicenter studies with tens of thousands of patients resulted in extensive experience that allowed on the evidence basis to develop modern standards for diagnostics and treatment of various conditions in cardiology. When selecting operating tactics besides the estimation of probability of hospital operative mortality, it is necessary to forecast the risk of serious complications in the early postoperative period (perioperative infarction, low cardiac output syndrome, etc.) [5; 8].

The incidence of complications after myocardial revascularization is conditioned by concomitant prevalent atherosclerotic process in aorta and large vessels, which causes at least 2/3 of adverse outcomes of the intervention. It means that probability for development of ischemic episodes of the heart in postoperative period conditions the necessity of studying hemodynamic reserves of the myocardium.

An important practical aspect of the problem is to forecast the outcome of an operative intervention. Clinical problem solving with the help of mathematical modeling methods has its own history. Development and introduction of models focused on clinical application, for example in functional diagnosis and cardiac surgery, are becoming more urgent. The risk level assessment is a multiple-choice problem that cannot be accurately quantified with a simple table. The minimum requirement for the model is approximation of its reactions and properties to physiological and pathophysiological parameters of the organism and also the possibility of forecasting.

According to the literature, when forecasting hospital complications and the outcome of surgical revascularization, the predictors are parameters that characterize the surgical intervention itself (use of artificial circulation, duration of surgery, number of shunts, multivessel lesion, number of stents, etc.), as well as parameters that describe the heart hemodynamics (local and integral contractility, coronary blood flow and its reserve, determined during load testing, degree of coronary blood flow lesion according to coronary angiography data, etc.) [1; 2; 10; 14].

With long-term forecast, such parameters as patency of shunts or stents, level and ratio of blood lipoproteins, disturbance of thrombocytic hemostasis and immune status play an important role.

International experts developed a number of scales for risk stratification of the myocardial revascularization.

EuroSCORE estimates the risk of surgical mortality. This scale is based on old data and often leads to the excess of death risk. Therefore, it is not recommended for use in the future.

The scale EuroSCORE II turned out to be most reliable in the assessment of the degree of death risk, which proved its effectiveness in researches carried out on the group of patients, who underwent coronary artery bypass surgery.

Today the method most commonly used in clinical practice is the forecast of disease developed by American experts of Agency For Health Care Policy And Research (AHCPR) National Heart, Lung and Blood Institute (NHLBI). It should be noted that the risk stratification proposed by the experts of AHCPR and NHLBI was based on retrospective data. However, prospective studies, in which patients are divided into risk groups at the beginning of the study and then the outcomes are compared at the end of the study period, are more important.

The multiplicity of factors that influence the course of IHD and the complexity of the disease mechanisms explain the desire to increase the accuracy of forecasts via a combination of symptoms.

Various authors used in the course of risk model formulation such factors as age, heart rate, systolic blood pressure, ST-segment depression separately from angina attack, heart failure and markers of myocardial necrosis, etc.

However, we should not ignore anatomical features of the coronary artery lesion. Undoubtedly, when there is a diffuse lesion of proximal and middle sections of coronary bed, long-term results are associated with a higher risk of restenosis [1].

At the same time, rapid progress that is continuously lasting in endovascular surgery during the last 20 years has allowed coronary stenting to come as close as possible to modern results of coronary bypass in multivessel lesions.

Thus, the issues of forecasting the outcomes and probable complications in coronary angioplasty and stenting are an actual problem of modern cardiology. Development of effective methods for forecasting of these complications would improve the results of endovascular interventions.

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OPPORTUNITIES OF MULTIPARAMETRICAL ULTRASONIC STUDY OF GASTRODUODENAL ULCERS

Abstract: A diagnostic layer-by-layer image of the stomach and duodenum (empty and with their cavities filled with water) obtained by ultrasonography allowed not only to assess the functional activity (motor, contractile, evacuative etc.), but to identify the presence of organic changes in the given hollow organs walls as well. A diagnostic image of the stomach in healthy people with presentation of quantitative characteristics of walls was reflected earlier. Results of complex research of 117 patients with stomach ulcer and DU were analyzed. Implementation of the offered technology of multi-parametric layer-by-layer ultrasound examination of the stomach and duodenum, including examination with tight cavities filling with water, allows to detect in time significant signs of gastric and duodenal ulcers and to recommend application of the method as early as possible at the onset of gastroduodenal ulceration in patients.

Keywords: ulcer, stomach, duodenum, ultrasound investigation, multi-parametric study.

Introduction. Almost all methods of X-ray diagnosis can successfully be used to obtain medical imaging — a structural-functional stomach and duodenum image (like any other human organ) in order to collect necessary information about the status of a healthy or a pathologically changed organ being examined [1]. At this, the main sources for obtaining medical or diagnostic imaging of abdominal organs, including when studying the stomach and duodenum, are X-ray, magnetic-resonance, ultrasound methods, allowing in most cases to get important diagnostic information, which is complementary to endoscopic studies results [1–5].

Despite the fact that ultrasound examination method in the algorithm of other methods of gastro duodenal zone (GD) examination is a relatively young trend, improving existing and developing of new diagnostic techniques enhanced opportunities of the method [6]. Many publications contain data confirming high accuracy and informative value of ultrasonic diagnostic technologies in identification of precancerous conditions, inflammatory, neoplastic and other various gastric and duodenal pathologies [7–9]. There are works on successful use of ultrasound diagnostics for pyloric and duodenal pathologies [10; 11]. It is also noted that ultrasound examination method of hollow digestive organs due to simplicity of its use and absence of invasive intervention is positively perceived by patients, while it gives the opportunity to obtain information on intraparietal changes and is a reliable monitoring means in gastric ulcer (sensitivity: 89% — 85%, specificity, accuracy — 86%) [12]. Currently, though sufficient experience in ultrasonic diagnostics of gastroduodenal pathology [6–11] is gained, the binding protocol of ultrasound abdominal examination does not include gastric and duodenal studies as mandatory.

Study purpose: determining diagnostic opportunities and informative value of multi-parametric transabdominal ultrasound examination in gastroduodenal ulcers.

Material and methods. The work is performed on the basis of data analysis obtained by gastric ultrasound examination of 117 patients with gastric ulcer (GU, n=45) and duodenal ulcer (DU, n=72) included into treatment group of the study, those who applied to the Budget Institution "Municipal Clinical Hospital № 1" of Public Health Ministry of the Chuvash Republic (Cheboksary, Chuvash Republic) and Kashkadarynsky regional medical diagnostic centre (Karshi, the Republic of Uzbekistan). Joint study was performed on the basis of cooperation agreement between Federal State Budget Educational Institution of Higher Education «I. N. Ulianov Chuvash State University» and Tashkent Physicians'

Continuing Education Institute. The age range of the patients was 17–68 years old (mean age was 40.7 ± 11.5 years). Among them, there were most men — 57.9%, and 42.1% women. In the control group 100 healthy individuals without any gastroduodenal pathology were examined. Among healthy persons examined there was an equal number of men and women (average age 42.8 ± 12.3 years).

The plan of patients' integrated examination included ultrasound, endoscopic, X-ray, MRI studies of the stomach and the duodenum, histomorphological studies of endoscopic biopsy and postoperative materials. All the patients had ultrasound examination of abdominal organs and kidneys performed. Ultrasound examination was performed using Aixplorer scanners (Supersonic Imagine, France) and Ascuvix V10 and Ascuvix V20 (Medison, South Korea) in different modes, 2D-3D ultrasound imaging using curved transducers, mini-curved transducers, sector and linear types of transducers at 3.5 to 7.5 Mhz. Magnetic-resonance tomography study was conducted in pulse sequence T1 WI, T2 WI, T1 and T2 Fsat, T2 STIR, with slice thickness up to 2.5 mm in axial, sagittal and coronary planes (EXCEL ART Vantage Atlas, 1.5 TSL «Toshiba», Japan) at tight filling of gastric and duodenal cavities with water at room temperature.

An improved technique of transabdominal gastric ultrasound examination and normal diagnostic image of the stomach were described in detail earlier [7; 9; 14].

The technique of multi-planar ultrasound of the duodenum was the following. Duodenal examination started after a thorough visual inspection of all gastric sections both under fasting condition and after filling the cavity with fluid [11; 14].

Results and discussion.

In most cases, normal diagnostic duodenal image received was better in duodenal bulb, which was determined to be more distally, more to the right and posteriorly of the pyloric gastric part (inferiorly and posteriorly in relation to right lobes of the liver, cervical and proximal parts of the gall bladder body and above the pancreatic head). At this, pyloric gastric part and duodenal bulb when their cavities were filled tightly with fluid gave a visual ultrasound image of semiorbicular interconnected liquid structures in the form of «Sandglass», and when scanning along the long axis — in the form of liquid structures located in different planar sections relative to each other depending on the beam and scan plane direction (fig. 1.2).
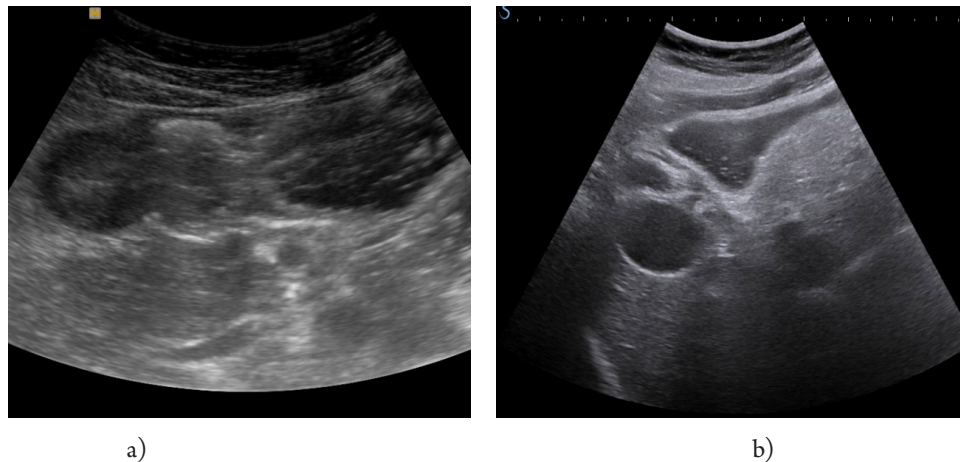

a)

b)

Figure 1.

Fig. 1 (а, б). Ultrasound image of pyloric part of the stomach and duodenal bulb in the norm in different scanning planes: a — without tight cavities filling with water, the patient is lying on his back, the sensor is in epigastric area, б — the same in mesogastic area with filling with water.
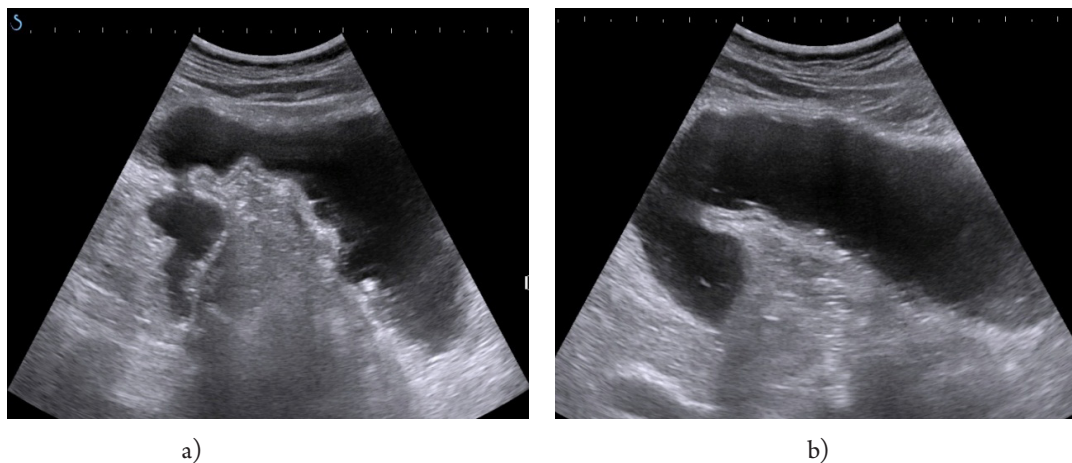

a)

b)

Figure 2.

Diagnostic ultrasound image of descending duodenal part in the norm when the cavity was filled with fluid was visualized a little more medially, lower and anteriorly of the medial contour and right reniportal structures (when studying in fasting condition in the norm it was practically impossible to differentiate it echographically from surrounding). It should be noted that when studying the given duodenal part, the patient was given an additional portion of liquid (the amount depended on the time of initial fluid evacuation from the stomach cavity, in the average — 160±35,0 ml). The remaining duodenal parts due to rapid fluid evacuation from them were not investigated.

Figure 2 (*a, б*). Ultrasound image of gastric and duodenal parts in the norm at their examination with their cavities filling depending on the patient's position: *a* — the patient is in right lateral decubitus; *б* — half-turn posteriorly.

The peripheral part of duodenal structures (the wall) had a significantly lower echogenicity and a layered structure in the form of a thin rim with smooth contours of uniform thickness, covering the central echogenic (when studying in fasting condition) or unechogenic (in the presence of liquid in the cavity) zone. Duodenal wall thickness normally averaged 4.9 ± 0.2 mm (p<0,001, when compared with treatment group), wall thickness of the bulb and thickness of postbulbar part did not significantly differ. The diameter of the bulb when filling the duodenum tight with water according to ultrasonography made 29.6 ± 2.7 mm. Echo-layers of duodenal bulb wall were identical to echo-layers of gastric wall [7; 9; 14].

When examining patients both under fasting condition and with filling the stomach and the duodenum with fluid in most cases (93.2%) in ulcerative defect localization in the wall of the stomach and duodenum the symptom of «hyperechogenicity» in the wall of the affected organ was found (DU — 68 cases (94,4%) GU — 41 cases (91,1%,) as a significant (p < 0,001) sign of ulcer which was characterized by the presence of local amplification in echogenicity in ulcerative fossa area, whose width size matched the size ulcerative fossa (fig. 3).
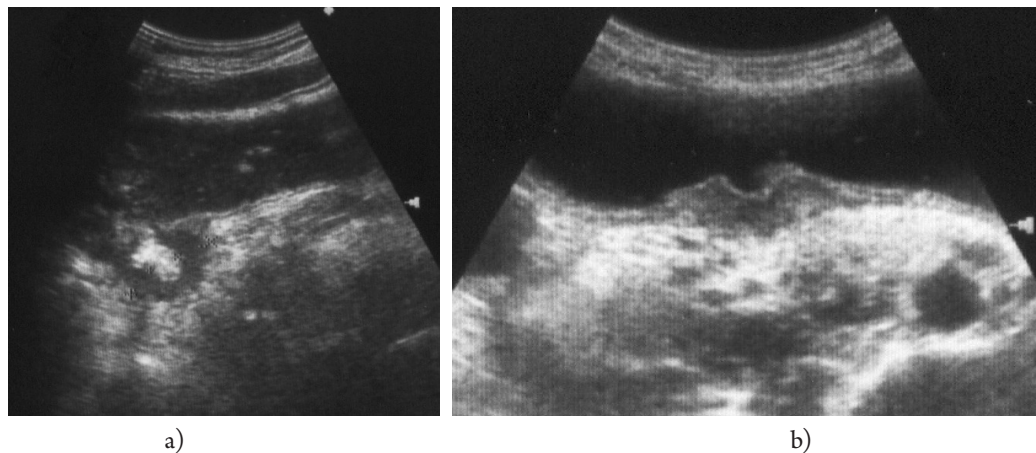

a)   b)

Figure 3.

Figure 3 (*a, б*). Ultrasound image of ulcer in the posterior wall of pyloric gastric part (*a* — antero-posterior image: *б* — profile image): local increased echogenicity in ulcerative fossa zone, hyperechogenic inner contour of ulcer edges and bottom are limited by hypoechogenic peri-ulcerative infiltration. An equal ratio of ulcerative fossa diameter to peri-ulcerative infiltration thickness is determined.

Gastroduodenal ulcers may be a manifestation of not only ulcers, it is necessary to be aware of symptomatic (secondary) ulcers that occur, for example, after extensive surgeries and injuries or acute vascular and other diseases of internal organs [15].

Both primary and secondary benign ulcerations of the stomach and the duodenum at multi-parametric ultrasound examination were characterized by breach of integrity and contours smoothness in the first two echolayers of their cavities, breach of the thickness of individual echolayers and the wall in general, breach of echolayers differentiation in the affected part. In all cases of stomach ulcer and duodenal ulcer the bottom, edges of ulcerative fossa were limited by peri-ulcerative infiltration, at this the wall thickness in GU (without complications) made 12.2 ± 2.6 mm and in DU — 11.3 ± 3.1 mm (when compared with the control group p < 0.001). Visual image of peri-ulcerative hypo-echogenic infiltration in acute benign ulcer with no complication was characterized by roughly an equal ratio of ulcerative fossa diameter to peri-ulcerative infiltration thickness (from ulcerative fossa edge to peripheral edge of peri-ulcerative infiltration). Combination of more than one stomach ulcer and a duodenal ulcer or an ulcer and erosions identified at transabdominal ultrasound examination was 5.1% (6 observations).

In cases where frequent exacerbations of ulcers were observed and ulcerative anamnesis was longer, the «syndrome of ulcer bottom exit outside the wall outer contour» was determined (14.5% of observations, of them in GU — 11.1%, in GU — 3.4%), in which the outer contour of peri-ulcerative infiltration stood out for the fifth external echolayer on the border with the unmodified wall. At this the visual ulcer image was characterized by decreasing in ulcer bottom thickness (GU — 1.8 ± 0.2 mm; DU — 2.4 ± 0.2 mm; p < 0.001), by increasing of ulcerative fossa depth (11.1 ± 0.4 mm in GU; 10.5 ± 0.1 mm in DU; p < 0.05). The given complex allowed to suspect the presence of ulcer penetration into nearby structures (mainly into the pancreas). In cases where the wall body in the field of ulcer bottom was thinner than 2 mm, there was a threat of ulcer perforation (1.7%).

Disturbance of differentiation in stomach wall layers in projection of peri-ulcerative infiltration depended on the thickness and length of peri-ulcerative infiltration. The smaller the ulcer depth and the peri-ulcerative infiltration thickness in a benign ulcer were, the

safer the third, the fourth, the fifth echolayers in the field of ulcer bottom were determined.

Table 1. – Informative value of multi-parametric transabdominal ultrasound gastric and duodenal examination in gastroduodenal ulcers (*n* = 117)

Indices	Number of cases
Total number of patients examined Among them:	117
– True-positive result	95
– True-negative result	11
– False-positive result	2
– False-negative result	2
Sensitivity	97,9%
Specificity	84,6%
Accuracy	96,4%

In studies of Z. A. Lemeshko et al. it is noted that in the presence of perforated GU and DU ultrasound examination marks thickening of hypoechogenic organ wall with discontinuous outer contour in the field of perforation orifice, which is filled with highly-echogenic content and is located in the zone of thickening that does not contradict our findings. The results of the ultrasound stomach and duodenal examinations were significant (p < 0.001) at their verification by MRI data, endoscopic, X-ray, histomorphological studies that served as the basis for statistical calculation of sensitivity, specificity and accuracy of the method in the diagnosis of gastroduodenal ulcers (table).

The results of our work on informative value of ultrasound gastric and duodenal examination method in GU and DU find their confirmation in other researchers. There are publications on informative value of ultrasound examination in gastroduodenal pathology, according to S. A. Sedykh et al., in definition of gastric cancer transition to the duodenum specificity of the method made 100%, its accuracy — 94.9% with sensitivity of 97.3% [8]. According to other researchers, ultrasound examination sensitivity in detecting gastric and duodenal ulcers reaches 84%, its specificity — 92% and accuracy — 89%, in identifying gastric and duodenal leiomyomas — sensitivity makes 96.3%, specificity 98.4% and accuracy 97.8%.

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MICROFLORA OF BIOTOPES AS A LEADING ETIOLOGICAL FACTOR AT ORAL DISEASES IN CHILDREN

Abstract: Being a source of foreign genetic information, microbes and viruses regardless of the exact place of the invasion during their life damage tissues' integrity and as a result provoke the development of disease of various severity. Oral cavity stands on the second place by the number of microbes with different level of virulence. Dysbiotic abnormalities cause biofilms formation in various oral biotopes. The associated links within biofilms facilitate the increase of microflora virulence. Poor oral hygiene stimulates microbes' growth and reproduction. Oral cavity is not homogeneous by the number of microbes' settlements. Most of microbes concentrate in areas with special anatomical features. Stomatitis, dental caries, parodontitis and periodontitis are the most frequent clinical manifestations of high active microflora. Monitoring of oral biocenoses allows to perform the analysis of their variety and structural adjustments, which is vital for optimal treatment and prevention of oral diseases.

Keywords: Microbes, Anaerobe, dental caries, oral hygiene, children, stomatitis.

The most frequently spread somatic diseases are stomatological ones. Every child knows what stomatitis or dental caries is. The main factor, which causes stomatitis in children is the oral bacterial flora. [1] Normally *the inflammatory response* is prevented by specific and nonspecific factors of antimicrobial resistance of *oral mucous membrane, as well as biochemical and immunological features of saliva. The forming of oral micro-biocenosis is a multilevel process, closely **linked with** the regularities of dento-facial system development. Transient microbes constantly getting into the children's mouth by dirty hands, toys and kisses of relatives damage micro-ecological and adaptive microbes' interrelations with both environment and each other.*

Clinical picture of inflammation in the particular patient depends on the factor, causing it as well as on the individual conditions of the patient, complementing this pathological process [2].

Understanding of the oral pathological processes in children requires knowledge of topographic, anatomic, histological and histochemical processes, often sharply changing depending on age.

There are distinguished 3 periods of age, which significantly differ by constitution and characterize the dynamic of main mucous structures development: the infants — a period of age from 10 days to 1 year, early childhood — the children from 1 to 3 years old and childhood — primary (4–7 years old children) and postprimary (8–12 years old children). With age the factors of local mucous protection improve [3; 4]. And, in spite of quality changes of oral mucous membrane structures during childhood, characterized by principally new ways of defence building, stomatitis is remains a very frequent disease among the children.

Catarrhal, acute and aphthous stomatitis are very similar by their symptoms among the children, therefore inadequate complex

treatment of a trivial form of stomatitis often provokes its shifting into aphthous stomatitis [4; 5; 6]. Up to now, the etiology of stomatitis, specifically which factors are dominant and which propose the development of the disease remains open to discussion.

The identification of the exact etiology of stomatitis in each particular case defines the system of medications and preventive measures as well as the prognosis of the disease recurrence.

The aim of investigation is to enhance the effectiveness of stomatitis diagnostics among the children and specify biocenotic interrelations of staphylococci and streptococci, colonizing biotopes of cheek, interdental gingiva and sublingual area.

Materials and methods. The study included the analysis of 60 kids from 7 to 10 years old from the first and second health groups with negative allergic anamnesis. Parents of children, who took part in the analysis, gave their informed agreement. At the moment of investigation 50 kids had no complaints typical for oral inflammatory diseases. 10 kids had from 2 to 5 elements of inflammation of various oral locations.

The children were divides into 3 groups by the frequency of stomatitis occurrence. The first group included healthy kids with no complaints specific for stomatitis in anamnesis in any period of oral system development (20 patients). The second group included 20 kids having a single visit to the doctor related to stomatitis in anamnesis.

20 kids visiting stomatologist once a year with complaints on painful aphthaes in the mouth formed the third group. Investigation included various methods of analysis such as questioning, oral examination, probing, percussion, hygiene state identification and microbiological analysis of oral biotopes.

During oral examination, probing and percussion there were identified n oral cavity and tooth lines conditions, carious and noncarious changes of hard tooth tissues. The oral hygienic state was estimated by Green-Vermillion (OHI-S) method. Dentobacterial plaque was colored by «Dinal» tablets due to their simple use and no emotional impact on children. Dentobacterial plaque was estimated on teeth, belonging to different groups, on surfaces, the most effected by dental deposits. Numeric representation of diagnostic criteria in this method of analysis [7] characterized the area of dental deposit. The intensity of caries at this stage of mixed dentition was estimated by KP and KPU analysis [8].

The bacteriological analysis was conducted according to general rules of clinical microbiology with definition of aerobic and facultative anaerobic microbes and quantative estimates of the results (primary seeding was done from 10^{-1}–10^{-5} dilutions of analyzed tissues (material)), required to extract conditionally-pathogenic bacteria [9]. Clear cultures of facultative anaerobic bacteria were grown using five-percent blood agar in exsiccators. The extracted cultures were identified after the number of isolated colonies on solid mediums counting. For bacteria identification a complex of morphological, cultural and biochemical patterns according to Berdgi classification (1980) was used. Biochemical identification of clear streptococcus, enterococcus and staphylococcus cultures was fulfilled by Lachema test systems.

Density of microbes' population was expressed in colony-forming units (CFU). The material for bacteriological analysis was taken from surfaces of buccal mucosa, interdental gingival mucosa within the teeth used for hygiene index analysis, oral floor mucosa and aphthaes.

Based on the analysis of caries intensity patients in groups were divided as following: the first group was characterized by low active caries and good oral hygiene, satisfactory structure of hard tooth tissues, correct forms and sizes of the erupting permanent teeth, oral mucosa of standard rose-pink color without any pathological changes. In the second group 8 patients from 20 had medium intensive caries, 4 had high intensive caries and 8 had low intensive caries, oral hygiene in the group was mainly satisfactory. No changes of hard tooth tissue structure, no pathological changes of oral mucosa were revealed within the investigation. The third group included 10 patients having oral aphthaes at the moment of the investigation. Aphthaes were located mostly on buccal mucosa within the necks of teeth, covered by soft dental deposits, and were covered by fibrinous pellicle, tender to palpation. Average value of OHI-S index in this group was equal to 0,5, which corresponded to good oral hygiene level, 2 patients had OHI-S index equal to 1,2. 12 patients had caries of high intensity and 8 patients had caries of medium intensity.

The results of investigation demonstrated low caries intensity and good oral hygiene in 100 per cent cases among the patients of the first group, as well as chronicity of the existing pathological sites on hard tissues. Patients of the second group had caries of low and medium intensity in 80% of cases and caries of high intensity in 20% of cases. Hygienic index was low in 100% cases. Among the patients of the third group poor hygiene was shown in 20% cases, 80% of patients demonstrated satisfactory hygiene level. However, together with good oral hygiene 40% of children in this group had caries of medium intensity and 60% of patients — caries of high intensity. Pathological processes on hard teeth tissues revealed acute development in 90% cases.

The conducted bacteriological analysis revealed a multiple variety and high density of CPU in all analyzed biotopes at primary inoculation. Streptococci appeared to be the most representative microbes.

High CFU density of streptococci remained up to 10^{-4} dilution of biomaterial, taken from interdental gingival mucosa and gingival margin in all 3 groups of patients (table 1, pic.1). Among streptococci there were identified *Streptococcus mutans, S. sanguis, S. salivarius,*. *S. mitis and S.viridans with* index of dominance equal to *100%*.

At 10^{-4} dilution *S. salivarius and S. Mitis* were identified in 70% cases among the patients of the 1st and the 2nd groups, in the 3rd group *S. salivarius* and *S. mitis* were detected in 90% cases. *S. Sanguis* and *S. Mutans* were found in all patients of the 3rd group and 80% patients of the 2nd group at 10^{-4} dilution. Data analysis based on parametrical criteria of Dannet with the 1st group used as control revealed a significant difference of the 1st and 3rd groups by *S. salivarius* (test significance level $\alpha = 0,05$, number of degrees of freedom $v = 29$, number of compared groups $l = 3$), *S. Sanguis* ($\alpha = 0,05$, $v = 35, l = 3$) *and S. mutans* ($\alpha = 0,05$, $v = 29, l = 3$) indexes. The revealed difference was also proved by nonparametric criteria Kruskall-Wallis and Dann.

Analysis of biomass in first inoculation demonstrated high density of staphylococcus. Typing allowed to extract *Staphylococcus* aureus and S.*haemolyticus.* The highest frequency of occurrence of these microbes appeared in the 3rd group of patients (pic. 2 a) at all dilutions. 95% confidence intervals for frequency estimates in the 1st

and 3rd groups at 10^{-4} dilution built with the use of binomial distribution with regard to small samples allowed to reveal the significant differences of groups by given microbes and consider these indexes as essential for pathological process prognosis. High CFU density of lactic bacteria and enterococcus in the 3rd group remained up to 10^{-5} concentration with average lactic bacteria CFU density within gingival margin equal to 5,25 and enterococcus CFU density equal to 7,5.

Frequency index of *S.viridans*, extracted from aphthaes surfaces, made 100%. This alpha-hemolytic streptococcus was distinguished in 40% patients of the 3rd group within gingival margin at 10–4 dilution (average density equal to 4,75 CFU). It also appeared as 5 CFU among 20% patients at 10–5 dilution. Aerobic microflora of this biotope in analyzed groups appeared to be dynamic and changeable.

The comparative study of bacteria population in biotopes of buccal, sublingual and gingival areas revealed the highest bacterial number in gingival margin. Gingival biotopes of conditionally healthy patients in all three groups significantly differed by both quantitative and qualitative indexes at maximum dilution (pic. 2a, 2b). The highest CPU density of identified streptococci, staphylococci, enterococci and lactic bacteria appeared in the 3rd group. Microbial density was lower in buccal mucosa and the lowest in sublingual area.

High number of residential bacteria at buccal mucous areas remaining at 10^{-4} and 10^{-5} dilutions contributes to local immune depression and, therefore, creates favorable conditions for transient microbial contamination, which increase biotope virulence.

Table 1. – Average values of identified microbial CFU and corresponding frequency of occurrence in gingival margin among the patients of the 1st, 2nd and 3rd groups at 10^{-4} dilution

Microobes	1st group (20 patients)		2nd group (20 patients)		3rd group (20 patients)	
	Average, m (CFU)	Occurrence rate (0 < p < 1)	Average, m (CFU)	Occurrence rate (0 < p < 1)	Среднее, m (CFU)	Occurrence rate (0 < p < 1)
S. salivarius	9,57	0,7*	13,57	0,7	16,33	0,9
S. sanguis	10,55	0,9	12,25	0,8	15,7	1,0
S. mitis	9	0,7	16,14	0,7	12,0	0,9
S. mutans	12,33	0,6	13,5	0,8	19,0	1,0
S. viridans	0	0	0	0	4,75	0,4
S. aureus	3	0,1	4	0,1	4,28	0,7
S.haemolyticus	0	0	0	0,1	3,2	0,5
Lactobacter	7,66	0,3	17,13	0,8	16,75	0,8
Enterococcus	9,0	0,5	14,71	0,7	8,7	1
Candida spp.	3	0,1	4	0,5	5,75	0,8

* The occurrence rate characterizes the number of patients in a group which have a particular microbe (0,7 corresponds to 70% of patients, namely 14 from 20 analyzed patients of the 1st group with S. Salivarius revealed)
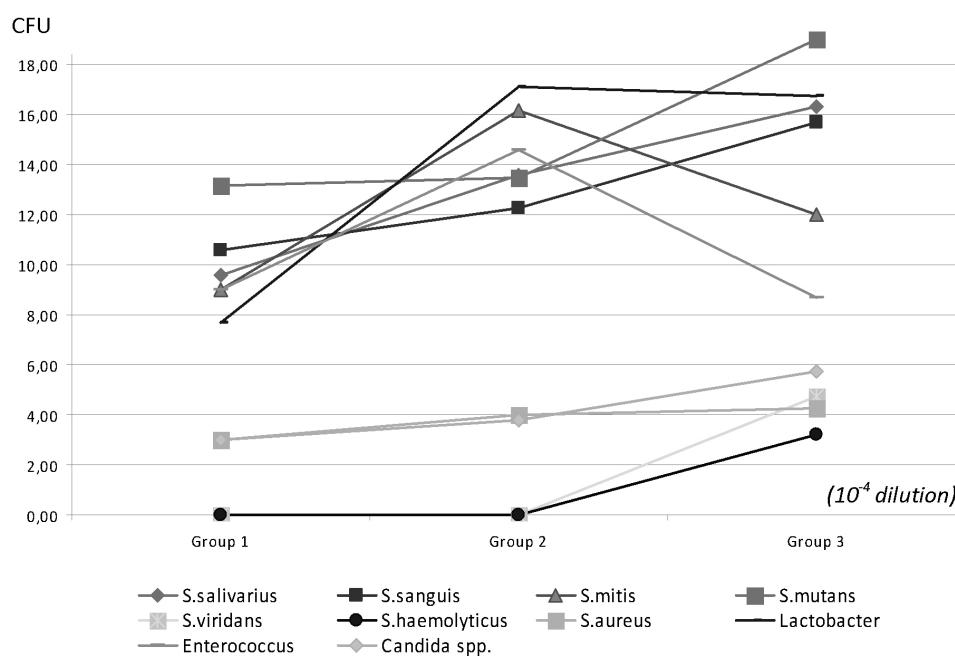
Picture 1. Average values of identified microbial CFUs in analyzed biotopes of gingival area (10^{-4} dilution)

The study revealed modifications and adjustments of aphthaes micro-biocenosis, characterized by both the decrease of dominance and environmental significance of the leading symbiotes and the increase of transient microflora frequency.

Transient microbes, been inoculated at stomatitis, have distinctive pathogenicity, which is clinically expressed by pathological formations on buccal mucous membrane. S. *Haemolyticus* in aphtha's biotope saves dominance up to maximum dilution.

Different degree of various biotopes' contamination in the particular patient is linked with anatomic features of these surfaces and immunological background. Constant sublingual and submaxillary salivatory secretions support high concentration of immune protective factors in sublingual area, which allows controlling the bacteria and preventing possible inflammation in this area. However, the diagnosed dysbiotic disorders in biotopes of buccal and interdental gingival areas prove the failure of local oral immunity in general.

In summary, the type of staphylococcus bacteria-carrying and *S.viridans* in oral diseases becomes a way of microbiological monitoring and detection of high risk groups at a particular oral pathology in compliance with identification of the disease structure, as well as clinical and microbiological factors.
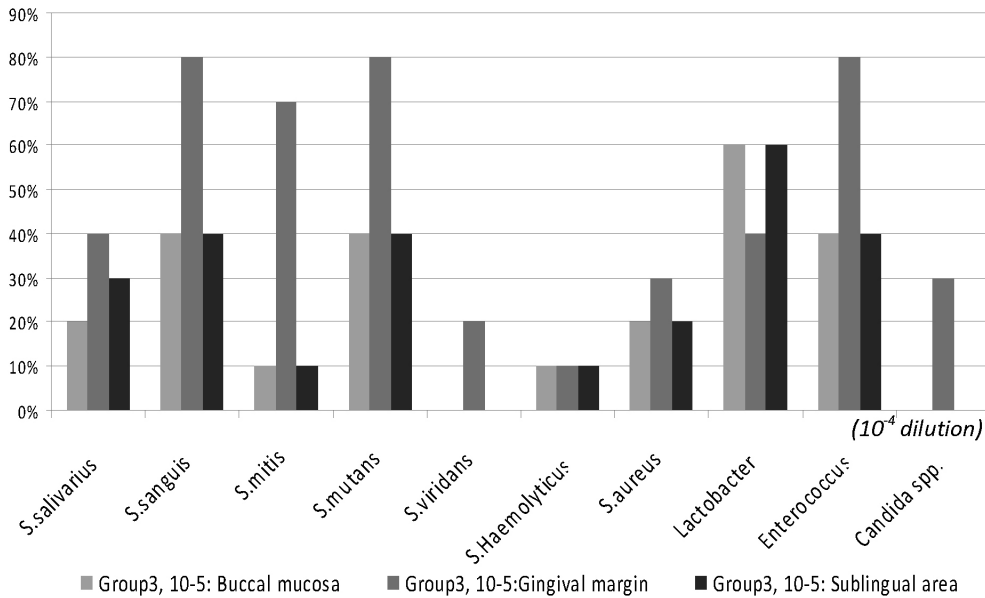
Picture 2 a. Frequency of occurrence (%) of aerobes and facultative anaerobes in analyzed biotopes at 10^{-5} dilution among the patients of the 3rd group
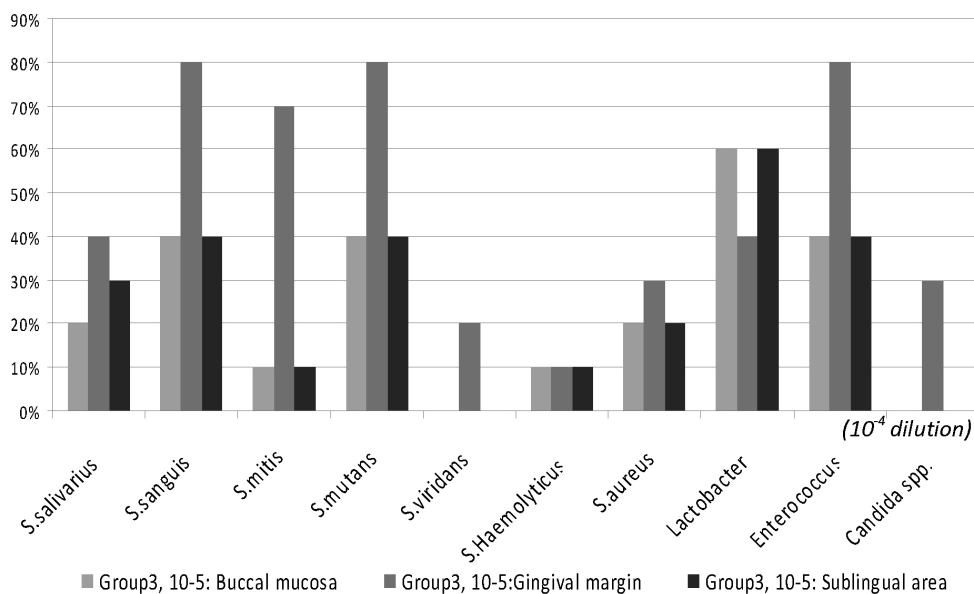
Picture 2 b. The bacterial number (CFU) of analyzed biotopes at 10^{-5} dilution among the patients of the 3rd group

26

The analyses of ecosystem anaerobic structure demonstrated different contributions of microbes to oral biocenoses and allowed to define dysbiotic changes in biotopes. It was proved that dominant microbes critical for microflora of microbiocenosis were streptococci with different type ratios in analyzed biotopes.

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THE ROLE OF MIXED BACTERIAL INFECTION IN PURULENT-SEPTIC DISEASES

Abstract: Bacterial vaginosis can provoke serious gynecological and obstetric complications both during pregnancy and outside it. Pre-gravity training, which includes the treatment of bacterial vaginosis with a mixed infection, significantly reduces the incidence of purulent-septic complications in childbirth and in the postpartum period.

Keywords: Bacterial infection, candidiasis, sepsis, miconazole.

Relevnce: The vagina is a complex self-regulating ecosystem that creates its own environment and maintains a balance between normal microflora and opportunistic microorganisms. With bacterial vaginosis, the number of lactobacilli sharply decreases, giving way to pathogenic flora [1; 5].

Normal vaginal microflora in turn help s suppress the growth of many potential pathogens and is one of the conditions for maintaining colonization resistance, the violation of which entails the risk of a number of pathological conditions and diseases, including during pregnancy and in the period of growth of purulent-septic complications [3; 4].

It should be noted that the choice of tactics for managing patients with bacterial vaginosis is sometimes difficult due to frequent relapses of the disease. The task of drug therapy for bacterial vaginosis has several goals: restoring the diseased balance of the vaginal microflora, suppressing the opportunistic flora (mainly anaerobic), preventing fungal superinfection. In this case, treatment should not affect the epithelium of the vagina — a pledge to restore normal microflora. In addition, it must be remembered that bacterial and fungal infections are often mixed, so a wide range of drugs should be used, with antibacterial, antiprotozoal and fungicidal effects [2; 6].

Objective: Was to identify the dependence of the course of pregnancy and childbirth on the state of the vaginal biocenosis of pregnant women.

Material and research. We conducted a retrospective analysis of the history of delivery of 165 women, which were divided into 2 groups. In 1 group included 93 pregnant women with uncomplicated course of the postpartum period. 72 patients with high infectious risk were assigned to group 2. A retrospective analysis of the history of labor showed that the outcomes of pregnancy in group 2 were as follows: 39 premature births in terms of 29–37 weeks, 33 urgent deliveries in terms of 38–40 weeks.

The age of patients in the two study groups ranged from 17 to 29 (mean age-21.8 ± 1.3 years). The duration of the disease is from 2 to 4 days. Menarche was approximately the same in the two groups and was: 12.8 ± 1.6 years and 12.6 ± 2.3 years, respectively. The age of onset of sexual activity also had no difference in the control and main group (p > 0.05) and averaged 22.7 ± 4.1 and 21.6 ± 3.4, respectively.

Based on anamnesis, the outcome of previous pregnancies is studied. In the main group, obstetric complications such as undeveloped pregnancy in 21 (29.1%), spontaneous abortions in terms of 4–16 weeks — 39 (54.1%), the threat of miscarriage was from 72 in 63 (87.5%), Urinary tract infection (UTI) in 47 (65.3%), premature rupture of membranes in 49 (68%), premature delivery in terms of up to 34 weeks in 28 (38.9%), before 37 weeks in 31 (54, 1%); In labor, the frequency of the abnormality of labor was in two groups identical; A manual examination for the delay of the placenta in 24 (33.3%), hypotension of the uterus in 16 (22.2); In the postpartum period: syndrome of the systemic inflammatory response (SIRS) in 12 (16.7%), endometritis in 13 (18%), infection of the sutures and wound healing by secondary tension in 15 (20.8%), UTI in 14 (19, 4) women. In the 1-group, the listed complications were 3 times less common;

As a result of the above complications, various invasive interventions with instrumental studies were conducted by women, which could also provoke the appearance of purulent-septic conditions, often in the penetration of anaerobic infection into the body.

Extragenital factors also played an important role: anemia of 2 and 3 degrees in 49 puerperas from 72 women of the 2nd group, presence of UTI in 29, recurrent or transferred during pregnancy bacterial vaginosis in 45 or more patients.

An investigation of the incidence of infectious-inflammatory pathology of the birth canal showed that the infectious and inflammatory process in the birth canal of a specific and nonspecific etiology was found only in the group of pregnant women of high infectious risk with an unfavorable outcome of pregnancy (89). For example, Nonspecific vulvovaginitis was detected in the third trimester in 43 cases (31.39%), of which bacterial vaginosis accounted for more

than 75% of sexually transmitted infections in 20 patients (14.6%) sexually transmitted infections in 20 patients (14.6%).

Statistical analysis showed that a favorable outcome of pregnancy in a significant percentage of cases is accompanied by normocenosis of the antenatal tracts of the pregnant woman — in 29%. In 2 group normocenosis was not recorded in any pregnant woman.

To verify the pathogen, the results of a bacterioscopic and bacteriological analysis of the microenvironment of the genitals (where the Candida fungi were sown 60%, including C. Albisans and tropicalis, and 40% of cases Trichomonus vaginalis and Gardnerella.

A comparison of the incidence of bacterial vaginosis showed that a significant difference in the incidence of bacterial vaginosis in both groups was: in 1 group, in 26 patients, in 15 patients, and in 24 for 34 women, 24.8%.

Similar results were obtained when analyzing the incidence of vulvovaginal candidiasis in 18 examined pregnant women (19.4%) and 26 (18.98%) in two groups, respectively.

Results of the study

Based on the study, we can conclude that the infectious and inflammatory pathology of the prenatal pathway of a pregnant woman is a risk factor for intrauterine infection and the development of adverse complications for the pregnant and fetus, and subsequently for the newborn.

To prevent the expected complications, in advance to all 72 gynecological patients with bacterial infection and sexually transmitted infections (STI) having a high infectious risk of the birth canal, a pregravidated complex antibacterial therapy with the inclusion of miconazole was carried out.

Studies have proven that myconazole has an selective bactericidal effect against those microorganisms whose enzyme systems are capable of reducing the nitro group. Active reconstituted forms of the drug disrupt Deoxyribonucleic acid (DBA) replication and protein synthesis in the microbe cell, inhibit tissue respiration. It is an antifungal and anti-inflammatory synthetic drug widely used in gynecology. The active substance of the drug — miconazole nitrate, has antifungal and antibacterial action against: Candida albicans of different species, Microsporum canis; Aspergillus niger, as well as against staphylococci and streptococci and less pronounced for Pseudomonas aeruginosa, Escherichia coli, Proteus, and others. With topical application, miconazole is practically not absorbed into the systemic circulation and is highly effective in the local treatment of mixed infections caused by Candida and gram-positive flora. The drug during pregnancy because of the lack of systemic actions was applied intra-vaginally after the first trimester, as only 1.4% of the dose is absorbed into the blood.

The drug Mikotran 1200 gynecological patients was prescribed in candles before bedtime 1 time and in cases of chronic and persistent vaginosis and candidiasis dose repeated after 3 days.

Women received a course of therapy in a polyclinic or at home under the regular supervision of a specialist. After the end of the course of therapy, all patients submitted tests for the presence of pathogens during 2–3 menstrual cycles, with chronic vaginal candidiasis, and they were more than 50%, on the 5th-6th day of the menstrual cycle (immediately after menstrual cycles), treatment Repeated 3–6 months in a row.

When choosing miconazole, we took into account its high activity with a wide spectrum, its biological and economic availability with minimal side effects.

The advantages of Mikotran for complex treatment was: the lack of systemic effects on the body; Minimal risk of adverse reactions; Simplicity and convenience of use (minimum one-time reception per day); Absence of contraindications (except for individual intolerance of the drug and during pregnancy during the 1st trimester); The possibility of using in patients with extragenital pathology (especially in the localized forms of the infectious process, such as acute vulvitis, vaginitis, cervicitis or exacerbation of chronic vaginal or cervical processes), rapid entry into the focus of infection and rapid action (3.5) and of no small importance Place, that the drug is economically available and the results of the studies have proved that its quality is not inferior to any other drugs possessing the same properties.

The effectiveness of therapy was assessed by the following indicators: the general condition and well-being of patients; Clinical data (history and gynecological examination data), laboratory bacterioscopy data.

Results of the examination and treatment showed a general improvement in the condition and relief of symptoms inflammation was observed from 72 women in 66 (91.7%) patients within 2–3 days after the end of the course of therapy. The change in the clinical picture and subjective sensations (change in the nature of discharge, reduction of irritation, itching, burning) is noted. According to the gynecological examination, the patients had a better vaginal mucosa (decreased puffiness and hyperemia). Positive bacteriological effect of the drug was noted — in 61 (84.7%) suppression of pathogenic microflora, including anaerobic flora (according to bacterioscopy) was detected. Adverse reactions against the background of therapy with the drug Mikotran are not noted in any case.

Thus, high efficacy, lack of systemic effect on the body, and also available use make it possible to consider a complex action drug, in particular myconosol nitrate (Mikotran), an effective and acceptable means for treating mixed infections in both the lower part and the upper genital tract.

We also evaluated the effectiveness of therapy with Mycotrana, with the pregravid preparation of women with mixed infection and STIs, in order to avoid the attachment of bacterial vaginosis. The long-term results of the study showed that in the group of 72 women the pre-schooled cases of gynecological complications in the form of an undeveloped pregnancy-6 (8.3%), spontaneous miscarriages-7 (9.7%) decreased by 5–6 times, the threat of miscarriage in the early stages – 12 (16,7%) to 5 times, UTI-23 (31,9%) almost 2 times, premature births in terms of up to 34 weeks (11,1%) – 3,5 times, up to 37 weeks – 3-fold, postpartum complication: manual examination of the uterine cavity for the delay of the placenta and its fragments in 6 (8.3%); SIRS-4 (5.5%) and endometritis and infection of postoperative sutures in 5 (6.9%) is a decrease of 3.5 times with cases when women with mixed infection did not undergo pre-education training.

Clinico-laboratory data indicate that the efficacy of Mikotran therapy has been as high as 95% under these conditions.

Conclusion: Pre-birth training of women with mixed infection and STI is necessary to prevent complications such as spontaneous abortions, the threat of abortion, undeveloped pregnancy, premature birth, UTI, postpartum-invasive interventions such as manual examination of the uterine cavity, infection of postoperative sutures, SIRS, metroendometritises, cases of UTI occurring during pregnancy and in the postpartum period, effective treatment of which decreases from 3 to 5–7 times higher than the transcript Complication [2; 4].

Due to the combined antimycotic and antibacterial effect of mykonosal nitrate in the composition of Mikotran, which has high clinical efficacy in genital infections and bacterial vaginosis, it increases the compliance of treatment, reduces the number of side effects, quickly corrects symptoms (discharge, itching), gives a pronounced clinical effect, confirmed by the results of microbiological studies, which also contribute to the reduction of perinatal mortality, as well as maternal and child morbidity [5; 6].

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WAYS OF OPTIMIZATION IN THE TREATMENT OF URINARY TRACT INFECTIONS IN PREGNANT WOMEN FOR THE PURPOSE OF PREVENTING SEPTIC COMPLICATIONS

Abstract: Infection of the urinary tract (IUT), means the presence of microorganisms in it, with the subsequent development of the inflammatory process. The frequency of IUT in pregnant women is from 4 to 8%. Pregnant women with IUT were treated with an antibacterial drug and phytopreparation, which in all 100 cases gave a clinical and laboratory effect.

Keywords: Infection of the urinary system IUT, asymptomatic bacteriuria, cyctit, Urfocin.

Relevnce: Infection of the urinary system IUT, means the presence of microorganisms in it, followed by the likely development of the inflammatory process. The frequency of infections of the urinary system in pregnant women is from 4 to 8% [1; 4; 7]. The presence of only bacteria in the urine without visible clinical manifestations of the disease (asymptomatic bacteriuria) is noted from 2% to 13% of cases.

Causes that affect the predisposition of women to infection are: a short urethra, proximity of the urethra to the rectum and to the external genital organs, changes in the hormonal background. During pregnancy, additional conditions are created for urine stagnation and disturbance of its outflow due to a significant expansion of the kidney pelvis, lengthening of the ureters, decreased tone and contractility of the muscles of various parts of the urinary system as a result of the action of progesterone and kidney displacement. In addition, the outflow of urine from the kidneys worsens due to the mechanical pressure of the pregnant uterus on the ureters. In this connection, ⅓ of pregnant women have a reverse urine flow from the bladder into the ureters, which promotes the spread of pathogens into the upper parts of the urinary system. Risk factors for the development of urinary tract infection are: failure to comply with the rules of personal and sexual hygiene, previous inflammatory diseases of the genitals (inflammation of the cervix, uterus and uterine appendages), the presence of foci of chronic infection in the body, endocrine pathology (diabetes), the pathology of the urinary system Urolithiasis, chronic cystitis, kidney development anomalies), as well as unsettled sex life and frequent changes in sexual partners.

Objective: treatment of pregnant women with uncomplicated IUT, with getting rid of the pathogen and preventing the recurrence of the infection.

Material and research: This condition was accompanied with dysuric phenomena, in all cases with a rise in temperature above 37C and in 32 women with the threat of miscarriage in different periods of pregnancy. First-pregnancy was-22, and the rest in the anamnesis had 2–4 births. Twenty-five re-pregnant patients reported a history of IUT in different gestation periods, these were episodes of cystitis, pyelonephritis, and in 17 they were complicated by a febrile condition, with a threatened interruption clinic, and after 30 weeks with an increase in blood pressure to 150/100 mm Hg., In connection with which in 11 pregnant women, the delivery was accelerated prematurely. In the postpartum period, out of 25 women, a picture of the systemic inflammatory response syndrome (SIRS) was diagnosed in 7 puerperas, caused by infection of the urinary tract and exacerbation of chronic endometritis.

On admission, data from a general blood test: leukocytes averaged 11.9×10^{12}, erythrocyte sedimentation rate 30.7 mm/h, creatinine 122 μmol/L, and urea 8.3 μmol/L, respectively. The general analysis of urine: a leukocyturia (on the average 19–21 in p.), Bacteriuria was revealed in all analyzes.

Microbiological examination of urine revealed E. coli (69%), klebsiella (19%) of staphylococcus (18%), proteus (7%), and streptococci (13%). Microbial associations were noted in 33%, which coincided with literature data, where acute uncomplicated bacterial cystitis in 80% of cases is caused by E.coli and in 15% by other pathogens: St. Saprophyticus, Klebsiella spp, Proteus spp. [1; 4; 5].

For the treatment of IUT in pregnant women, antibiotics were mandatory given the absence of teratogenic effects. These were preparations of phosphomycin trimethomol (trade name Urfocin). The appointment of an acceptable and safe dose of antibiotic, taking into account the possibility of use during pregnancy, was of no small importance. Taking into account these facts, we appointed Urfocin («Asfarma», Turkey) depending on the severity of the pathological process orally 3g once., With the rise of temperature 38 and higher, 1–3-generation cephalosporins in therapeutic doses.

With recurrent cystitis Urfocin was administered again 3g, 7–10 days later.

In addition to antibacterial preparations, phytopreparation, which have a mild antimicrobial and diuretic action, which were of no small importance in the eradication of the pathogen in IUT.

Wild carrot, which is part of the phytopreparation having a pronounced reparative and litholytic activity, promotes improvement of renal blood flow, restores its acid-base balance. Therefore, the course of therapy with phytopreparation, we counted on a long daily reception, in courses of 3–4 weeks with a weekly break.

Urfocin is easily absorbed and quickly reaches the urinary tract and kidneys with blood, effectively removes attacks of renal colic, causing hyperemia (plethora), thereby improving their blood supply, thereby enhancing urinary excretion [3; 4]. The experience of using Urfocin in large scientific and clinical institutions, in the countries of the commonwealth and at the Department of Urology Tashkent Institute of improvement of doctors in pregnant women with renal pathology showed high efficacy of the drug in kidney diseases, as well as an undoubted therapeutic and preventive effect in the development of hypertension in patients of the study groups [2; 3; 4].

Pregnant with IUT and obstetric complications (threat interrupt or hypertension) were treated in a hospital, and the rest were treated in the clinic antibacterial and fitopreparation to 3 days.

Results of the study: After 48–72 hours, the laboratory parameters were analyzed: where the leukocytosis decreased to 7.9×10^{12}, while in healthy individuals this index was 7.2×10^{12}, the ESR decreased by 9.5 mm/hour (in healthy subjects it was 19.7 mm/hour), urea and creatinine level was closer to the lower limit of normal and the number of leukocytes in urine assays exceed 3–4 In the field of vision and in 43 samples of bacteria have been identified.

These changes clinic in the direction of improvement suggests Urfocin multilateral action both urinary as well as the activities of other organs and system, that in common with those of other authors [3; 4].

Further observations of the pregnant women gave the following results: relapse of the IUT was again detected in 37–45 days only in 6 pregnant women, who indicated that the phytopreparation was not taken regularly. With the threat of abortion, only 5 women were re-admitted, which was caused not by infection, but by stress and physical stress. Births in 43 pregnant women occurred in terms of 38–42 weeks, without infectious complications. In 4 parturient women, the birth was complicated by a premature discharge of amniotic fluid, the cause of which was inadequate induction of labor, the 3-period in 1 woman was complicated by uterine hypotonia, which resulted in a radical operation.

The course of the postpartum period in 2 puerperas out of 47 was complicated by cystitis, which was stopped by the appointment of phosphomycin trimetamol with phytopreparation.

In conclusion, I would like to note that the timely and comprehensive treatment of IUT in the early stages of its development in pregnant women with a short course of antibacterial therapy, new helps reduce not only the inflammatory processes of the urinary, but also obstetric, such as the threat of abortion and premature birth, The cause of which is infection, thereby in childbirth and the postpartum period leads to a reduction in the incidence of infectious complications to 87.3%, which coincide with the data of foreign studies [6; 7]. This preventive approach, where antibacterial therapy is carried out with long-term support of phytopreparations, reduces the infectious and inflammatory diseases of the urinary tract, suppressing the development of purulent-septic conditions in childbirth and in the postpartum period, and improves maternal and perinatal morbidity and infant mortality.

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CHARACTERIZATION OF CORRELATION RELATIONSHIPS BETWEEN AGGREGATION ACTIVITY OF PLATELETS AND STRUCTURAL COMPONENTS OF PLATELET MEMBRANES IN PATIENTS WITH CORONARY HEART DISEASE

Abstract: It has been established that changes in the functional activity of platelets in angina pectoris are due not only to the general content, but also to the violation of the interlayer content of phospholipids. Correlation analysis also reveals the relationship of AAT to the metabolism of cholesterol in the platelet membrane. An increase in AAT correlates with both an increase in OXC and a violation of the ratio of metabolites of cholesterol. The increase in AAT is associated with an increase in CXS and a decrease in ECS.

Keywords: angina pectoris, phospholipid, platelet membranes, coronary heart disease.

Actuality: Cardiovascular diseases on the basis of atherosclerosis, first of all, coronary heart disease (CHD) remain one of the main health problems of industrially developed countries. It is important to identify the leading pathogenetic link, which becomes decisive for pharmacological correction. This link recognizes the violation of lipid metabolism with the formation of dyslipoproteinemia (DLP) [1; 2]. Lipid metabolism functions in the inseparable unity of plasma lipids and cell membranes. Among the theories and hypotheses of atherosclerosis, the membrane membrane is formulated, formulated on the basis of the condensing effect of cholesterol on the phospholipid bilayer. It is assumed that similar changes exist in the membranes of smooth muscle cells of the vascular wall, as the first of the biochemical processes for cell proliferation [4]. Cell membranes, accumulating cholesterol, go to the state of "cholesterol"; Atherosclerosis is considered as a complicated cholesterosis [3].

Phospholipids affect the allosteric and catabolic centers of membrane enzymes [5; 7] and play a role in the development of complications of atherosclerosis along with cholesterol [10]. Numerous results of studies on the violation of the structural and functional organization of cell membranes in atherogenesis dictate the need to study the lipid constituents of membranes during lipid-regulating therapy. However, the evaluation of the membrane link of lipid metabolism is not taken into account.

In this connection, the aim of the study was to study the functional activity of platelets in various forms of angina with the position of membranology on the model of thrombocytes. The platelet membrane is chosen as a prognostic marker — a classical object of membrane science, which characterizes the plastic function at the level of any cytoplasmic membrane. It is known that intravascular thrombus formation and spasm of coronary vessels are important pathogenetic mechanisms of angina pectoris, in the development of which a great importance is given to the thrombocyte-vascular unit of hemostasis and, especially, the aggregation activity of thrombocytes.

Material and methods of investigation. A clinical and functional analysis of the condition of 59 patients with IHD with stable angina pectoris of II–III functional classes (FC) and 65 patients with unstable angina was performed. The age of patients is 38 to 76 years. The criteria for diagnosing IHD were based on WHO criteria.

Criteria for excluding patients from the study:

– acute coronary syndrome at the time of the beginning of the study;

– Acute liver disease, stove, decompensated diabetes mellitus.

Groups of patients, depending on age, were divided into 2 groups; Patients under 60 years and after 60 years. The control group consisted of 25 practically healthy persons aged 25–48 years. All patients underwent conventional methods of clinical investigation. All patients received consent to participate in this study. All subjects received venous blood in the morning on an empty stomach after 12 hours of fasting. The blood was stabilized by EDTA (1 mg/ml). Membranes of platelets were used to study lipid metabolism. Thin layer chromatography yielded free cholesterol (CX), cholesterol esters (ECS), total phospholipids (OPL). Phospholipid fractions were: lysophosphatidylcholine (LFH), sphingomyelin (SM), phosphatidylcholine (PX), phosphatidylserine (PS), and phosphatidylethanolamine (PEA). Aggregation activity of thrombocytes was studied by the Born method.

Results of the study

As can be seen from the presented data, patients with angina pectoris are characterized by an increase in the functional activity of thrombocytes. The severity of this activation is determined by the clinical forms of the disease. If the increase in AAT in patients with stable angina was 68% ($p < 0.01$), then in the group of patients with unstable angina, 82% ($p < 0.001$) in relation to the healthy group. Unstable angina was characterized by more pronounced activation of platelet hemostasis (by 8% more).
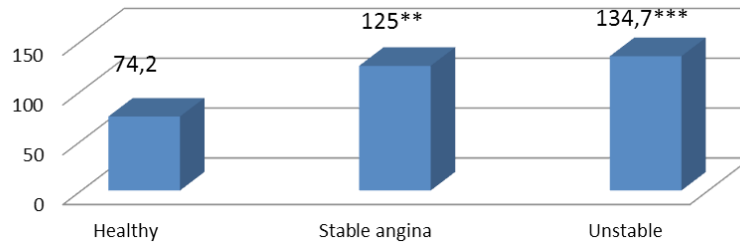
Figire 1. Aggregation activity of thrombocytes (AAT %) in patients with angina pectoris

*Note: ** p < 0.01; *** p < 0.001 Reliability of differences in relation to a healthy group*

Table 1. Characteristic of correlation relationships between AAT and structural components of platelet membranes in patients with stable angina pectoris

Analyzed indicators	The statistical value of the correlation
AAT-General phospholipids	
LFCH	R = + 0,3861 p < 0,02
PS	R = + 0,4255 p < 0,01
SM	–
PCH	R = – 0,3564 p < 0,01
PEA	R = + 0,3982 p < 0,05
Outer layer	
LFCH	R = + 0,4926 p < 0,05
PS	R = + 0,4618 p < 0,01
SM	R = – 0,3347 p < 0,02
PCH	–
PEA	R = + 0,3283 p < 0,05
Inner layer	
LFCH	–
PS	R = – 0,3783 p < 0,01
SM	R = – 0,4135 p < 0,01
PCH	R = + 0,3677 p < 0,02
PEA	-
AAT-CCH	R = + 0,4832 p < 0,05
SCHS	R = + 0,3591 p < 0,05
ECHS	R = – 0,3728 p < 0,02

As can be seen from the data given, there is a definite relationship between the analyzed parameters in patients with angina pectoris. The relationship between the nature of the correlation relationship and the clinical forms of the disease is revealed. At the same time, if in patients with stable angina correlation in 77.8% of cases, in patients with unstable angina this indicator is 88.9%. Stable and unstable angina also differ in the correlation force between the analyzed parameters. The severe form of the disease is more closely connected. The increase in AAT is associated with an increase in the total content of LFH, PS and PEA, and a decrease in PX. Analysis of the correlation of AAT with different phospholipid fractions reveals more intimate mechanisms of AAT increase. Moreover, as the results of the analysis show, an increase in the functional activity of platelets is associated with the accumulation of LFX, PS and PEA in the outer layer, and a decrease in

the CM content, as well as the accumulation in the inner layer of PC and the decrease in the content of PS and SM. In contrast to stable angina in unstable angina, AAT is also associated with a decrease in the content of PX in the outer layer and in the LFH in the inner layer.

Table 2. Characteristic of correlation relationships between AAT and structural components of platelet membranes in patients with unstable angina pectoris

Analyzed indicators	The statistical value of the correlation
AAT-General phospholipids	
LFCH	R = + 0,4589 p < 0,02
PS	R = + 0,4056 p < 0,01
SM	–
PCH	R = – 0,5273 p < 0,05
PEA	R = + 0,3983 p < 0,05
Outer layer	
LFCH	R = + 0,5694 p < 0,05
PS	R = + 0,5972 p < 0,02
SM	R = – 0,3885 p < 0,05
PCH	R = – 0,4267 p < 0,02
PEA	R = + 0,4964 p < 0,01
Inner layer	
LFCH	R = – 0,4689 p < 0,01
PS	R = – 0,5437 p < 0,01
SM	R = + 0,3841 p < 0,05
PCH	R = + 0,4583 p < 0,02
PEA	–
AAT-CCH	R = + 0,5972 p < 0,01
SCHS	R = + 0,5469 p < 0,05
ECHS	R = – 0,5623 p < 0,01

Thus, AAT is bound and veil from the nature of lipid metabolism in the platelet membrane.

Conclusions

1. It has been established that changes in the functional activity of platelets in angina pectoris are due not only to the general content, but also to the violation of the interlayer content of phospholipids.

2. Correlation analysis also reveals the relationship of AAT to the metabolism of cholesterol in the platelet membrane.

3. An increase in AAT correlates with both an increase in OXC and a violation of the ratio of metabolites of cholesterol. The increase in AAT is associated with an increase in CXS and a decrease in ECS.

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THE CLASSIC HEPATIC LOBULE IS IN THREE DIMENSIONS: ORGANIZATION, CYTOACRCHITECTURE AND HEMOCIRCULATORY MAINSTREAM OF SIMPLE HEPATIC LOBULE FOR RAT AND HUMAN

Abstract: It was determined, that simple classic hepatic lobule has polyedric shape, on it's lateral surface the inter lobular vein passes, that gives short branches inside lobule, being branched into 2–3 sinusoid hemocapillaries, those fan-shapely or radially direct to central vein, being revealed only in middle part of lobule. The blood outflow is carried out through intercalary vein, being connected out of the lobule with sublobular vein.

The aim of study. Clarification peculiarities of microcirculatory bed for hepatic lobule at biliary obstruction and recanalization of bile.

Material and methods. Experimental model of mechanical jaundice (white rats n = 54) was reprotuced in 3 series. The restoration processes were observed in the10th, 20th and 25th days of cholestasis in the terms of 5,15 and 30,90 days after secondary operation. The parts of hepatic tissue, and, also, histological preparations with filling vessels were processed by general morphological methods of study.

Results: At development of restorative processes after cholestasis in 20 days it was clearly separated classic hepatic lobule. It was determined the ordinary hepatic lobule has polyedric shape, the interlobular vein passes on it's lateral surface, from that the short branches inside of lobule, and, they are, at once, fall to sinusoid capillaries. Sinusoid hemocapillaries have fan shaped direction in upper part of lobule, in middle and lower third part they are radial, being flow into central vein. The central vein is revealed in the middle third of lobule, then it, bending, goes out from the lobule and connects wit sublobular vein

Keywords: classic hepatic lobule, hemocirculatory bed, interconnection of interlobular vein, sinusoids and central vein.

Introduction

Last years the considerable progress was reached in study structural organization of liver, it's components construction peculiarities were specified. Together with classic hexagonal hepatic lobule in the liver the simple and complicated complexes, acinar and portal lobules such as structural and functional units of organ [2; 5; 6; 7; 8; 11].In hemocirculatory mainstream of liver the systems of inflow, circulation and outflow are also separated. But, so far, the notions on architecture hemocirculatory mainstream of classic hepatic lobule for man, rat and some other mammals are not concretized. In general they are based on summarization a wide variety of opinions on hepatic lobule, or, they are made up on computer graphics, that is caused to a certain extent, due to the complexity of its perfect identify.

Obviously, in this regard, there is no clear understanding on characteristics of transition interlobular, vessels to interlobular, on topography of central vein with sublobular vein.

In connection with it, the results of study cytoarchitecture and hemocirculatory mainstream of classic hepatic lobule during recanalization of experimental cholestasis in different periods, were summarized.

Materials and methods.

Experimental model of mechanical jaundice was reproduced on 54 rats weighting from 140 to 160 by ligation of general bile duct and its transection between two ligatures.To monitor the dynamics of morphological changes for the rats (n-24) with bile ducts, they were killed interims of 5,10,20 and 30 days of cholestasis. The remaining (n-30) were restored the bile flow after 10 and 20 days of cholestasis. At these terms the duct stump was large and had transparent bile. Choledochoduodenoanastomosis was created with attaching the enlarged duct to duodenum's wall. To restore the biliary outflow to the intestine the puncture of bile duct through the duodenal wall was performed, and, the place of puncture on external wall of duodenum was sutured with a traumatic needs. The bile outfow restoration in intestines was monitored by the general condition of animals icteric staining of urine and bilirubin level in blood serum.

The dynamics of recovery process was controlled with two series of experiments in terms from 15 to 30 days after choledochoduodenoastomosis application.

The hepatic tissue parts from cycle and experimental animals were fixed in Carnya, OFS mixture, and, they were covered with paraffin, the sections were colored by Mallory, Gomory with hematoxylin-eosine. The microcirculatory mainstream was researched with drugs after filling in the hepatic vessels with Gerot Akilov's mass [4].

Results of study. The morphological researches determined that deformity of hepatic lobule was already worked at 10th day of cholestasis, when multiple proliferating bile ducts, sometimes being wedged in lobule's, at lobule's periphery. But the structure of hepatic plates, topography of central vein have no essential changes. While progressing mechanical jaundice (20 days) the proliferating bile ducts are wedged in lobules, fragmenting them into separate parts. In connection with it hemocirculatory mainstream of lobule is reconstructed, and, at the result the central veins are replaced to the periphery, and, the lobules disappear. Therefore, at this stage of reconstruction the hepatic lobules are represented as deeply dissected growing bile ducts and connective tissue.

Study liver structure after recanalization of 10 daily cholestasis, showed full recovery of livers architecture by the 15th day of postoperative period. The reversibility of pathological processes at cholestasis with duration 20 days occur more slowly, and it is connected with preservation fibrotic tissue in interlobular parts of liver parenchyma. The connective tissue elements disappear in the lobules firstly, they become gradually thinner, and, they are partially absorbed at interlobular areas. On the 15th day at 20 daily cholestasis the interlobular structures are fully restored, the hepatic plates are oriented radially, the lumen of sinusoids is moderately enlarged and contains a few elements of blood. But at that period duct to presentation of fibrous septa in interlobular areas the classic hepatic lobule is clearly detached and contoured that creates ideal conditions for it's study. Thanks that on preparation being colored by Mallory or at filling vessels the transverse, oblique ort longitudinal lobule's section is easily distinguished. On these preparations the lobules are limited with thin stripe of sclerotic tissue or avascular areas, surrounding them from all sides. In connection with it the main morph functional analysis of hepatic lobule was performed on the material of 20 daily cholestasis. Except fibrous layers with additional criteria of identification for hepatic lobules their volume, trias localization sinusoidal orientation, topography of central vein, thanks that the plane of section is easily determined.

On transverse section the hepatic lobule has expressed penta- or hexagonal shape, it's angels, because of portal structures (artery, vein, bile duct and lymphatic vessel) are slightly rounded and there is central vein in the center of lobule, where the hepatic plates and sinusoidal capillaries are converged. The level of section is determined by the volume and diameter of central vein (pict. 1a).The narrow lumen of central vein indicates the initial portion of the lobule.
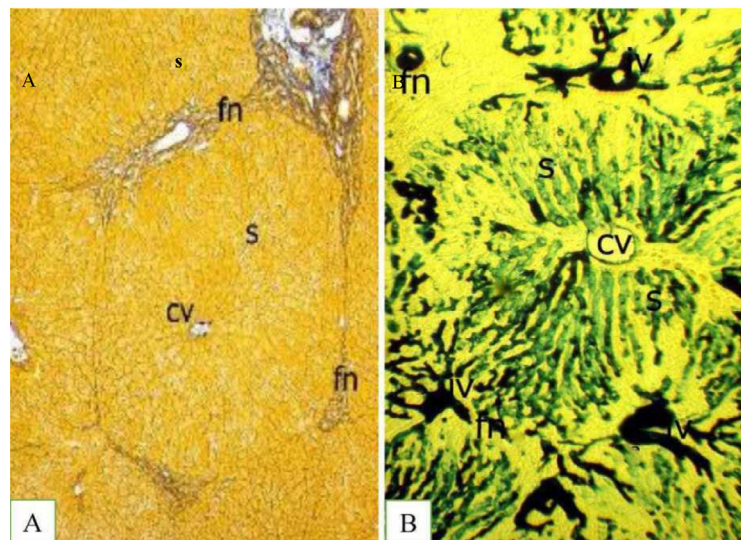
Picture 1.Cytoarchitectonics and hemocirculatory bed of classic hepatic lobule; A is transverse section of upper lobular part: the pentagonal shape of lobule. Staining by Mallory ob. 10. st. 10; B is transverse section of lobular middle third. Filling in vessels with Paris blue. Incr. Vol. 10, stain. 10

Designation here and there:
– sv — sublobular vein, fn – fibrous net, s – sinusoid, iv – interlobular vein, cv – central vein, int v – intercalary vein, bd – biliary ducts, ia – interlobular artery, bc- bile;
– canaliculy, sv – septal vein.

At picture 1b (middle level of section) after filling vessels in lobule the multiple radially directed sinusoids, connecting with central vein, are seen. In the corners of lobule the interlobular veins with contrast content, giving short vessels (according to septal branches) are revealed the side of interlobular capillaries. At oblique section the lobule is characterized with conical shape and clear bordered wide flat fibrous tissue, and, in center of lobule the narrow section of central vein are revealed, and, in lover part of lobule it is clearly passed in transverse cutting inserting vein with round contours. In pictures 1c and 1d the cytoarchitecture and hemocirculatory mainstream of hepatic lobule are observed, they are full of contrast substance, and, they are revealed in the area of lobule's angles. More over in the upper part of the lobule the sinusoid capillaries have fan-shaped location, and, in middle

and lower parts they are radial. At successful parallel incision of inter-lobular and central vein it is clearly seen their interconnection. As it is seen on picture 3 the interlobular vein is on lateral surface of two closely located lobules, from that the short processes are branched.
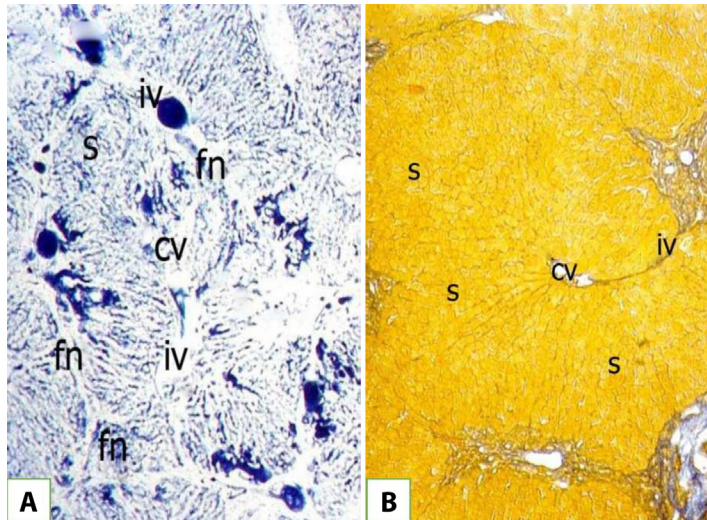
Picture 2.Interconnection of sinusoid capillaries, central vein and insert vein in lobule. A – is longitudinal section of hepatic lobule.In upper lobular part the sinusoid are orientated fan-shaped, in other part they are radially, and, all they flow in central vein, in low lobular third it passes to insert vein. Filling in vessels with Paris blue. Vol. 10. St. 10; B – is oblique section of lobule. Topography of lobular cytoarchitectonics and hepatic plates according to central vein. The part of going out insert vein from lobule and its connection with sublobular vein. Staining by Mallory, Vol. 10. St. 10

These subsequently located short processes at once are divided into 2–3 identical by the diameter sinusoid hemocapillaries. Inside lobule the sinusoid capillaries interlacing with each other ruch on the side of central vein and join it. It should be marked that at the same picture the central vein, not reaching the lower lobule's border, bends it, and, goes out from it, the fragment of this vessel, and, it is found out on the lobule's periphery. It is important to underline that in literature there is absent clear imaginations on interrelations of sinusoid capillaries with central vein in different parts of lobules, and, also peculiarities of crossing parts for central vein to sublobular vein. In connection with it we analyzed serial incisions of hepatic lobules, after filling vessels beginning from upper boundary surface and finishing the lower one. In given study, except the above mentioned lobule's orientations, we took into account the appearance longitudinal incision of central vein to it's crossing to fixed vein, being connected with sublobular vein. Construction of part serial incisions, including longitudinal section, central vein and it's connection with sublobular vein are presented on picture 4.
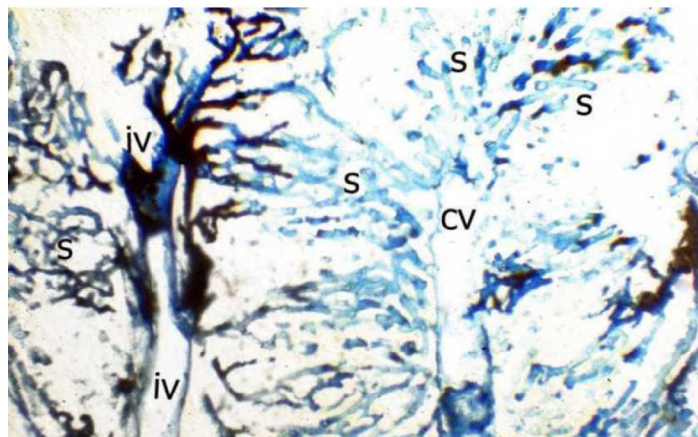
Picture 3. Hemocirculatory bed and cytoarchitectonics of hepatic lobule

At very surface incision, bouldering with the above laying lobule, the sinusoids located without order, and, on periphery the lobules in some parts occur being filled with contrast substance the interlobular veins from those inside the short processes are branched. On the next sections the sinusoids acquire radial orientation, the oblique cut lower and upper fragments of central vein, locating in accordingly parts of lobules (pic 4 b), occur. In upper thirds of lobules the fan-shaped location of sinusoid capillaries in relation to central vein, are marked. In difference from interlobular veins the lumen of central vein is empty, and, in beginning part it has the least diameter. By the measure of approaching to lower part of lobule the lumen of central vein is gradually enlarged. Therefore, the clearly

making out lumen of central vein appear not on the apex, but at the level of middle third part of the lobule.Just at this space here only radial directing sinusoid capillaries flow in. Further the central vein no reaching the lower part of lobule perimeter, curves and directs to the side of interlobular tissue (pic 4d). In this space, including the part of flexion, many sinusoid capillaries, locating both laterally and lower from it (pic. 4 e) entering the central vein passes to insert vein, that curving is directed transversely to periphery of the lobule, is connected with sublobular vein. (pic. 4 f). Moreover, on the last picture it is well differed vein of longitudinal section for central vein

of neighbor lobule, where the sinusoid capillaries are orientated, that are also coming from the interlobular vein. At the lowest sections the orientation of hemocapillaries again disorder, the lobule decreases in volume and gradually passes the next lobule.

On the 30th day of restoration after 20th day of cholestasis the interlobular connective tissue becomes considerably thin, and, only in separate parts of parenchyma the fibrous septa are saved, and, in the others the interlobular connective tissue fully disappeared, because of that the lobular borders are flowed in. Such picture is followed on preparations with vessel's filling.
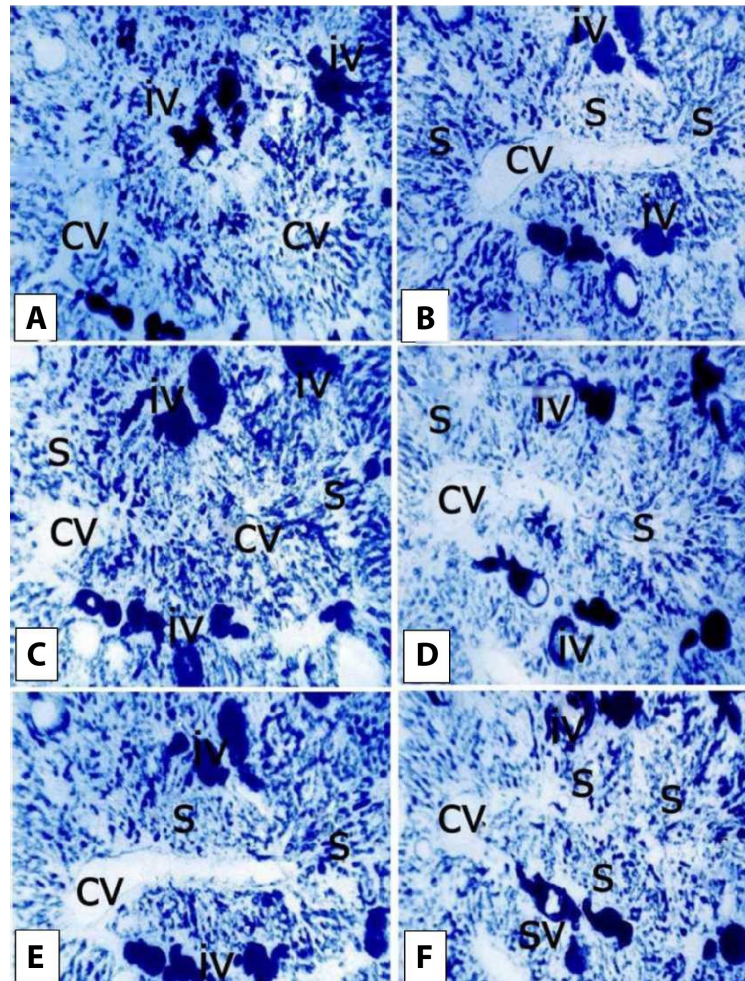
Picture 4. Construction of serial sections longitudinal section of hepatic lobule.
Vol. 7. st. 10. Filling in vessels with Paris'blue.Explanation is in text

At liver's examination of patients with gallstone diseases, being complicated with obturational jaundice, we determined, that in some cases the hepatic lobule was contoured well, though fibrous septa are not developed well (pic. 5 a, b).Comparative study cytoarchitectonics of human hepatic lobule show, that it has the same volume and prolonged shape, and, it is a little differ from the lobule of experimental animals.In picture 2 c the oblique longitudinal section of hepatic human lobule, where the liver plates and sinusoids are located in disorder, obviously, the section was not passed on central vein's level. On another oblique longitudinal section of lobule (pic. 2 g) the lobule has cone-shaped with eccentric dislocation of

large vessel obviously mathing to insert vein, having the same passage as experienced animals.

Our morphometric studies showed, that, like prism, the hepatic lobule has several dimensions. On transverse section the diameter of lobule is 0,65 ± 0,03 mm, the lest one is 0,4 ± 0,01.On the longitudinal section the length of lobule is 1,1 ± 0,1 mm the width is 0,45 ± 0,02 mm.Contours of pentagonal lobule are more clearly divided at staining by Gomory. On the 30th day after restore the flow out of bile, only in interlobular parts the argyrofile frame stays thickened and hyperplased especially around bile ducts, where the fibers form small looped net. Inside lobules the reticulin fibers braid hepatic plates,

being located on the way of sinusoid liver capillaries. From the one side they are connected with wall of central vein from the other side with argyrofile frame of portal tracts, thus forming united integral frame of hepatic lobule.
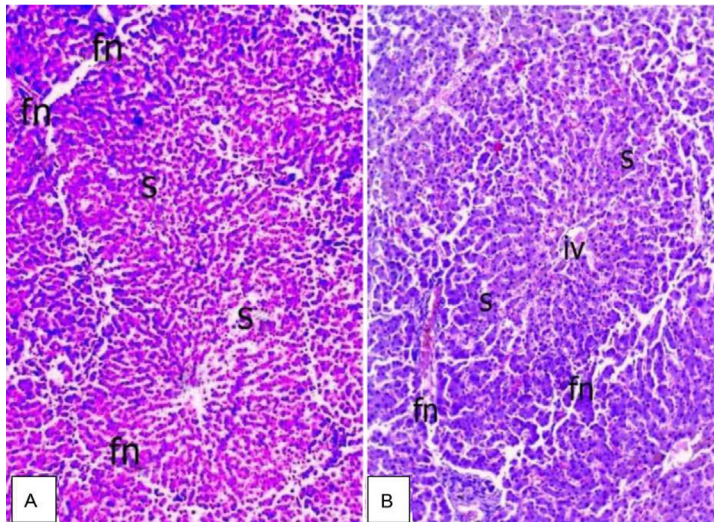

Picture 5. Interconnection of sinusoid capillaries, central vein and insert vein in lobule

A is liver of patient with gall-stone disease, being complicated with obturational jaundice. The contours of hepatic lobule (longitudinal section, there is central vein in lower part)are well marked out. Staining with hematoxilineosin. Vol.10St.10 B is the same case, oblique section of lobular lower part. Excentrically located insert vein. The same staining. Vol. 10 St. 10.

Directing in transverse and vertical planes, they do not only keep hepatic planes in strict definite position, but also prevent from constriction or collapsed walls of blood capillaries, and, by that, it provides free blood flow in sinusoids, promoting favourable exchange between blood and hepatic cells.

Discussion

The results of taken researches show, that in early terms of cholestasis, when per lobular fibrosis is developed in liver, after recanalization, by 15 days the branched interlobular connective tissue is fully disappeared, and, also the parenchymatous elements are restored. In the cases of long cholestasis (20 days) in connection with considerable disorganization both stromal and parenchymatous elements, restoration processes are considerably become slow, and, they are depend on changes level of hemocirculatory source, especially central vein. In cases of keeping central vein, though eccentrically, the cytoarchitectonics of hepatic plates and sinusoid capillaries, the interlobular fibrous septa are still kept long, due to that, the hepatic lobule is well shaped.
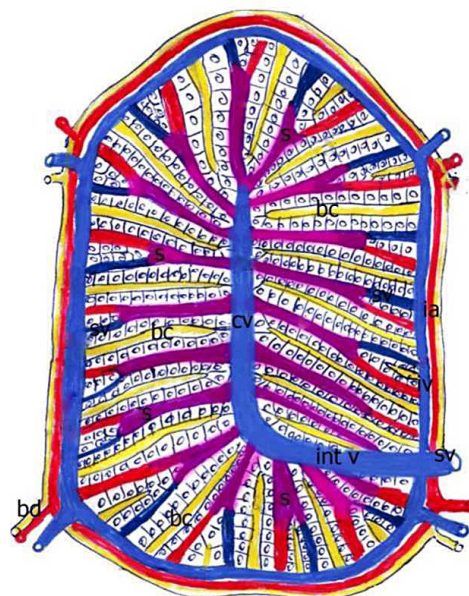
Picture 6.Simplified scheme of structural organization cytoarchitectonics and hemocirculatory bed of simple classic hepatic lobule

Our taken data on quantitative parameters of topography vascular system, morphology transverse and longitudinal sections allow to consider that hepatic lobule has the kind of many-sided prism, being enlarged in its low part. The diameter of this prism is from 0,36 to 0,4 mm, and, from 0,5 to 0,6 mm accordingly, on the apex and base, the length is from 1,0 to 1,1 mm. The comparative study volume, shape, cytoarchitectonics and hemocirculatory source, and, also parameters of classic hepatic lobule of rat and man were the same, and, they were coincided with the data of other researches [1; 3; 9].

At analysis of serial sections of liver it was determined that central vein is clearly revealed only in its middle third, and, then it is going down, and, not approaching to lower border, bending, passes into insert vein. The last is connected with sublobular vein, being located out of hepatic lobule. On the base of morphometric and demonstrative photos on cytoarchitechtonics and hemocirculatory source of lobule we work out the scheme, reflecting topography of its structural elements.The given scheme of longitudinal section for classic hepatic lobule is the most fully reflected not only it's shape, volume, buff and localization of original interconnections of hemocirculatory (pict. 5).Thus, the established spatial model of classic hepatic lobule, apparently, the most exactly correspond to true architectonics oh hepatic lobule in situ. Moreover many parameters of hepatic lobule of rat were close the same at human.

Conclusions.

1. The classic hepatic lobule of rat and human by shape, volume, cytoarchitectonics and hemocirculatory bed occur the same, and, in transverse section it has pentagonal shape, and, in longitudinal section it reminds polyhedral prism, and there axially passes the central vein, has pentagonal prism, and, there axially passes the central vein, where the sinusoid hemocapillaries converge.

2. Morphological studies of hemocirculatory bed of hepatic lobule show, that interlobular vein is located on its lateral surface and participated in formation the triad of liver together with biliary duct and arteries. From interlobular vein successively branch off the short processes, apparently, in accordance with septal veins those are just branched into 2–3 sinusoid hemocapillaries.

3. Sinusoid hemocapillaries in upper part of lobule topographically have fan-shaped, in middle and lower third the radial directions, and, in the center the lobules are flown in central vein.

4. In classic hepatic lobule the central vein topographically is revealed only in its middle third on the level of low third, deviating passes to insert vein, and, it is connected with sublobular vein at interlobular parts.

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INTERRELATIONSHIP BETWEEN LIFE QUALITY AND VEGETATIVE NERVOUS SYSTEM IN PATIENTS WITH ASTHMA

Abstract: The purpose of this work was to study interrelation shipbet ween quality of life parameters and vegetative nervous system in patients with bronchial asthma (BA). In the pulmonological department 62 patients with asthma were studied. The Quality life was assessed by Seattle Questionnaire. In the patients with asthma there was noted tension and damage of adaptation-compensatory body capacity and reductionof the life quality parameters. In thepatients with asthma defined relationship is more pronounced reduction in QoL physical and emotional state of hypersympathicotonic and vagotonics. The expansion of rehabilitation measures aimed at restoring the adaptive-compensatory abilities of the body, can help to restore and improve the quality of life of patients with asthma.

Keywords: bronchial asthma, vegetative nervous system, quality of life.

Bronchial asthma (BA), is not only medical, social and economic, but also the general humanitarian problem [3].

Clinician's interest is increased in study of the functional state of the vegetative nervous system (VNS) currently. VNS mediates its effect on the functional state of the bronchial tubes through the sympathetic and parasympathetic regulation mechanisms. Influences are transmitted via vagus, causing contraction of bronchial smooth muscle, through the pulmonary sympathetic plexus — adrenergic effects, relaxing smooth muscle [2].

Assessment of quality of life (QL) of a person takes the major place in the clinical and socio-medical researches, assessment the degree of comfort within themselves and within their society. QL related to health, — a set of parameters describing the various aspects of human functioning: physical and psychological state, social relations, the functionality of the period of his illness [1; 8; 9].

Found that in AD is a significant decline in the quality of life of patients [4; 5; 6; 7]. Interconnection between subjective feelings of the patient and objective parameters that characterize the vegetative-nervous system has not been studied.

The aim of this work is researching the interconnection of parameters of quality of life and the vegetativenervous system in patients with asthma.

Materials and methods:

Clinical and functional studies of 62 patients with asthma on the basis of Pulmonology Institute of TB and Pulmonologist Ministry of Health of Uzbekistan Republic were conducted. Quality of life was determined by the Seattle questionnaire comprising 29 questions that assess physical condition, emotional state, the state of professional competence and satisfaction with treatment.

State of the vegetativenervous system was assessed by Cardio-intergraphic (CIG) on Bayes (1976). The obtained data were processed statistically using Student's t test.

Results and discussion.

According to the study the initial vegetativetonus that characterizes the adaptive ability of the organism to the disease, in patients with asthma noted that only 30% remains adaptability, manifested Ayton (ET), at 20,9% shows the state sympathic (ST), which determines the voltage adaptation possibilities, at 45,3% — hypersympathicotonia (HST) and 4,8% — vagotonia (VT), reflecting the failure of the state of adaptation options.

Comparing the state of autonomic tone with the original parameters QL of patients with asthma found that the stress and frustration of adaptive capacity had significantly marked reduction of QL parameters for the physical and emotional state (table 1). Specifications QL in patients with asthma with various conditions vegetative tonus (in basis points).

The parameters of the physical condition of patients with asthma hypersympathicotonic were reduced — by 23%, and in patients with asthma vagotony — by 31% compared to tonicity and respectively — 54% and 59% of the maximum possible points. Parameters of the emotional state of patients with asthma sympathicotonic reduced — by 26,4%, from hypersympathicotonic — by 32,3% and vagotony — by 43,8%, compared with patients with asthma and tonicity — by 57,7%, 61,1% and 67,7% of the maximum possible points. QL parameters fit and satisfaction with treatment in patients with asthma have been reduced to 55,8% and 50% respectively of the maximum possible values. However, without a significant decrease in these parameters depending on the initial vegetativetone.

Table 1.

Pairmetres	Max. possible	ET (n = 18)	ST (n = 13)	HST (n = 28)	VT (n = 3)	P		
						1–2	1–3	1–4
Physical condition	5,2	3,09 ± 0,20	2,18 ± 0,24	2,38 ± 0,09	2,14 ± 0,21	< 0,01	< 0,001	< 0,001
Emotionalcondition	7,0	4,02 ± 0,37	2,96 ± 0,36	2,72 ± 0,20	2,26 ± 0,14	< 0,05	< 0,001	< 0,001
Professionalfitness	7,0	4,09 ± 0,32	3,32 ± 0,44	3,09 ± 0,19	3,91 ± 0,25	> 0,5	< 0,01	> 0,5
Complacencybytreatment	5,0	2,58 ± 0,19	2,69 ± 0,12	2,55 ± 0,09	2,5 ± 0,10	> 0,5	> 0,5	> 0,5

The study of the compensatory capacity of the organism of patients with asthma, estimated by vegetativereactivity, showed that only 30.6% of patients with asthma recorded normal vegetativereactivity (NVR), reflecting preservation of compensatory abilities, in 54.8% of patients — hypersympathicotonicvegetativereactivity (HSR) reflecting voltage compensation abilities and 14,6% — asympathicotonic autonomic reactivity (ASVR) — failure mechanisms of compensation.

Comparing the form of the vegetativereactivity of patients with asthma with the parameters of quality of life was observed a significant reduction of the maximum possible values (table 2).

Specifications the patients QL with various conditions of asthma autonomic reactivity (in basis points).

Patients with asthma with normal vegetativereactivity parameter QL physical condition reduced — by 53,5% of the maximum possible, on the emotional — by 57,7%, as a professional fitness — by 54%, and treatment satisfaction — by 50,6% of the maximum possible score. Among patients with asthma and SSR ASVR quality of life parameters were also significantly reduced. However, we have not established communication with derating QL compensatory abilities of the body.

Table 2.

Pairmetres	Max. possible	NVR (n = 16)	HSR (n = 34)	ASVR (n = 7)	P	
Physical condition	5,2	2,42 ± 0,20	2,66 ± 0,11	2,30 ± 0,22	>0,5	>0,5
Emotionalcondition	7,0	2,96 ± 0,32	3,21 ± 0,20	3,08 ± 0,45	>0,5	>0,5
Professionalfitness	7,0	3,22 ± 0,26	3,61 ± 0,19	3,53 ± 0,42	<0,2	>0,5
Complacencybytreatment	5,0	2,47 ± 0,09	2,60 ± 0,12	2,77 ± 0,17	>0,5	<0,2

Conclusions

1. Patients with asthma often marked stress and disruption of adaptive-compensatory abilities of the body and reduced quality of life parameters. Patients with asthma defined relationship is more pronounced reduction in QL parameters in physical and emotional state of hypersympathicotonic and vagotonys.

2. Reducing of QL parameters in patients with asthma is not established due of reducing these parameters on the state of the vegetativereactivity

3. The expansion of rehabilitation measures aimed at restoring the adaptive-compensatory abilities of the body, can help to restore and improve the quality of life of patients with asthma.

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THE STATE OF HUMORAL MECHANISMS OF THE IMMUNE SYSTEM IN HEROIN ADDICTS

Abstract: The article is devoted to the study of humoral mechanisms of immunity in heroin addiction. It was revealed that the disorganization of immune systems, which are in close relationship with the central nervous system, lead to disruption of homeostasis and aggravate the course of drug abuse.

Keywords: heroin addiction, withdrawal syndrome, activated neutrophils, myeloperoxidase.

In recent years, many investigations indicating immunological failure in drug addicts and the increased interest to study the influence of drugs on the immune system of people [1, 50–52; 3, 3–5]. It is known that among patients with drug abuse infectious and inflammatory diseases are spread much more often than in healthy people [5, 191–193; 6, 198–200]. In this regard, of considerable interest is the study of the immune system of these patients. The results of a clinical assessment of the functional state of the individual components of nonspecific resistance in drug addicts remain to be elucidated [2, 23; 4, 120–122].

The aim of the study was to investigate immunological features of patients with heroin addiction.

Material and methods: 57 heroin addicts. Of these 34 patients aged 19–20 years, 11 patients aged 10–22 years, 8 patients — 23–25 years; 43 male, 14 female employees. All patients for the duration of the use of opium preparations were divided into 2 groups. Duration of drug abuse in group 1 ranged from 4 months to 5 years (31 patients). In the 2nd group duration of drug addiction was more than 5 years (26 patients). All patients were formed on narcotics withdrawal. The analysis of anamnestic data of drug addicts have revealed a tendency to infectious diseases, while prevailing were the so-called blood-contact infection — viral hepatitis and HIV infection. So, 64,0% of the patients were identified antibodies to hepatitis C virus, 14,0% of both hepatitis C virus and In and 11,1% of patients — to HIV. In addition, most patients complained of frequent (4–5 times per year) respiratory diseases, mostly acute respiratory viral infection.

To the cells, taking an active part in realization of the basic functions of the immune system, as well as key positions in the non-specific immunological resistance, are dendrite-wide cells, neutrophils, monocytes/macrophages, esinophils, basophils, mast cells. The main role belongs and refers to neutrophils. Given this fact, in the course of this study that these cells were the main focus in assessing the status of patients who abuse heroin. A series of studies was devoted to the evaluation of the actual phagocytic function of neutrophils (percentage of activated neutrophils) in the peripheral blood of heroin abusers.

For statistical processing of material was used statistical analysis and information delivery SAS (Statistical Analysis System).

Results and discussion: The results of the survey showed that perediary burdened by alcoholism, drug abuse was detected in 6 patients. All the studied patients abused heroin, which was their main drug. Parallel, but much less from case to case, the patients had used alcohol, cannabis, psychotropic drugs.

As follows from the data, the most pronounced reduction in the proportion of activated neutrophils in peripheral blood were registered in patients of the 2nd group in the withdrawal period taking heroin for over 5 years (Table 1).

The percentage of phagocytic cells was the lowest and amounted to $25,7 \pm 2,3\%$ and significantly differed from the value compared to the control. In the future, these indicators at the exit of the withdrawal syndrome and is in remission increased, but did not reach the numbers of the control group.

Table 1. – The state fraction of activated neutrophils in the peripheral blood
of heroin addicts with different duration of the disease

Groups	The proportion of activated neutrophils in the withdrawal period	The proportion of activated neutrophils after treatment	The proportion of activated neutrophils in remission
I group	$34,8 \pm 3,2\%$*	$38,5 \pm 3,8\%$	$39,8 \pm 3,6\%$
II group	$25,7 \pm 2,3\%$ *	$29,8 \pm 2,8\%$	$30,7 \pm 3,3\%$*
Control group	$41 \pm 3,9\%$	$41 \pm 3,9\%$	$41 \pm 3,9\%$

significantly compared to control group ($p < 0,05$)

Pronounced changes in the functional state of phagocytic cells was recorded also at the duration of taking the drug up to 5 years in patients of the 1st group. Patients who use heroin has a direct moderate correlation between duration of intake of drugs and the proportion of activated neutrophils ($r = 0,56$, $p < 0,05$), while the proportion of activated neutrophils and phagocytic number also correlate among themselves.

The fraction of lymphocytes in peripheral blood were assessed according to the magnitude of the phagocytic number (Table 2).

Table 2. – The state of phagocytic numbers in the blood of heroin addicts with different duration of the disease

Groups	Withdrawal period	After treatment	Remission
I group	$8,8 \pm 0,76$	$9,0 \pm 0,55$	$9,1 \pm 0,72$
II group	$7,8 \pm 0,56^*$	$8,6 \pm 0,66$	$8,9 \pm 0,88^*$
Control group	$9,5 \pm 0,78$	$9,5 \pm 0,78$	$9,5 \pm 0,78$

significantly compared to control group (p<0,05)

Currently, it is well known that the metabolism of phagocytes is mediated by the presence in their lysosomes of a number of enzymes including acid hydrolases, neutral proteases, bactericidal enzymes (myeloperoxidase, lysozyme) as well as lactoferrin and others. Of particular importance is the activation of these enzymes during phagocytosis and other effects of oxidative metabolism. When this occurs, activation of the oxidase to the cell membrane, which restores the O_2 to superoxide ion O_2 accumulated in phagosome and becoming partly in H_2O_2 in an acidic environment.

In the next phase of this study, we evaluated the extent to which heroin use is reflected in this component. The bactericidal effect of the mentioned substances is enhanced by myeloperoxidase. The entire set of enzymes of phagocytes can act not only within cells but also released into surrounding tissues and the blood, forming, thereby, along with other biologically active-governmental substances (complement, lysozyme, 3-lysine, lymphokines, monokini, etc.), the humoral component of the immune system. In this connection seemed interesting to assess in conditions of chronic heroin intoxication this side of the functioning of phagocytes.

We determinated serum concentration of myeloperoxidase, a key enzyme of oxygen-dependent metabolism of phagocytes. The results of the studies in this direction showed that in the acute period of the disease the concentration of this enzyme in the blood serum of the examined patients was significantly lower than the control (Table 3).

Table 3. – The content of myeloperoxidase in serum of heroin addicts with different duration of the disease

Groups	Withdrawal period	After treatment	Remission
I group	$220,7 \pm 10,75^*$	$229,4 \pm 12,55$	$239,8 \pm 20,76$
II group	$208,7 \pm 10,73^*$	$215,7 \pm 7,19$	$225,7 \pm 4,53^*$
Control group	$252,5 \pm 3,19$	$252,5 \pm 3,19$	$252,5 \pm 3,19$

significantly compared to control group (p < 0,05)

As can be seen from the Table 3, the use of heroin leads to a decrease in the level of myeloperoxidase in blood serum of examined patients at all stages of the disease. Depending on the duration of drug abuse value of myeloperoxidase were detected reliably at a lower level than in the control group (p< 0,05). Failure of the phagocytic systems in heroin addicts is clinically manifested in the form of infectious-inflammatory processes in internal organs. Given information, determine the relevance of a comprehensive study of acquired defects of phagocytosis, to determine the feasibility of establishing new ways to study the functional activity of neutrophils and development of pathogenetic methods of their prevention.

Conclusions:

Thus, on the basis of a comprehensive study of the phagocytic activity of neutrophils in heroin addicts, we have determined that heroin addiction is accompanied by pronounced changes in cell-humoral system of human. Drugs have a suppressive effect on immunocompetent cells. Disruption of the immune system leads to the violation of cellular and humoral homeostasis and exacerbates the course of addiction. The comprehensive study of the functional activity of neutrophils extends pathogenetic interpretation of the clinical manifestations of addiction and helps the development of additional methods of correction of ongoing therapeutic interventions.

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THEOPPORTUNITIES OF ORGAN-SAVING SURGERY FOR EARLY DIAGNOSED KIDNEY CANCER

Abstract: The study design was a comparative study of the results of partial nephrectomy and total nephrectomy in patients with stage T1kidney cancer: identification of indications and identify the special characteristics of resection of kidney cancer in stage T1; comparative analysis of the immediate results of partial nephrectomy and radical nephrectomy in stage T1; explore long-term results of surgical treatment.The object of the study were 75 patients with morphologically verified diagnosis of renal cell carcinoma (RCC) T1N0–1M0 stage, treated in urological departments of Republic research center of oncology (RSCO) and Tashkent city oncology dispensary (TashCOD) for the years 2011–2015. For a comparative analysis of results of treatment, patients were divided into two groups: the first — 25 patients, who underwent anorgan-savingoperation — kidney resection; the second — 50 patients who underwent the traditional radical nephrectomy.

Keywords: kidney cancer, partial nephrectomy, tumor, survival rate, long-term results.

Introduction

Due to the rapid development of medical technology and the modernization of intensive care services in clinical oncology the possibility of the organ-saving surgical interventionshave appeared. Implementation of organ-saving surgery primarily aimed at improving of the quality of life of patients, which in turn should be in conformity with established oncologic principles and should guarantee, at least, identical results with radical surgery.

Despite the introduction of the modern technologies, until recently, the "golden" standard in the treatment of operable kidney cancer was nephrectomy [1; 2; 5; 7; 9]. However, patients with a solitary kidney after surgery can not be considered as completely healthy [3; 4]. Consequently, these patients constantly need medical and social rehabilitation. Therefore, performing organ-saving surgery for kidney cancer looks very promising. In literature, there are works devoted to this issue. Several authors already have some good long-term results [1; 2; 3; 4; 5; 9]. However, analysis of the literature shows that the available results were not based on sufficient clinical materials, do not provide a clear indication to form and define the distinction between partial nephrectomy and radical nephrectomy.

In general, the available views on this issue are various and multidirectional. Proceeding from the above, the actuality of this problem is the following:

a) Is early kidney cancer (EKC) the indication for organ-saving operation?

b) Can partial nephrectomy be compared with radical nephrectomy for their immediate and long-term results?

c) What is influence of organ-savingoperations on the quality of life of patients with EKC?

Objective: To study the results of organ-saving operations in treatment of early kidney cancer.

Materials and Methods:

The study design was a comparative study of the results of partial nephrectomy and total nephrectomy in patients with stage T1kidney cancer: identification of indications and identify the special characteristics of resection of kidney cancer in stage T1; comparative analysis of the immediate results of partial nephrectomy and radical nephrectomy in stage T1; explore long-term results of surgical treatment.The object of the study were 75 patients with morphologically verified diagnosis of renal cell carcinoma (RCC) T1N0–1M0 stage, treated in urological departments of Republic research center of oncology (RSCO)and Tashkent city oncology dispensary (TashCOD) for the years 2011–2015. For a comparative analysis of results of treatment, patients were divided into two groups: the first — 25 patients, who underwent anorgan-savingoperation — kidney resection; the second — 50 patients who underwent the traditional radical nephrectomy.

Among the patients 54 (72.0%) were performed by males, 21 (28.0%) were females. Lymph node involvement — N1 7 patients in the first group, 15 patients in the second group. The common stage T1a (tumor > 4 cm) was observed in 22 (86%) (first group) and 31 (63%) (second group). In both groups aged and older patients prevailed over the young and middle age group, accounting for 65% and 70% respectively. Consequently, the average age of patients in the first and the second group was 56,3 ± 0,3 and 59,5 ± 0,5 years. For localization of tumor in the kidneys indices were not significantly different from each other (tab.1). But there was a slight predominance of the tumor in the upper pole of the kidney (44%) over the lower pole (36%) in the first group. Bilateralrenallesion hadbeenestablishedin 1 patient (4%) in the firstgroup.

Histologically in 61 (81.3%) patients squamous cell RCCwas verified, 7 patients (9.3%) hadchromofilic and 5 (6.6%) — chromophobe type of the tumor. Patients of the first group in 74% of cases had extrarenal growth. In the second group intrarenal growth was observed in 47% ofthe cases (diagr.1).

Table1. – Localization of tumor in the groups, n=75

Side of lesion	1-group (n-25)		2-group (n-50)	
	Number	%	Number	%
Left kidney	11	42%	25	50%
Right kidney	13	54%	25	50%
Bilateral	1	4%	0	0

Comorbidities of contralateral kidney was detected in 5 (20%) patients of group-1 and in 2 (4%) patients (Table. 2) ofagroup-2.
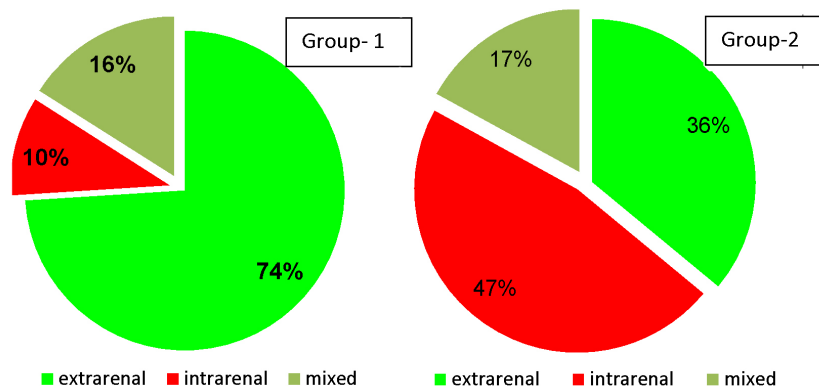
Variants of growth of tumor in groups

Diagram 1.

Table 2. – Characteristics of comorbidities in contralateral kidney, n = 75

Pathology of contralateral kidney	Group-1		Group-2	
	#	%	#	%
Cystic disease	1	4%	0	0
Urolithiasis	1	4%	1	2%
Pyelonephritis	2	8%	1	2%
Hypoplasia	1	4%	0	0
Total	5	20%	2	4%

Results and Discussion:

Based on the pre-operative research methods the indications for partial nephrectomy were following:

— The presence of concomitant pathology of the contralateral kidney (5 patients);

— Bilateral lesions of the kidneys (1 patient);

— Extra organ tumor growth without the involvement of the pelvi-caliceal system (19 patients);

— The absence of thrombus formations in the venous system;

— Hystologically verified RCC with no signs of invasion to the perirenal structure.

Along with this, a compulsory component of partial nephrectomy was performing lymph dissection at the level N1. So for tumors greater than 4 cm (T1b <7 cm) and pre-operative determination of the existence of increased lymph nodes preference was given to the transabdominal approach.

A special feature of the kidney resection in our survey was short-term renal ischemia by clamping the renal artery. Time of the controlled compression ischemia ranged between 5 and 25 minutes, averaging $9,2 \pm 1,4$ minutes ($p > 0,05$). In addition, the main method of hemostasis in the final partial nephrectomy was to impose an 8-shaped atraumaticsutures and stypageof theresected area by-perirenalfat. Preference was given to the wedge resection of the renal parenchyma with distance to 0.5 cm from the tumor visual margins. For tumors less than 4 cm with mixed or intrarenal growth there were performed enucleoresection — 43%.

In the postoperative periodcomplications had developed in 3 (12%) patients of the first group (Table. 3). In one case 1 (4%) draining of the abscessing haemotomewas done. Urinary fistula had been liquidated within 3 months after the surgery. In the 2 — group complications were observed in 4 (8%) patients, where there has been a bleeding and evisceration — in 2 (4%) patients. Mortality at the second group was observed in 1 (2%) case, the cause of which was posthemorrhagic shock.

Table3. – Postoperative complications after surgery in early kidney cancer, n = 75

Type of complication	Group1, n=25	Group2, n=50
1	*2*	*3*
Retroperitoneal hematoma with developing of abscesses	1	0

1	2	3
Woundinfection	1	2
Urinary Fistula	1	0
Eventration	0	1
Hemorrhage	0	1
Total	3 (12%)	4 (8%)

The study of long-term results (Diagram 2), directly related to the conduct of operations has shown that1 (4%) patient of the first group experienced recurrence of the disease and in 2 (8%) patients there were observed a progressive nephrosclerosisof resected kidney. In contrast, in secondgroup patients locoregional metastasis development was noted in 2 (4%) and distant organ metastases 4 (8%) cases. The frequency of recurrence of the tumor in the kidney removal was identical as in the first group — 1 patient.

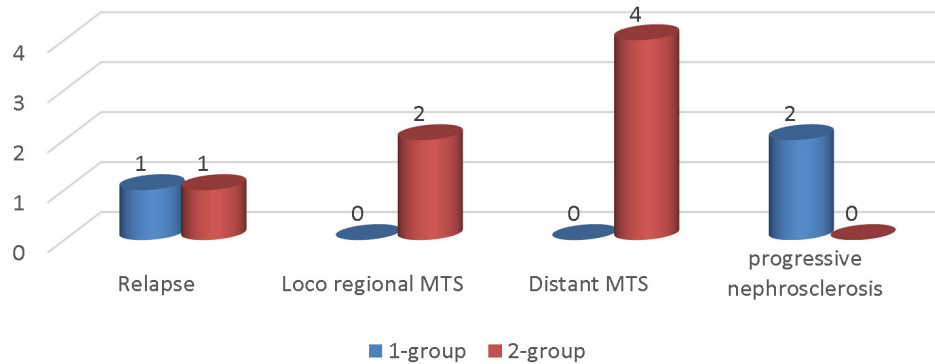Long-term results of surgical treatment of EKC, n=75.

Diagram 2.

During the a year of follow up three patients have died in the investigated groups: 1 — group — 1 (4%) in group-2 2 (4%).

A comparative study of survival rates (diagr. 3) shows that in 3 years of monitoring of the patient survival there are significant differences between the study groups. 5 year survival after organ-saving partial nephrectomy was 84% versus 68% after radical nephrectomy.

Analysis of the quality of life of patients with early kidney cancer after surgery also showed variation in the data, depending on the type of the operation. So, after resection methods of surgical treatment of EKC an average quality of life for the Karnofsky scale was $73,5 \pm 0,7\%$ ($p > 0,05$) vs. $61 \pm 0,3\%$ ($p < 0,05$) after radical nephrectomy.

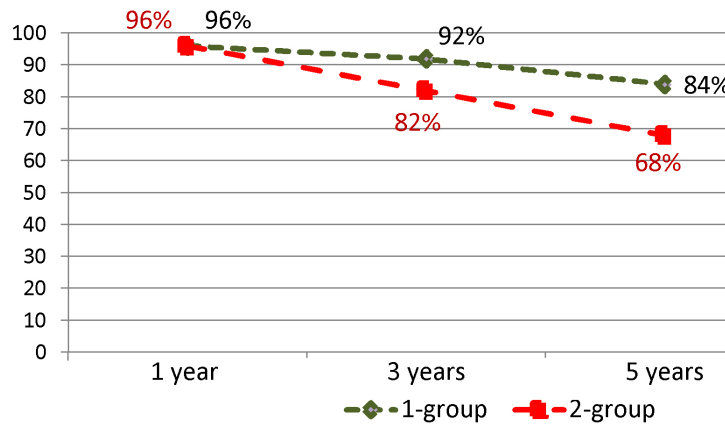Comparable survival rates of patients with EKC, n = 75

Diagram 3.

Thus, the analysis shows the benefits of organ-saving methods of surgical treatment of early kidney cancer, which contributes to a better medical and social rehabilitation of patients.

Conclusions:

1. Performing of organ-saving surgery in T1N0–1M0 stage of kidney cancer patients indicated for middle and older age groups, as well as in presence of concomitant diseases of the urinary system.

2. Partial nephrectomy in early kidney cancer is not accompanied by an increase in the incidence of postoperative complications, which may be considered as treatment of choice.

3. Partial nephrectomy at early kidney cancer contributes to the early rehabilitation of the patients, which is reflected in the increase in the 5 — year survival rate and quality of life.

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VALUE OF IGF-1 AND IGFBP-3 LEVELS IN DEFINITION OF THE DISEASE ACTIVITY IN PATIENTS WITH ACROMEGALY

Abstract: Our data showed that IGF-1 level is the sensitive marker of diagnostics of activity of process and efficiency of treatment in patients with newly revealed acromegaly and ones received medicamentous treatment. And for patients undergone surgical removal of somatotropinomas and X-ray therapy, the most sensitive criteria reflecting efficiency of treatment and characterizing presence or absence of residual secreting tumor tissue, is IGFBP-3 level which may be used as an additional biochemical marker for active process.

Keywords: acromegaly, insulin-like growth factor, marker.

IGF-1 and IGFBP-3 are the important markers of growth hormone functions. Detection of their levels in blood plasma is of the paramount diagnostic importance at various forms of GH secretion disorders [1]. There are data that serum IGF-1 levels correlate with average daily values of GH in blood which proves importance of its detection in patients with acromegaly undergoing dispensary monitoring [2]. IGF-1 level remains elevated for a long time in patients "cured" for acromegaly comparing to the healthy ones. Though they have normal basal GH level, average GH level in intervals between its peaks at these patients remains slightly elevated, and correlates with IGF-1 [3].

IGF-1 and IGFBP-3 levels strictly correlate in patients with clinical signs of acromegaly; and for the raised levels of IGFBP-3 typical for acromegaly, there was no data for any of them to be at range of normal levels for healthy people (4). However according to the experience of some authors (5) such cases have take place, and though there were crossings of IGF-1 levels in healthy people and patients with newly diagnosed acromegaly, there is no case for IGFBP-3. Therefore, measurement of IGFBP-3 levels can be useful in estimation of condition of patients with clinical signs of acromegaly and suspiciously normal levels of IGF-1 and results of the oral glucose tolerance test (4).

Proceeding from the above-stated, *the objective* of our researches was studying of IGF-1 and IGFBP-3 levels in previously untreated patients and in patients receiving different types of therapy.

Materials and methods. 48 patients with GH secreting pituitary adenomas addressing in RSSPMCE were examined. Middle age was 41±19 years, disease duration — from 1 to 23 years. Patients were divided into four groups on 12 in each one: 1st group — untreated patients (newly revealed) (n/r), 2nd — undergone surgical treatment (ST) (transnasosphenoidal pituitary adenomectomy), 3rd — undergone X-ray therapy (XT) (gamma therapy for hypothalamus-pituitary area), and 4th group — receiving medicamentous therapy with dopamine agonists (MT) (parlodel, bromergone, bromocriptin) in a daily dose of 7.5–12.5 mg/day regularly. The control group was made by 12 healthy subjects of the same age. All patient undergone clinic and biochemical tests; basal levels of pituitary and peripheral glands' hormones, IGF-1, and IGFBP-3 levels were studied by RIA method (Immunotech, Chechia); pituitary CT/MRT was performed; daily rhythm of GH secretion was defined.

*Research results.*IGF-1 and IGFBP-3 levels of 46 patients were compared with daily average GH levels of healthy control patients (table 1).

The study found out, that GH levels varied over a wide range from 7.4±1.8 mU/l to 71.78±17.7 mU/l, being 37.26±6.7 mU/l on average, which is almost 2 times exceeded the top normal threshold

and is more than 10 times higher than the average daily rhythm of healthy persons. The highest basal GH levels were found to be in patients with newly revealed acromegaly (71.78±17.7 mU/l) and MT group (42.47±12.1 mU/l), and rather low levels of the hormone were in patients undergone XT (13.4±2.2mU/l). Patients undergone ST had normal GH levels (3.4±1.8 mU/l).

Table 1. – Basal GH, IGF-1, and IGFBP-3 levels in blood serum of patients with acromegaly

Groups	GH (mU/l)	IGF-1 (ng/ml)	IGFBP-3 (ng/ml)
Newly revealewd, n= 12	71.78 ± 17.7	1,525 ± 70.31	15,413 ± 1,201.9
MT, n = 12	42.47 ± 12.11	1,451 ± 124.9	19,938.1 ± 1,943.8*
XT, n = 12	13.4 ± 2.2***	731.5 ± 28.17***	39,694 ± 10,790.9
ST, n = 12	3.4 ± 1.8***	202.7 ± 27.4***	13,287 ± 1,515.1
Total (n = 48)	37.7 ± 6.7	1,011.6 ± 87.5	22,465.5 ± 3,211.1
Control group, n = 12	15–23	107–310	1,531–4,277
P between MT and XT	p < 0.001	p < 0.001	p < 0.01
P between MT and ST	p < 0.001	p < 0.001	p < 0.01
P between XT and ST	p < 0.05	p < 0.001	p < 0.01

Note: * P < 0.05; ** P<0.01; *** P < 0.001 – statistical difference in relation to n/r

Interesting data were received regarding IGF-1 and IGFBP-3 levels. IGF-1 level in patients with clinical signs of acromegaly varied from 128 ng/ml to 2,087 ng/ml (1,011.6 ± 87.5 ng/ml on average), which exceeded 2.5 times those variations in healthy subjects. It is necessary to notice, that the clear parallelism in levels of GH and IGF-1 was revealed. With increase of GH level, the level of IGF-1 raised accordingly, and its highest levels were registered in patients with newly revealed acromegaly being 1,525±70.31 ng/ml, and the least levels — 202.7 ± 27.4 ng/ml were revealed in patients undergone ST.

The comparative analysis of IGFBP-3 levels in patients receiving various types of MT found out following interesting data (table 1). Thus, the least IGFBP-3 levels were revealed in patients undergone radical tumour removal (13,287 ± 1,515.1 ng/ml),

and the highest levels were in group of patients undergone XT 39,694 ± 10,790.9 ng/ml. I. e. its levels mismatched with average values of basal levels of GH and IGF-1 in patients undergone XT. It is necessary to notice, that levels of its physiological fluctuations widely vary from 1,531 to 4,277 ng/ml, which makes it complicated to use it in estimation of degree of acromegaly activity as a biochemical marker. So, in our study as well its levels varied from 13,287 to 39,694 ng/ml and were on average 22,465.5 ± 3,211.1 ng/ml. Moreover, patients undergone ST had also elevated IGFBP-3 levels despite normal levels of GH and IGF-1.

Further we studied correlation between basal levels of GH and IGF-1 as a whole and depending on therapy applied. We thus found out high positive correlation r = 0,92 in a whole (fig. 1), but this dependence has grown at the separate analysis.

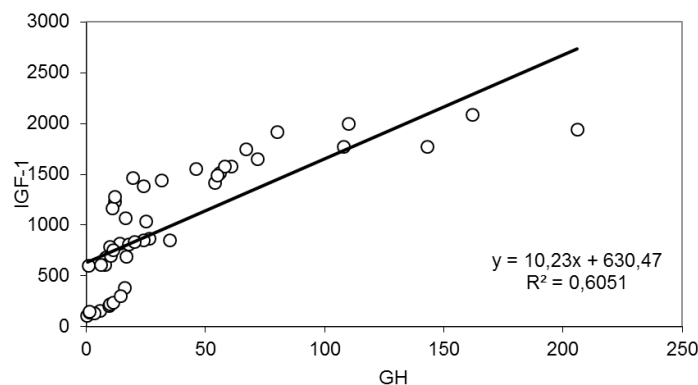$$y = 10,23x + 630,47$$
$$R^2 = 0,6051$$

Figure 1. Correlation between GH and IGF-1 in patients with acromegaly

We revealed the highest correlation coefficient in patients with newly revealed acromegaly (r = 0.9), and ones receiving MT (r = 0.97), which specifies low efficiency of MT using dopamine agonists, even in cases of high daily doses administration (7.5–12.5 mg/day). This coefficient was slightly lower in patients after surgery (r = 0.95) and X-ray (r = 0.94) therapy.

According to the literature data, it is known, that IGFBP-3 is the representative of family of proteins which bind IGF-1 and modulate its action at tissue level [6]. So, IGFBP-3 is the main circulating form of binding proteins and the basic physiological regulator of IGF-1 level which increases its half-time of life and biological activity. In this connection we studied correlation between GH and IGFBP-3 levels (fig. 2).
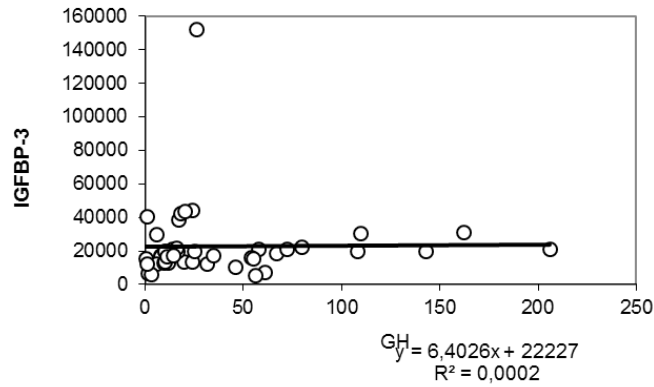
Figure 2. Correlation between GH and IGFBP-3 levels in patients with acromegaly

At the analysis of correlation between GH and IGFBP-3 by groups, positive correlation in group of ST (r = 0.69) and XT (r = 0.63) was found.

Generalising the received results, it is possible to conclude, that IGF-1 level has strong correlation with GH level in blood, and its detection is informative as well as in untreated and in previously treated patients.

Detection of IGFBP-3 level has an important clinical-diagnostic value; this index may remain high even after process remission, when levels of GH and IGF-1 are within the normal values. Raised serum IGFBP-3 levels specify the presence of residual hypersecretion of GH in patients undergone surgical treatment and ones being in post-X-ray remission. Probably this explains development and progressing of complications of acromegaly even after successful therapy which evidently reflected in normal GH and IGF-1 levels which are basal criteria for any treatment choice in acromegaly. It is known, that in healthy subjects IGF-1 and IGFBP-3 levels clearly reflect condition of GH and have positive correlation [7] with its level, while in patients with acromegaly the given interrelation is not always presented. This results from the fact that the number of factors such as insulin resistance, impaired glucose tolerance, diabetes mellitus and somatic diseases — hepatitis, nephritis, etc. [8] — have

their influence on GH, IGF-1, and IGFBP-3 levels. Therefore in our opinion, IGF-1 and IGFBP-3, as well as GH levels should be estimated only during OGTT which excludes cases of underestimation of activity of acromegaly.

Thus, our data showed that IGF-1 level is the sensitive marker of diagnostics of activity of process and efficiency of treatment in patients with newly revealed acromegaly and ones received medicamentous treatment. And for patients undergone surgical removal of somatotropinomas and X-ray therapy, the most sensitive criteria reflecting efficiency of treatment and characterizing presence or absence of residual secreting tumor tissue, is IGFBP-3 level which may be used as an additional biochemical marker for active process.

Thus, the most sensitive markers of estimation of acromegaly activity and its progressing with development of various complications, along with indicators of daily rhythm of GH secretion are IGF-1 and IGFBP-3. Carried out survey specify a diagnostic value of serum levels of IGF-1 and IGFBP-3 both in newly revealed, and in patients with acromegaly receiving treatment. Their complex detection is an additional biochemical criterion which allows defining medical-diagnostic strategy in cases of residual GH-activity after surgical treatment and on the background of post-X-ray remission of the disease.

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Section 5. Pedagogy

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MAJOR TRANSFORMATIONAL CHANGES IN UKRAINE'S HIGHER EDUCATION SYSTEM IN THE POST-SOVIET PERIOD

Abstract: The article describes the main stages of the formation and development of the system of higher education of Ukraine in the years of independence. The list of normative legal documents regulating the activity of the higher education system of Ukraine is analyzed.

Keywords: higher education of Ukraine, higher educational institution, independence, Law of Ukraine "On Higher Education", transformational shifts.

Introduction. It is well-known that higher education plays a crucial role in shaping future generations. After Ukraine gained independence, there started the transformation of not only the system of higher educational institutions, but of the higher education system in general. Ukraine inherited from the Soviet Union a powerful, extensive educational system with advanced infrastructure as for that time. However, at the moment, it needs transforming, as qualitative and quantitative indicators do not always correspond to the European level of education and the requirements of the modern labor market, and as a result, it has obsolete content, forms and methods of training, as well as other obstacles and problems. Despite the insignificant historical gap, it is expedient to make certain generalizations about the transformational shifts of higher education in Ukraine from the moment of its independence in 1991 to today.

The analysis of scientific literature on the research problem suggests that studies on the chosen problem were carried out by Ukrainian scholars Y. Alekseev, M. Tymoshenko, M. Zerkal, Y. Sirim, V. Andrushchenko, O. Bilan, S. Boyko, V. Lytvyn, B. Pogrebnyak, M. Panov, and others.

The purpose of the article is to provide a theoretical substantiation of the transformational shifts of higher education in Ukraine during the years of independence (1991–2017).

The period since 1991 has become remarkable in Ukraine, since the very first private institutions of higher education began to appear at that time. From 1992 to 1994 there was a rapid increase in their number, this was a period when there was no need to summarize the first results of the work of educational institutions — the issuance of education documents. Adoption of the June 1, 1992 Resolution of the Cabinet of Ministers of Ukraine "On Accreditation of Higher Educational Institutions" declared at the state level the right of private higher educational institutions to carry out their activities in the legal circle [5, 8].

In June 1992 was created the "Inter-branch Republican Accreditation Commission", which introduces the licensing process, introduces a single list of necessary documents for licensing, and creates other unifications and systematization of management, and already in 1995–1996 takes place the process of accreditation of private higher educational institutions, and at the same time, there was a significant reduction in the number of private universities. Through continuous work in 1997, there started the issuance of the first state-level diplomas to graduates of private higher educational institutions is initiated [5, 8].

According to M. Tymoshenko, the formation and development of higher education in Ukraine covers the following stages (table 1) [11, 236].

Table 1. – Stages of the formation and development of higher education in Ukraine

Period of time	Characteristics
1	*2*
"The Post-Soviet period"	The legislation of Ukraine was aimed at reforming the legal regulation of the economic activity of higher educational institutions since the early 90's of the XX-th century.

1	2
Period from the end of 1991 — till 1995	In line with the fast reduce in public funding, the practice of extra-budgetary funding is spreading.
1996–2000	Adoption of the "Constitution of Ukraine" on February 12, 1996 and the Resolution of the Cabinet of Ministers of Ukraine "On Licensing, Certification and Accreditation of Educational Institutions".
From 2000 p. till today	In connection with the adoption in 2002 of the Law of Ukraine "On Higher Education" of January 17, 2002, the regulation of the content of higher education, documents certifying obtaining of higher education; consolidation of the system of higher education standards; establishment of the order of management in the system of higher education.

By the order of the Ministry of Education and Science of Ukraine of December 24, 2003, the "Licensing conditions for the provision of educational services in the field of higher education" were approved, which established the minimum norms of provision of educational institutions with material, technical, methodological and informational basis, scientific-pedagogical and pedagogical personnel [1].

It should be noted that the signing of the Bologna Declaration in 2005, which led to the integration of the Ukrainian system of higher education into the pan-European education, was no led to important transformational changes in the system of higher education of Ukraine. The main objective of the Bologna Process was to consolidate the efforts of the academic and educational community

and governments of European countries to significantly increase the competitiveness of the European education system and ensure its quality [2].

Adoption of the new edition of the Law of Ukraine "On Higher Education" in 2014 became a formal beginning of the reform and transformation of the national system of higher education. The purpose of the reform is to solve the most acute problems of Ukrainian higher education and its approach to modern European standards [4].

For better understanding of the essence of transformational shifts in modern Ukraine, one should consider the dynamics of the number of higher education institutions in Ukraine. Thus, over the past 17 years, their number has decreased from almost a thousand to 657 (Fig. 1) [6].
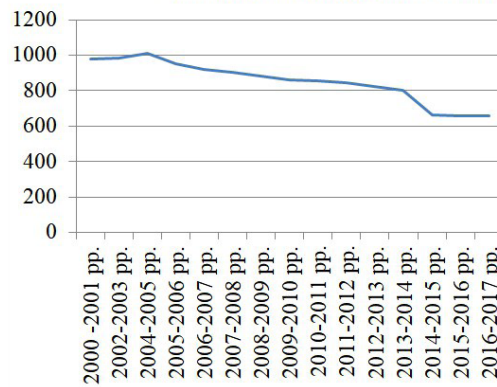

Figure 1. Total number of higher educational institutions of Ukraine

According to the new "Law on Higher Education" Ukraine is on the edge of significant revolutionary changes, namely: the education quality control will be provided by the "National Agency for the Quality Assurance of Higher Education", academic autonomy, financial and economic autonomy, strong student self-government, transparency, bachelor — Master — PhD, like in Europe, an updated classification of higher education institutions, plagiarism fighting, reduction in the loading on teachers and students, academic mobility, enrolling only on the base of external independent testing, competitive system of government order, scholarships at the level of subsistence level, state financing of science, teaching in the Ukrainian language. Some of the above pointed innovations have already started to work, so let's take a detailed look at each of them.

At present, the quality assurance of higher education will be provided by the "National Agency for the Quality Assurance of Higher Education", which will include 25 members of this collegial body, be elected for 3 years. 13 of them will represent universities, 5 branch academies of sciences, 3 associations of employers, 2 National Acad-

emies of Sciences, and student self-government bodies. It should be emphasized that the structure of the agency can not include heads of universities or the Academy of Sciences and their deputies, there can be no more than two terms of membership of this body [7].

Changes in the structure of higher education institutions. Academic autonomy of higher educational institutions, the essence of which is that each university has the right: to implement its own educational and scientific programs; award academic degrees; decide independently whether to recognize foreign diplomas and degrees when admitting to study and work; to issue both own and state diplomas; rectors and deans will be elected by directly by teaching personnel for a term of 5 years, as well as students whose share of votes is increased to 15% [4].

The next point of the revolutionary changes is the financial and economic autonomy, which means that: higher education institutions have the opportunity to open their own accounts, receive bank-loans, dispose of property and land, establish scientific parks

and enterprises; freely dispose of their own revenues; establish own sustainable financial fund and use it.

An important change is the strong student self-government, the functioning of which has also undergone changes as it is currently formed by the students themselves, protects their rights and interests, self-government can make suggestions on the development of curricula, and they can receive 0.5% of the financial revenues of the universities [4].

Transparency is equally important, which includes the fact that higher education institutions should provide public access to all information about their activities. Like in Europe, the bachelor-master-PhD system, there will be only 5 educational and qualification levels: Junior Bachelor, Bachelor, Master, Doctor of Philosophy, Doctor of Science.

It should be noted that at present, there will be only 4 types of higher education institutions functioning: universities (universal educational institutions), institutes and academies (branch schools), colleges (where specialists are trained to the level of junior bachelor or bachelor).

A significant contribution is the plagiarism combat, which means: scientific reviews and reviews of opponents before the defense are posted on the university's website; the defense of theses will be public; sanctions for plagiarism; there will be internal control over plagiarism among teachers and students.

We shall emphasize that many higher educational institutions of Ukraine have their own 'Code of Academic Honesty', which lists the rules that students and teachers should manage in their scientific work. Such a code is used at the Kiev Boris Grinchenko University, the Kyiv Polytechnic Institute, the Kyiv Mohyla Academy, and the Catholic University. Let's consider some of them on the example of the Boris Grinchenko University of Kyiv and the Catholic University.

Boris Grinchenko University of Kyiv approved the 'Declaration on Academic Integrity' on September 30, 2016 at the Conference of the Labor Collective of the University. The purpose of this is to identify and establish the main priorities and values of the internal quality assurance of education and research, the observance of which by the community of the University is a prerequisite for the creation of a favorable environment for study and work [3].

Instead, the Catholic University operates the Provision "On the Prevention of Plagiarism and the Correct Use of Quotations in the Learning Process of the Ukrainian Catholic University", which regulates the application of general principles and rules of scientific ethics in written papers of the students and scientific researches, and methodological developments of the UCU Teachers; acknowledges the academic and professional ethics and respect for copyright as the key principles of the organization of the educational process and research work; improves the quality of the organization of the educational process, the level of discipline of students when performing educational tasks in the form of written papers, ensuring compliance with the requirements for registration and responsibility for their violation [9].

Next point in the list of changes is a reduction in the load on teachers and students, which has been reduced by one -third, from 900 to 600 hours (without staff changes) for students, then one credit of 30 hours, instead of 36 [4].

Among all the transformational shifts, an important role is played by academic mobility, which means the introduction of a credit-module system in the educational process of a higher education institution, free choice of study courses by students, the possibility of changing the specialty upon admission to the magistracy, the possibility of protection and continuation of study abroad.

In many higher educational institutions, academic mobility is manifested in: academic internships for teachers and postgraduates within the Erasmus+ program, signing international cooperation agreements, student exchange programs, and conducting open guest lectures by well-known foreign scholars that we can observe today in this audience.

Among the main changes is the university admission only by the results of the external independent assessment, which means that each EIA certificate will weigh 20% of the final score, the school certificate — 10%, the prize places in the national Olympiads and contests — 5%, the score for the creative contest or physical training at some universities comprises 50% [4].

The system of state orders has also been transformed, which will continue to represent the process of electronic admission to higher educational institutions, the selection of entrants in the specialty at the stage of preparation of the EIA, as well as the possibility to obtain private higher educational institutions budget places for training.

A valuable upgrade of the higher education system includes the increase of the scholarships to the subsistence level according to the 2017 budget allocation plan, which raised the average student and academic scholarship, and its appointment will be based on the student's success rate.

An important transformational shift in the Ukraine higher education is the teaching in the Ukrainian language, which means that, the university has the right to teach part of the disciplines in English or other foreign languages, while providing knowledge of the discipline to students in the Ukrainian language as well; list of foreign languages acknowledged as languages of instruction, will be approved by the educational institution; if foreign students are taught in a foreign language, special groups are created, where students are obliged to study the Ukrainian language as a separate discipline.

Today we can observe that this shift is implemented in the non-auditing activity of many higher educational institutions, within which there are various competitions, round tables, excursions, flash mobs, brain rings, student actions, Ukrainian readings, conferences, etc.

It should be noted that the higher education system also introduces active forms of communication and information exchange between the subjects of the educational process: seminars, trainings, round tables, conferences, etc. At the same time, it should be outlined that modern Internet technologies allow using the above-mentioned forms of communication between participants who are located in different parts of the globe. Their communication is provided by computer technology using Internet channels and related software. The mentioned communication has the following names: on-line-seminar, web-conference, webinar, etc. The software platforms for hosting webinars may be programs that are installed on the server of an educational institution or which are hosted on the Internet by servers of companies [8].

One of the innovative methods currently used in higher education institutions is case-study, which is a method of post-classic teaching methodology; it contradicts the classical methodology, and is characterized by high methodological saturation, since it con-

tains a significant epistemological, praxeological and axiological potential; it allows to accumulate considerable volumes of knowledge, to form professional qualities of students; it is an intensive education method that mobilizes and activates the activities of the educational process subjects; reveals significant opportunities for the formation of universal, social and professionally relevant qualities; has the ability to integrate with other methods of learning, to enrich at their expense, and therefore to increase their functional capabilities [11].

Further transformation of Ukraine's higher education system is not possible without strategic directions of its development, which should include: ensuring the innovative orientation of the education system; increasing the effectiveness of the domestic sector of scientific research and development in order to strengthen its role in providing innovative development of the national economy; ensur-

ing expanded reproduction of knowledge based on the integration of the activities of higher educational institutions, academic and industry scientific institutions.

Conclusions. Main transformational shifts in Ukraine's higher education should be based on the following principles: firstly, it is a national idea of higher education, which is supposed to preserve and increase national educational traditions; secondly, the development of higher education should be subject to the market economy laws, that is, the law of labor division, the law of labor variability and the law of competition, since the economic sphere is extremely important in shaping the logic of social development; thirdly, the development of higher education should be considered in the context of trends in the development of world educational systems, taking into account integration processes.

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Section 6. Political science

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IMPORTANCE OF THE SOUTHERN GAS CORRIDOR

Abstract: The Republic of Azerbaijan understands its importance in playing an important role in the energy diversification policy of European countries. This role is very important to Azerbaijan because the energy cooperation promotes and stimulates the continuing development of its national economy. Also, cooperation with European countries promotes the important status of the country in the Caspian basin region. In light of this, the country is developing its own strategy to play the most critical role in the energy diversification policy of the European Union.

Keywords: Azerbaijan, Russian Federation, European Energy Security, geopolitics, diplomacy.

Introduction

When looking at the successful implementation of the BTC crude oil and SCP natural gas pipelines, it becomes clear why the same energy corridor has received so many pipeline proposals to bring more natural gas reserves from the Caspian basin [4]. Azerbaijan has been the main player in the Caspian basin region to contribute to the European Union's energy diversification policy and since 2011 it has received many proposals to select from as means of transporting its natural gas reserves. Currently, Azerbaijan, with its Shah Deniz Stage II, plans to become one of the main contributors for the European Union's energy diversification strategy [8]. Natural gas, which will be produced from the second stage of the Shah Deniz field in the Caspian Sea, will travel more than 3500 km in distance to reach the European gas market. This 3500 km long journey is called the Southern Gas Corridor and it is expected that with the enhancement of the existing energy infrastructure and construction of the new pipelines, this corridor will contribute to the security of European energy [7].

If the energy routes in the Southern Gas Corridor are adequately diversified, this will result in the assurance of stable and affordable imports with secured energy infrastructure. Therefore, the European Union, within the framework of its energy diversification policy, has identified and has supported new energy routes since the fall of the Berlin wall. This policy is mostly aimed at reducing the reliance of EU countries on a single energy supplier [3]. In the last two decades, natural gas reserves have become the main target of the European consumers. Due to many of its positive characteristics, the European Union has been following the policy of reaching new rich natural gas producing countries. The Caspian basin, Levant basin, and Middle Eastern regions have been at the center of attention within the agenda of expanding European natural gas imports.

Eastern and central European Union countries are heavily dependent on a single natural gas supplier in high percentages [3]. Therefore, new natural gas corridors would not only help the European Union, but it would also provide other European countries with the opportunity to diversify their energy imports. The Southern Gas Corridor (SGC) aims to fulfill this policy of the EU countries and deliver natural gas reserves from the countries of the Caspian basin [13]. Currently, the SGC consists of one existing natural gas pipeline and in addition to this two natural gas pipelines have been further proposed and are currently under construction. The Baku-Tbilisi-Erzurum (BTE), also known as the South Caucasus Pipeline (SCP), is the already existing gas infrastructure that the SGC will use as its starting point. The TANAP and TAP projects are currently being constructed and they will be in their active phase of completing the project in less than a few years. At the completion of the first phase of the SGC, it will have the capacity to transport approximately 16 bcm of natural gas. When considering the potential supplies from the energy-rich Central Asian countries, it is likely that the SGC could easily increase the volume of the transported natural gas up to 80 bcm per year by 2019 [13].

Diversification policy of the Energy Routes

The European Union has developed a strategy to ensure the security of its energy imports through the SGC corridor in accordance with its diversification policy. The energy corridor is considered to be the most valuable alternative energy corridor for the EU gas market and provides an alternative route that bypasses Russia and also reduces the European Union's dependence on Russia's supplies [14]. All Western countries have supported this approach of the European Commission. The European Union's vision for this energy corridor has been to create a major access point into the regions containing Caspian natural gas reserves. However, the European Union considers

the SGC not only to be the secured access corridor to Caspian gas, but also a very important mechanism by which to build strong relations with all of the countries along the corridor and negotiate their partnership in the European Union's energy policy [5]. To some extent, this would create a common energy strategy on a multilateral level. This strategy has already begun to be implemented within the alliance of Azerbaijan, Georgia, and Turkey. The already existing energy pipelines that run between these countries has significantly helped to establish the experienced teamwork needed for further energy cooperation in the future. Azerbaijan, in collaboration with Turkey and Georgia, is already playing an active role in the EU's energy security because of its involvement in the BTC and BTE pipelines, which demonstrate the commitment of the country to facilitating future development in the Southern Gas Corridor [10]. Abbasov made the following statement concerning the realization of the Southern Gas Corridor.

"Southern gas corridor is accepted and decided to develop under this declaration. We are not afraid, and we are committed to building this Southern Gas Corridor because we have previous practices, and experience. We know that we can do it. There are many countries within the Southern Gas Corridor, but Azerbaijan is most likely the only country that is taking serious action on developing this corridor" [1].

Azerbaijan has the desire to see advancement of the Southern Gas Corridor because this will lead to the opportunity to secure energy exports and also strengthen its role in the energy security of Europe. However, Sek argues that the "EU's plan was always to stop the monopolistic roles of the suppliers and that's why diversified infrastructure especially in the gas sector, made this policy an important contribution and attention for the European energy security" [12]. It is further contended that step-by-step Europe is becoming closer to a level of infrastructure diversification in which security and certainty are assumed. On a final note, he says that the countries of Eastern Europe are the most concerned by the situation and are desperately striving to secure the future energy supplies entering their territory.

Jarosiewicz states that the Southern Gas Corridor will soon be the fourth most important of Europe's diversified gas routes. It is via this gas corridor that the EU energy market can access alternative energy sources from Kazakhstan and Turkmenistan via Azerbaijan [6]. It is also suggested that Turkey's relationship with the European Union's is going to be defined as a new kind of partnership in the context of the transit route. This will involve Turkey playing the role of an "energy bridge" between Azerbaijan and the European continent via Central Asia and the Caspian Sea. The implementation of the Southern Gas Corridor over the huge geographical distances is drawing the attentions of the European Union as well as the United States. The United States supports the energy route diversification policy of the European Union it is also showing an interest in the region as a result of economic, political, and social issues.

The Southern Gas Corridor has challenged the interests of Russia and the state company Gazprom. This is because Russia is afraid to lose its dominant position in the gas markets of Europe. Furthermore, the project is seen as a threat to the political interests that Russia has in the Caspian basin, South Caucasus, and Central Asian regions [6]. However, as a result of the crowded interest from various companies seeking to take part in the project, some countries have proposed their own pipeline projects. Examples of these include ITGI, TAP, TANAP, and the Trans-Caspian. As such, the European Union has decided to back any project under the condition that it satisfies the demands of Europe's energy security. The Nabucco consortium has agreed to propose Nabucco-West, which offers a shorter version of its original [6].

In response to the abovementioned turn of events, Richard Morningstar, the previous US state department special envoy for Eurasian energy states that the Nabucco project is the most efficient form of infrastructure [11]. Alternative options will only be considered if Nabucco is seen as commercially unviable. These other options include small pipelines, such as ITGI (Italy — Greece — Italy), TAP (Trans-Adriatic Pipeline), and TANAP (Trans-Anatolian Pipeline), which can be subsequently developed when gas volumes increase [2]. The commissioner of the European Union, Guenther Oettinger, indicates that Azerbaijan is going to be playing a pivotal role as both a transit country and a gas supplier. Within the geostrategic context of these "gas games", it is believed that Azerbaijan's position is accurate [9].

Conclusion

A significant level of interest is being given to the position of individual countries and their involvement in the Southern Gas Corridor. Some European countries have been negotiating on the specifics of pipeline projects directly with Azerbaijan, while the European Union and the United States assess the route in its entirety. As such, all projects are evaluated based on what they can provide for Azerbaijan's future. TAP, ITGI, Nabucco, Nabucco West, as well as other proposed pipelines have lodged proposals to carry natural gas to the European continent from Azerbaijan.

Azerbaijan's geographic location and its existing transportation infrastructure make it a major transit country in the Southern Gas Corridor. This status of the country provides an important opportunity for the transportation of energy reserves from Central Asia to mainly European markets. Based on the research, the main pipelines from the South Caucasus region, namely the Baku-Tbilisi-Ceyhan crude oil pipeline and the Baku-Tbilisi-Erzurum (SCP) natural gas pipeline, are considered to be important elements of the backbone of European energy security because they serve to provide alternative routes and because they increase the levels of cooperation with energy-producing countries from the Caspian basin region. This cooperation has mainly been concentrated on the supply of the natural gas to European markets from the Azerbaijani section of the Caspian Sea. But this experience has opened up the chapters for the Central Asian countries to transport their own energy reserves via Azerbaijan.

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Section 7. Psychology

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DIAGNOSTIC QUESTIONNAIRE FOR DETERMINATION OF THE SIGNS OF COMPUTER ADDICTION AND ITS IMPACT ON HEALTH

Abstract:

Computer addiction is referred to a kind of social epidemic. Expansion of influence of the media environment on various human activities poses the need for development of new diagnostic methods of behavioral disorders in this kind of dependence. The study of commercial products created for the purpose of entertainment with the use of information and communication technology (ICT) has acquired a particular importance.

This article presents a questionnaire developed for the diagnosis of a computer addiction, which consists of two parts: the first helps to reveal the degree of such dependence, while the second identifies the disorders in the emotional sphere and mental health.

The development of the questionnaire during three years has been based on the results of our own research and other studies published in peer-reviewed journals. 720 students of technical specialties from two universities of Minsk have been interviewed within this period using a continuous method, which testifies to the sufficient representativeness of sampling. As a results a diagnostic questionnaire for determination of the stages of development and severity of computer addiction has been created. For the purpose of comparative analysis with the test by K. Young, simultaneous survey was held in 105 students (78 males (74.3%)) of technical specialties in one of the universities of Minsk city. The average age of the subjects is 19.7 years (± 1.5).

The presented questionnaire makes it possible to reveal computer addiction via responses to 7 questions, as well as to diagnose the following symptoms: compulsive urge, abstinence syndrome, sleep disorders due to adverse emotions caused by dreams, and psychopathological phenomenon of autonomous virtual image. An application for an invention "Method for Diagnosing the Human Mental State (Options)" # a 20140678 was published by us on August 30, 2015, authors Mezianaya K. N., Yashin K. D., and Karaneuski K. M.

Keywords: addiction (psychology), computer, gambling, diagnostic questionnaire, mental health.

Currently, there is a lack of research tools to study computer addiction, which has been ranked as a social epidemic [1, 96–97]. The rapid expansion of the market for products created on ICT basis has a significant impact on their consumers. In the last decade, computer games and video films have become widespread. However, the specific impact of these products on the user is not sufficiently taken into account in the existing diagnostic tests. One of the first questionnaires created by K. Young in 1996 to identify addiction

on the Internet is widely used to date in various modifications. Using a test developed in Russia in 2005 by Nikitina and Yegorov, the scientists conduct research in the CIS countries [1, 134–136].

Currently, the scientists prefer to investigate the effects on the person's personality of various gadgets: tablets, smartphones, laptops, etc. [2, 85–92]. However, all the specified technical means only provide access to the virtual space. The study of the complex influence of the virtual world on human health is a priority task of research of this type of non-chemical dependence.

The questionnaire developed by us is a tool for screening the threat of forming a dependent form of behavior in the persons using a computer media environment for the purpose of entertainment. The questionnaire has been developed for three years. During this period, five polling's were conducted among students who were trained in technical specialties at two universities in Minsk city. The total number of respondents was 660 people. The results of our research are published in a number of scientific journals [3, 50–55; 4, 130–13]. We published an application for the invention "Method for Diagnosing the Human Mental State (Options)" on August 30, 2015. No. 20140678, authors: Mezyanaya K. N., Yashin K. D., and Karaneuski K. M. [5; 6].

Purpose of the study: to create a new way to diagnose computer addiction and the consequences of its impact on health.

Materials and methods

The questionnaire consists of two parts (Appendix 1). Part 1 includes 13 questions that allow us to identify the stages of the development of computer addiction. Part 2 includes 14 questions that identify disorders in the emotional and mental health. In Part 1, the first four items do not have a scoring and are used for qualitative analysis of the sample. In the range of services provided by the computer media environment, according to the existing classification, six types are distinguished: 1) computer games; 2) social networks and dating; 3) Internet surfing; 4) films, television series and video reels; 5) cybersex; 6) exchange trading and gambling [1, 96–97]. Respondents are allowed to indicate several activities. Evaluation of results is carried out on a three-point scale, depending on the number of virtual world types used: 1–2 types (1 point), 3–4 types

(2 points), 5–6 types (3 points). Items 5–12 allow quantifying the degree of dependence, as well as identifying deviations in the mental health of the ICT user.

To analyze the time devoted to entertainment in the virtual world, a time period of 7 days (168 hours) is applied, which is divided into three intervals: from 1 to 24 hours, from 25 to 39 hours, 40 or more hours per week. The intervals are evaluated on a three-point scale: the minimum score is 1 — for the minimal amount of time. The number of hours spent at the computer during the day is also analyzed in three intervals using the same assessment. To identify the behavioral disorders and symptoms characteristic of this type of dependence, three issues are included, which formulate the problems of excessive use of the Internet, according to the results of a three-factor analysis conducted by Hungarian scientists [6, 657–664]. These are obsession (a kind of neurosis), social dysfunction (neglect) and control disorder. [7, 557; 8, F48]. Evaluation of the results of answers to each of the three questions of the questionnaire is assessed on a three-point scale: never — 1 point, sometimes — 2 points, often — 3 points. The result is the total number of points on seven questions (5, 8–13). The evaluation of the scoring ranges is set out in the instructions (Appendix 2). In order to test the questionnaire, 105 students of technical specialties studied at one of the universities of Minsk were interviewed using the method of continuous survey, which indicates a sufficient representativeness of the sample: males — 78 (74.3%), females — 27 (25.7%). All students received informed consent. An anonymous survey was conducted in the first semester of the academic year (October 2015). The average age of the subjects was 19.7 ($\pm$ 1.5) years. The average record of use of the Internet and computer games is 10.5 years.

For comparative analysis, a poll was conducted simultaneously using the test of Internet addiction diagnostics by K. Young [9, 133–134];

Statistics

In order to analyze the stability of the data obtained from this questionnaire, ten students were surveyed twice, randomly selected, at intervals of 30 days. The Mann-Whitney criterion was determined for two independent samples (Table 1).

Table 1. – Retest reliability coefficients and indicators of the dynamics of the computer addiction evaluation in subjects for a period of 30 days.

Index	Aggregate Rank 1	Aggregate Rank 2	Mann-Whitney U-criterion	σг mean square deviation	N1 first sampling size	N2 second sampling size
Values	55	55	42	10	10	10

With significance level of p < 0.05.

The differences in the attribute level among the compared groups are statistically insignificant, which makes it possible to draw a conclusion about sufficient retest reliability of the questionnaire.

The data obtained during this research was processed by the standard Microsoft Office Excel 2010 application and STATISTICA package version 10.0.

Results

The results of testing on the questionnaire by K. Young showed that in the study group 99 people (94.3%) belong to ordinary Internet

users and 6 people (5.7%) have problems associated with excessive devotion to Internet. Persons who suffer from Internet addiction are not identified. This allows us to conclude that this questionnaire, which was created in 1996 with subsequent modifications and is focused on diagnosing Internet addiction in social networks, does not reflect the problems of users of computer games and video films that have widely spread over the last 10 years in our population.

A survey of students using the questionnaire developed by us established that 27 people had computer addiction (25.7%) with

the range of 14 points and higher. The risk of developing computer addiction was found in 53 people (50.5%) having the range of 11–13 points.

The clinical picture of the withdrawal syndrome during the period of abstinence from the use of an addictive agent is determined by questions of the questionnaire, reflecting the corresponding symptoms: anxiety, low spirits, depression, superficial sleep with nightmarish dreams, negative attitude towards one's duties and surrounding people [8, F 48; 10, 87–111]. Table 2 shows the distribution of issues characterizing this syndrome in the questionnaire.

Table 2. – Diagnostics of withdrawal symptoms

Symptom	Part 1	Part 2
	Question No	Question No
Depression (low spirits), anguish, irritability when it is impossible to return to Internet or to a computer game and disappearance of these feelings after returning to the computer.	11	
The people around you say that you spend too much time at the computer.	12	
They say to themselves in a dream: "I just dream it!"		5
Awakening from fear and anxiety.		7
Awakening from unpleasant dreams.		6

To evaluate the results, it is suggested to consider as the basic one the answer about subjective sensations during the period of the user's abstention from the agent of addiction (part 1, question 11). Positive answers to 3 of 5 questions indicated in Table 3 may indicate the presence of abstinence syndrome in the subject. Positive answer to question 11, part 1 is obligatory for that. The results of the survey showed that an abstinence syndrome has been formed in 21 persons (20%).

Obsessive disorder (part 2, question 8) was detected in 32 persons (30.5%). To identify compulsive disorders, the questionnaire includes three questions: two about irresistible attraction to computer activities: 1) inability to turn off the computer without assistance (part 1, question 10); 2) inability to prohibit or permanently distract the user from being in the virtual world (part 1, question 13); 3) obsessive desire to commit in real life what he did in the process of computer game (Part 2, answer 13). Respondents, as a rule, resist such thoughts. As a result of the survey it was found that in 27 persons (25.7%) there were symptoms of irresistible attraction, while an obsessive desire to commit in real life what he did during the game was revealed in 31 persons (29.5%). The presence of both obsessive and compulsive disorder was established in 9 persons (8.6%) — (part 2, questions 8, 13). The questionnaire expands the ability to identify the symptoms of disorders, which will improve the diagnosis of obsessive-compulsive disorders in users of the virtual world.

In the second part of the questionnaire, the influence of images of the virtual world on mental health is analyzed: the structure of dreams, sleep disorders and the psychopathological phenomenon of an autonomous virtual image. Analysis of the dream plots allows us to identify changes in the psychology of the user, which appear under the influence of video materials of the computer media environment (part 2, questions 1–4) [Freud]. Another important symptom of a mental health disorder is sleep disturbances (part 2, questions 5–7) [11, 130–133]. This facilitates early diagnosis of the formation of anxiety disorders [12, 1–63; 13, 1093–1102].

Other symptoms of mental disorder are identified by questions 9–14 (part 2). As a result of the survey it was found that 4 persons (3.8%) see virtual images in the surrounding space for several tens of minutes after turning off the computer. Of these, three students see these images only in the dark. One of the respondents sees an image from a computer game and hears his voice and commands for several hours after turning off the computer, considering his experiences as dreaming: "like in a dream." 14 persons (13.3%) of the respondents indicated that they "feel the influence of the image from the game on themselves" (part 2, question 11). Such disorders are based on an autonomous virtual image in the form of a hallucinoid or induced hallucination, the analysis of which was carried out in a previously published article [3, 50–55; 7, 557].

Conclusion

The developed diagnostic questionnaire is aimed at people aged 18 years and older who use the media environment for entertainment purposes. The questionnaire makes it possible to conduct, on the basis of temporal parameters, data on psychological state of the user and social consequences of being in the virtual world, screening diagnostics of computer addiction, to determine the degree of its intensity, and to identify the risk group using a limited number of questions.

The questionnaire helps to reveal the symptoms of mental health disorders in users of, primarily, computer games. For the first time the influence is analyzed of the virtual world's plots on the unconscious processes manifested in dreams, the symptoms of mental health disorder in users are revealed, first of all, under the influence of computer games. The questionnaire provides the key to early diagnosis of insomnia — an important symptom of formation of anxiety disorders, which will contribute to the development of treatment and prevention programs in the early stages of computer addiction formation.

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ANNEX 1

QUESTIONNAIRE

Part 1

1. Your gender:
    a) o male
    b) o female

2. Your age (full years) _____

3. Duration of your use of the virtual world (computer games and Internet) _____

4. Accommodation conditions:
    a) o in the family/with relatives
    b) o in the hostel
    c) o in a rented apartment/room

5. In the virtual world you use (indicate options):
    a) □ computer games
    b) □ social networks and dates
    c) □ Internet surfing
    d) □ movies, television series, video reels
    e) □ cybersex
    f) □ exchange trades, gambling (including cards)

6. Have you ever played computer games?
    a) o played
    b) o did not play

7. Have you abandoned computer games for the last 2 years or more?
    a) o yes
    b) o no

8. The total number of hours spent in the virtual world during the day:
    a) o 0–3 hours.
    b) o 4–7 hours.
    c) o 8 hours or more

9. The total number of hours spent in the virtual world during the week:

a) o 1–24 hours.
b) o 25–39 hours.
c) o 40 hours or more

10. Has it ever happened that you could not leave Internet or game without outside help?
a) o often
b) o sometimes
c) o never

11. Have you experienced depression (low spirits), a feeling of anguish, irritability, if you could not return to the Internet or to a computer game, but these feelings disappeared after returning to the computer?
a) o often
b) o sometimes
c) o never

12. Do people around you say that you spend too much time at the computer?
a) o often
b) o sometimes
c) o never

13. If you are completely involved in the process of a game or Internet activity, can someone stop you from doing this for a long time or forbid it?
a) o yes
b) o no
c) o not sure

Part 2

1. In dreams you had to see:
a) □ sexually coloured plots
b) □ Plots in which people worship you, and you control and command
c) □ none of the above

2. You could see in your dreams:
a) □ punishment of yourself
b) □ punishment of others
c) □ none of the above

3. In your dreams you happened to:
a) □ continue the game
b) □ experience a sense of fixation (impossibility to move)
c) □ none of the above

4. You could see in your dreams:
a) □ dead human bodies
b) □ bloodied, dismembered bodies
c) □ none of the above

5. Have you ever said to yourself in a dream: «I just dream it!»?
a) o often
b) o sometimes
c) o never

6. Have you awakened from unpleasant dreams?
a) o often
b) o sometimes
c) o never

7. Have you ever woken up from fear and anxiety?
a) o often
b) o sometimes

c) o never

8. Do you have in your mind (head) an image of the virtual world after the end of the game or exit from the Internet?
   a) o often
   b) o sometimes
   c) o never

9. If you saw the image (s) of the virtual world (or its graphics) after the end of the game or exit from Internet, then indicate the options:
   a) □ it sits, stands, moves (*underline*)
   b) □ appears only in the dark
   c) □ none of the above

10. This image may do the following:
    a) □ talk to you, to others, argue, explain, prove
    b) □ command
    c) □ none of the above

11. Have you ever felt that the virtual image influences you?
    a) o often
    b) o sometimes
    c) o never

12. Have you ever felt that the image from the game controls you?
    a) o often
    b) o sometimes
    c) o never

13. Have you experienced a compulsive craving to repeat in real life what you did in the game?
    a) o often
    b) o sometimes
    c) o never

14. How long do you see this (these) image (s) and/or experience the above feelings?
    a) o days
    b) o hours/minutes (*underline*)
    c) o never

Processing Results

Table 1. – Processing the results of the answers on the first part of the questionnaire.

Points	Questions						
	5*	8	9	10	11	12	13
1	1–2	A	a	A	a	A	a
2	3–4	B	b	B	b	B	b
3	5–6	C	c	C	c	C	c

* numerical score by the number of marked points

Table 2. – Processing the results of the answers on the second part of the questionnaire.

Points	Questions					
	1	2	3	4	5	6
1	c	C	C	C	C	c
2	a or b	a or b	a or b	a or b	a or b	a or b
3	a+b	a+b	a+b	a+b	A	a

INSTRUCTIONS FOR EVALUATING TEST RESULTS

Part 1

Questionnaire for determining the degree of involvement in the computer virtual world

7 –10 points. There were no signs of the formation of computer dependence. Priority of interests of the real world remains.

Recommendation: observe the time limit for entertainment in the virtual world: 15 hours a week.

11–13 points. The result of testing revealed the signs of pathological involvement: withdrawal and tolerance syndromes: feeling of well-being increasingly depends on a long stay in the virtual world. The degree of involvement in entertainment available through computer acquires the features of dependence. This leads to the substitution of the interests of real life by the events of the computer virtual world, which has a devastating effect on mental and physical health.

Recommendation: if the time spent on entertainment in the virtual space is close to 30 hours a week, it should be reduced to 15 hours.

14 to 17 points. The result of the questionnaire indicates a computer dependency. Entertainment in the computer virtual world has a devastating effect on mental and physical health, which leads to illness.

Recommendation: limit the number of forms used to one of those listed in the questionnaire. If the time of using the computer is 30 or more hours per week, then it should be reduced to 15 hours and scenarios showing violence should be avoided. Consult a psychologist and/or a psychotherapist.

18 or more points. The results of the questionnaire indicate that a severe form of computer addiction has been formed. Changes in physical and mental health are pathological in nature with a high probability of irreversibility in the future. The destructive impact of the computer virtual world on personality and the mental state is accompanied with a reduced ability to properly assess and adequately respond to the events in real life.

Recommendation: refuse to use the computer and consult a psychotherapist.

Part 2

The degree of influence of the computer virtual world on the user's emotional state and mental health.

13 –14 points. No specific disorders in the state of health.

15–17 points. The result of testing indicates the tendency to satisfy the ideas of one's own greatness and interests of a sexual nature in the virtual world. This distorts the perception of the surrounding world and damages the interests of real life. The prerequisites for a permanent return to the virtual world are created.

Recommendation: limit the time of using the computer and refuse to play aggressive games.

18–22 points. The plots of the virtual world acquire a dominant position over the events of real life. The user is captivated and simultaneously enslaved by the ability to meet any of his/her desires in computer games and other video content. This creates the prerequisites for the formation of anxiety disorders and depression. The appearance of dreams with dead and bloody bodies is a sign of a serious mental health disorder.

Recommendation: consult a psychologist and a psychotherapist.

23 –28 points. The impact of the virtual world has caused pathological mental changes, which are becoming persistent. The presence of anxiety during sleep and in dreams testifies to the perception of the threat, the source of which is the plots and events of the virtual world. The image of this world (simulacrum) has a significant impact on your mental health.

Recommendation: abandon aggressive plots in computer games and videos. Consult a therapist for the treatment of anxiety neurosis.

29 or more points. Interaction with images of the virtual world has acquired an intimate nature, which caused painful (pathological) changes in your health with a high probability of irreversibility. Formation of disorders of mental function is possible in the form of paranoia and hallucinations. Realization of real relationships in the ordinary surrounding life will become impossible.

Recommendation: Avoid using the computer for entertainment and consult a psychiatrist.

Section 8. Agricultural sciences

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EFFECT OF NATURAL ZEOLITE AND PEAT ON NITOGEN DYNAMICS IN A SANDY SOIL

Abstract

Alaboratory incubation study was carried out at the Agricultural University of Tirana (Albania) to determine the effect of natural zeolite (Stilbite-Stellerite) andpeat application on nitrogen dynamics in a sandy soil (Haplic Arenosols). The treatments under this study were: T1 Soil (control), T2 Soil + $N_{300}P_{225}K_{180}$, T3 Soil + Z_1 (6 q ha^{-1}), T4 Soil + Z_2 (12 q ha^{-1}), T5 Soil + NPK + Z_1, T6Soil + NPK + Z_2, T7Soil + NPK + Z_1 + P_1 (4. 99%), T8 Soil + NPK + Z_2 + P_1; T9Soil +NPK+Z_1 + P_2 (9. 99%), T8 Soil +NPK + Z_2 + P_2. Theresults indicatedan increasein soil NO_3^- concentration on the 20th day of incubation for two treatments with zeolite and peat at the rate 4. 99 g, and on the 10th day for the treatment with double rate of zeolite and peat at the rate9. 99 gcompared with control. Increasing zeolite application led to a decrease in the NO_3^- concentration during the incubation period. While increasing peat rate led to a considerable increase in the NO_3^- concentration. Duration of incubation significantly affected soil NO_3^- concentration. Increasing zeolite rate causedan obvious decrease in the soil NO_3^- concentration on the 30th day. On the contrary, increasing peat rate causedan increasein the soil NO_3^- concentration during 30 days of incubation. Increasing zeolite and peat at the rate 9. 99 g application caused an significant increase in the soil NH_4^+concentration on the 20th day. This could be explained with adsorption of NH_4^+ in the zeolite mineral lattice and on the peat exchange sites. Zeolite and peat applied alone or in combination could reduced nitrogen losses by retaining NO_3^- and NH_4^+ ions in soil.

Key words: nitrate, ammonium, stilbite-stelleritezeolite, peat, sandy soil, Albania.

1. Introduction

The loss of plant nutrients through leaching is a form of soil chemical degradation, which adversely effects plant productivity, environmental quality and human health. Among nutrients, nitrogen is easily leached from soil, especially from the light-textured sandy soils. This because sandy soils generally have low cation exchnge capacity and low clay and organic matter contents. Losses of nitrogen in agroecosystems increase the potential for human health impacts and environmental degradation [2] Therefore, the agroenvironmental research that improves nitrogen use efficiency and decrease its losses is a crucial issue. Zeolite and peat had the highest affinity for ammonium and the highest ammonium adsorption capacity [10]. Results of a pot experiment with reygrass (*Lolium multiflorum*), where three zeolite rates (6 q ha^{-1}, 12 q ha^{-1} and 5%, w/w basis) were applied to a sandy soil, indicated a reduction in the rate of decline of soil organic matter and nitrogen contents with increasing application rate of zeolite [1]. Research on the use of natural soil emendments with mineral fertilizers in Albania is missing. Therefore, a labora-

tory incubation experiment was carried out to investigate the effect of zeolite and peat application on the nitrogen dynamics in a sandy soil (Haplic Arenosols) treated with NPK fertilizers.

2. Material and methods

The properties of the materials used in the experiment are presented in Tables 1–3. The experimental soil (a sandy soil that belongs to Haplic Arenosol according to *WRB, FAO* 2006)was collected from 0–30 cm depth of anagricultural field of the Divjaka, which had received NPK fertilizers and manure over many years. The soil properties were described in detail by Ceci et al. [8].

The determination of soil properties were made in the laboratories of the Department of *Agro-envirnment* and Ecology, Agricultural University of Tirana, Albania (Table 1). The soil was moderate alkaline in reaction (pH H_2O=8. 04), medium in organic matter (2. 33%), low in total nitrogen (0. 06%), nitrate nitrogen (0. 43 mg/kg) and ammonium nitrogen (4. 04 mg/kg), and has a low cation exchange capacity — CEC (14. 14 meq/100 g).

Table 1. – Chemical properties ofused soil

Property	Unit	Value
pH H_2O	–	8. 04
pH KCl	–	7. 56
CEC	meq/100 g	14. 15
Organic matter	%	2. 33
Total-N	%	0. 06
NO_3^-	mg/kg	0. 43
NH_4^+	mg/kg	4. 04
Available-P	mg/kg	4. 81

The zeolite used in this study was collected from the Munella deposits, northern Albania (zeolite was extracted from the depth with a probe). Chemical composition of the zeolite was determined in the laboratories of the Soil Science and Soil Conservation Institute of Justus-Liebig University of Giessen, Germany (Table 2). Cation exchange capacity (CECpot) of the zeolitic material was low (6. 72) meq/100 g, electrical conductivity (EC) was 91 µS/cm, $CaCO_3$ was < 0. 5% and pH (H_2O) was 7. 8.

Table 2. – Chemical composition of used zeolite

Property	Unit	Value
1	2	3
pH (H_2O, 1:5)	–	7. 8
$CaCO_3$	%	<0. 5
CECpot	meq/100g	6. 72
EC (1:5)	µS/cm	91
K	mg kg^{-1}	3. 91
Na	mg kg^{-1}	75. 90
Ca	mg kg^{-1}	1196

1	2	3
Mg	mg kg^{-1}	33. 60
Mn	mg kg^{-1}	ND
Fe	mg kg^{-1}	33. 60

ND – not detected

The properties of tested peat (reed-sedge peat) are preasente in Table 3. The peat has a relatively high pH (pH H_2O=7. 44), a high CEC (74,6 meq/100gr), low EC (0. 22 mS/cm), high total nitrogen (2. 07%), and low nitrate and ammonium nitrogen (0. 07mg/kg and 7. 30 mg/kg, respectively).

Table 3. – Chemical composition of used peat

Property	Unit	Value
pH H_2O	–	7,44
pH KCl	–	6,84
CEC	meq/100gr	74,6
Organic matter	%	42. 6
EC (1:5)	mS/cm	0. 22
Total-N	%	2,07
NO_3^-	mg/kg	0. 07
NH_4^+	mg/kg	7,30
Available-P	mg/kg	29,425

The zeolite and peat were mixed with experimental soil, and then were incubated in aerobic conditions at 25 °Cand relative humidity of 75% for 30 days inan incubator. The incubation experiment was conducted at the laboratories of the Agricultural University of Tirana, during October — November 2016. The experiment was set up with 10 variants and 6 replicationsin the form of a randomized block design.

Table 4. – Experiment variants

Variant	Material	Amount
T_1 (control)	Soil	100 g
T_2	Soil +NPK	99,94 g Soil+0. 06 g NPK
T_3	Soil+Z_1	99. 98 g Soil+0. 02 g Zeolite
T_4	Soil+Z_2	99. 96 g Soil+0. 04 g Zeolite
T_5	Soil+NPK+Z_1	99. 92 g Soil + 0. 06 g NPK +0. 02 g Zeolite
T_6	Soil+NPK+Z_2	99. 90 g Soil + 0. 06 g NPK +0. 04 g Zeolite
T_7	Soil+NPK+Z_1+P_1	94. 93 g Soil + 0. 06 g NPK + 0. 02 g Zeolite+ 4. 99 g Peat
T_8	Soil+NPK+Z_2+P_1	94. 91 g Soil + 0. 06 g NPK + 0. 04 g Zeolite+ 4. 99 g Peat
T_9	Soil+NPK+Z_1+P_2	89. 93 g Soil + 0. 06 g NPK + 0. 02 g Zeolite+ 9. 99 g Peat
T_10	Soil+NPK+Z_2+P_2	89. 91 g Soil + 0. 06 g NPK + 0. 04 g Zeolite+ 9. 99 g Peat

Z=zeolite; P= Peat: NPK=300:225:180 kg ha^{-1}

Plastic bottleswere filled with 100 g of mixtures: soil + zeolite + NPK and soil + peat + NPK. Every two days, the bottles are weighed and watered with distilled water as needed. Bottles were destructively sampled on days 3, 10, 20 and 30 and analyzedfor NO_3^-, NH_4^+, and total nitrogen. Total N was measured in a *spectrophotometer* at *655 nm*. NO_3^- was measured in a *spectrophotometer* at *220/275 nm*, NH_4^+ was measured in a spectrophotometer at 655 nm. The total nitrogen, nitrate and ammonium contentswere expressed in mg/kg of dry matter. ANOVA wasused to analyze the data. The LSD test at p<0. 05 was used to find statistical differences between the studied treatments.

3. Results and discussion

3. 1 Nitrate accumulation during incubation

The ANOVA results indicated that the effect of zeolite and peat application on nitrate accumulation was insignificant (p<0. 05) (Table 5).

Table 5. Results of ANOVA for nitrate accumulation

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	866,8152	3	288,9384	1,439338	0,247403	2,866266
Within Groups	7226,782	36	200,7439			
Total	8093,597	39				

However, nitrate concentration in soil increased on the 20th day of incubation for both zeolite (at two rates) and peat (at the rate of 4. 99 gr/pot), on the 10th day for both zeolite (at two rates) and peat (at the rate of 9. 99 gr/pot), compared to control. In general, increasing zeolite rate led to a decrease in NO_3^- concentration during the incubation period (Fig. 1).
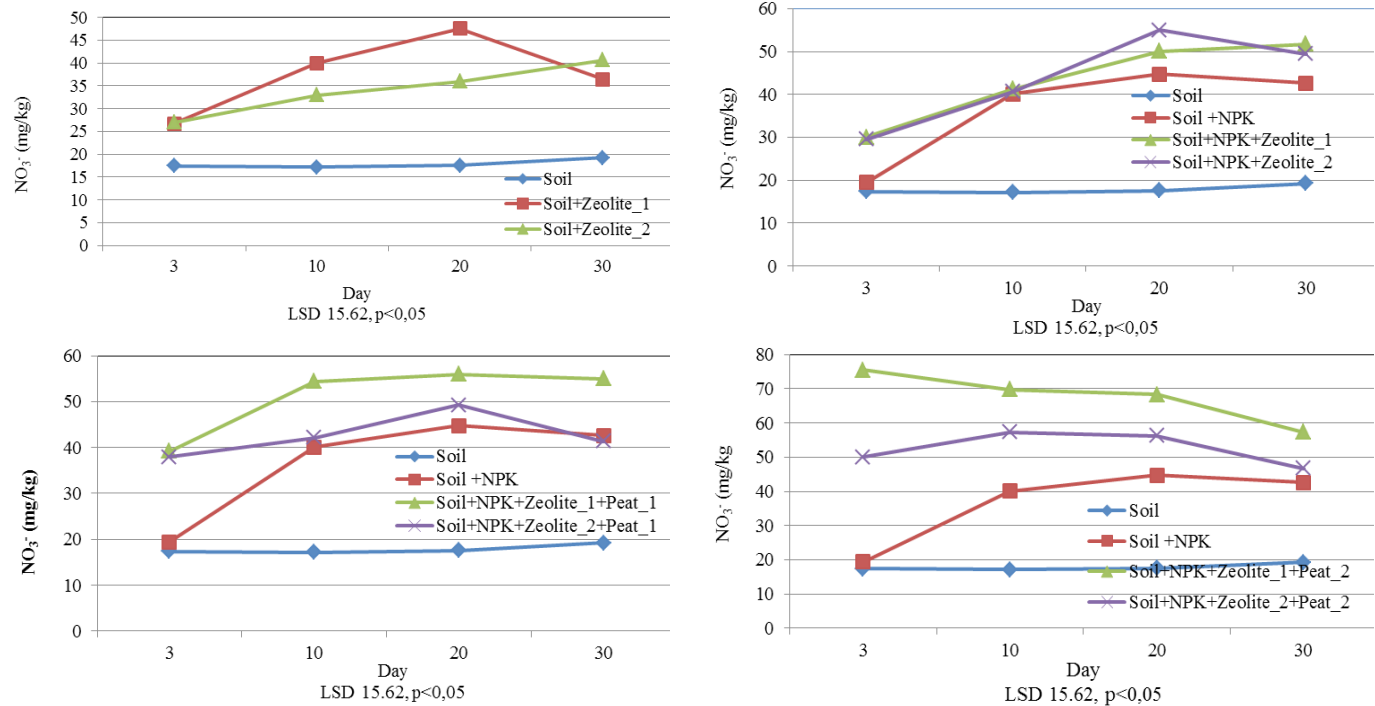
Figure 1. Effect of zeolite and peat application on nitrate accumulation in soil

On the other hand, increasing peat rate led to a significant increase in NO_3^- concentration. The incubation perioddid not have a signifiant effect on NO_3^- concentration in the soil. Increasing zeolite arte caused a significant decrease (21. 5%) in the NO_3^- concentration on the 30th day for both rates of peat application. While increasing peat rate caused increased NO_3^- concentration in soil during the incubation period.

3. 2 Ammonium accumulation during incubation

The ANOVA indicated that the effect of zeolite and peat application on amonium accumulation in soil was insignificant (p<0. 05) (Table 6).

Table 6. – Results of ANOVA for ammonium accumulation

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	56,06275	3	18,68758	1,111153	0,357293	2,866266
Within Groups	605,455	36	16,81819			
Total	661,5178	39				

Use of NPK fertilizers increased NH_4^+ concentration in soil as compared to control (soil alone). Also, the NH_4^+ concentration was significantly higher in soils where the NPK fertilizers were used in combination with zeolite and peat than in soil where the NPK were used alone. The higher concentrations of soil exchangeable NH_4^+ in these treatment can be explained by the fact that that portions of NH_4^+ released during NPK hydrolysis were adsorbed onto the exchange surface of zeolite and humic substances of peat.

The retention of soil NH_4^+ could be attributed to the high CEC of the used peat.

In all tretments with PNK, zeolite and peat, the NH_4^+ concentration in soilobviously decreased during the incubation period. However, the NH_4^+concentration was higher in comparison with the control (soil alone) (Fig. 2). The NH_4^+concentration was also higher at higher rate of zeolite applicationon on the 30th days of incubation.

On the other hand, the use of peat increased significantly NH_4^+ concentration in soil as compared to the use of zeolite alone. The NH_4^+ concentration increased on incubation with increasing peat rate application. The NH_4^+ concentration in soil decreased during the incubation period. The highest decrease in

NH_4^+ concentration was on the 30th days of incubation. This can be explained by the adsorption of NH_4^+ ions in the structure of zeolite and peat. The application of zeolite and peat alone or in combination can reduce nitrogen losses by retaining the NO_3^- and NH_4^+ ions in the soil.
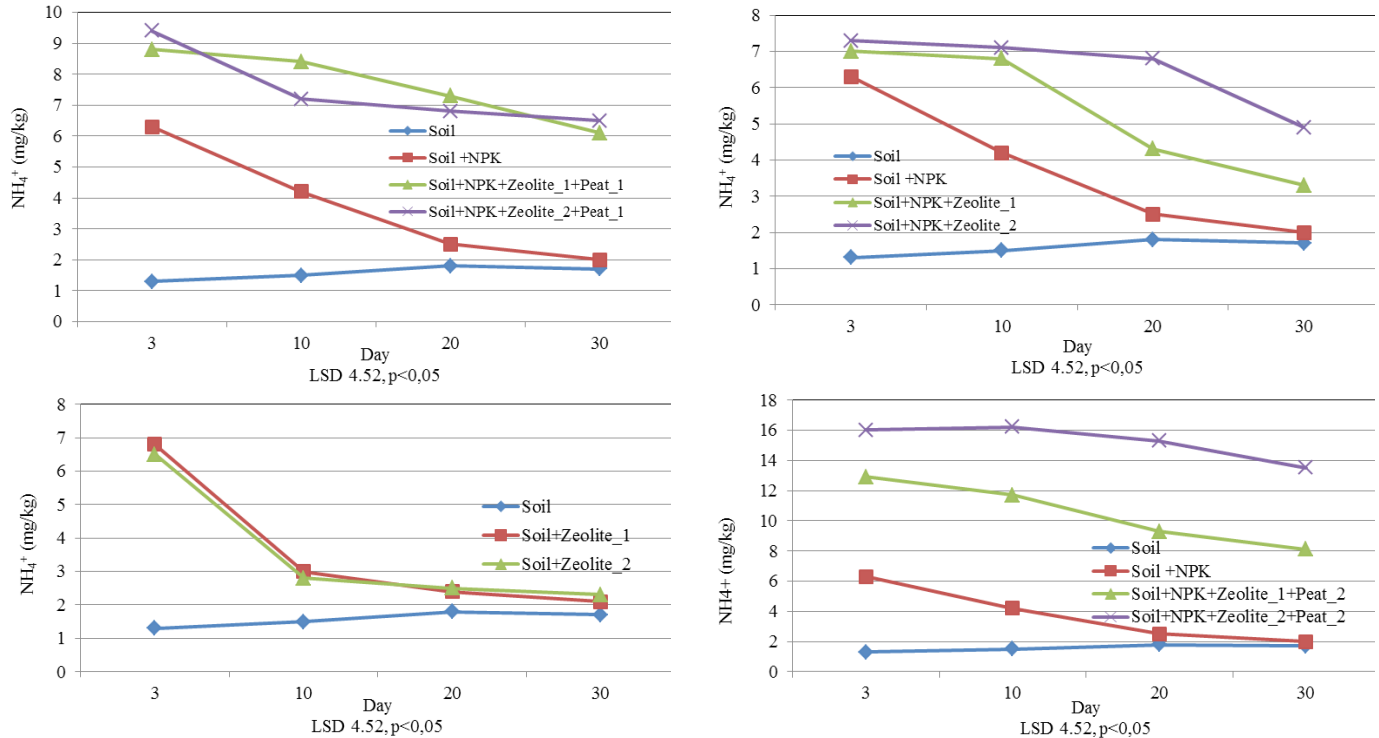
Figure 2. Effect of zeolite and peat application on ammonium accumulation in soil

Similar results have been reported in literature by Klein and Appel [3], Kristensen [4], Latifah et al. [5], Lija et al. [6], Omar et al. [7], Perrin et al. [9] and Witter and Kirchmann [10].

4. Conclusion

The effect of zeolite and peat on NO_3^- and NH_4^+ accumulation in soil was insignificant on incubation. It was observed an increase in soil NO_3^- concentration on the 20th day of incubation for treatments with zeolite and peat at the rate 4. 99 g, and on the 10th day for the treatment with double rate of zeolite and peat at the rate9. 99 g compared with control. Increasing zeolite rate led to a decrease in the NO_3^- concentration during the incubation period, while increasing peat rate led to a considerable increase in the NO_3^- concentration.

The incubation period significantly affected NO_3^- concentration in soil. Increasing zeolite rate caused an obvious decrease

(21.5%) in the soil NO_3^- concentration on the 30th day, and increasing peat rate caused an increase in the soil NO_3^- concentration during the incubation period. At the higher zeolite and peat rates an significant increase in the soil NH_4^+ concentration on the 20th day as noticed. This could be explained with adsorption of NH_4^+ in the zeolite mineral lattice and on the peat exchange sites. Zeolite and peat could be used as soil amendment to reduce nitrogen losses by retaining NO_3^- and NH_4^+ ions in soil.

5. Acknowledgments

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PROBLEMS OF DEVELOPMENT AND TESTING OF TILLERS FOR MECHANIZATION OF CULTIVATION

Abstract: The problems of research, development and testing of machinery and equipment cultivation of vineyards. Test's of some tillers for the cultivation of vineyards. The analysis of indicator's of technological machines process during the laboratory and field studies.

Keywords: Vineyards, machines and tools, cultivator, hoeing, laboratory and field testing, quality indicators, working depth, energy.

Design and creation of agricultural machinery is not possible without the test phase, which is the most decisive of their industrial and economic feasibility. During the tests revealed not only the line of agricultural machinery standards and the requirements of the stated specifications, but also reveals the level of production. Efficiency and nature of the requirements in the standards developed allow us not only to determine the reliability and safety of the structure of agricultural machinery, to assess their technical and economic parameters, but also at the same time reveal the nature of certain phenomena occurring defects.

The work of the research and creation of machines and equipment is engaged in several research, design, universities and institutions for the cultivation of vineyards in Uzbekistan. The Uzbek State Centre for Certification and testing of agricultural equipment and technologies under the Cabinet of Ministers of the Republic of Uzbekistan (UzGTsITT) also conducted research in this area, namely, the tests are carried out to create and design of machines and tools for the cultivation of vineyards.

It is known that the main characteristic features of the technique and equipment for the cultivation of vineyards, in our conditions is their adaptability to a method of covering.

Currently, not all wine-growing holdings of special machines and tools are used, intended for the cultivation of vineyards. Therefore, there are cases when using equipment designed for other crop sectors.

The use of this technique is not always justified because of the lack of data on the optimal parameter and affecting the dimensional characteristics, the choice of mode of working parts, hardware and tools. In addition, the relevant questions are to improve and develop machines that perform operations such as tillage between the rows and shrubs (tree trunks) areas vineyards.

Embarked these questions indicates the urgent need to address the structural problems of the development of machinery and equipment and introducing them into production.

The main goal of the research is:

– identification of the subject during the study of laboratory-field experiments and identifying dependencies and influencing

factors on the functioning of the laws of machines, tools and working body used in the cultivation of vineyards;

– determination of the prerequisites and directions to justify the choice of method of cultivation in the cultivation of vineyards, allowing the use of these machines and technical equipment for soil cultivation between the rows and the areas between the bushes;

– identify and propose to develop an optimal design and technological scheme of machines and equipment for the cultivation of vineyards.

After a preliminary determination of acceptable parameters and operating modes of the working bodies of the test program included testing in the vineyards in the production environment performance of machines and tools.

The overall objective of the research is:

– study of the conditions of work of technical equipment in the vineyards in the processing of row spacing in a single pass and preform technology with a number of machines, general purpose tools;

– identify the best structural and operational parameters of machines and equipment;

– produce production test, make samples of technical equipment and machinery;

– to determine the efficiency of the developed technology and technical solutions.

To accomplish these tasks, experts UzGTsITT together some test tillers were held with the engineers and designers of the Head Specialized Design Bureau JSC «BMKB-Agromash» used in the cultivation of vineyards [1; 2].

During the tests were checked work machines performing in areas sheltered viticulture the most energy-intensive manufacturing operations.

One of the labor-intensive processes in the technology of cultivation is soil cultivation in vineyards. To make cultivation, cultivation between the rows and the continuous loosening soil the areas between the bushes bands were developed and tested cultivator's vineyard UK-3. Cultivators designed for loosening operations in the vineyards with row spacing of 2,5 m and 3 m. It may be aggregated with tractors of class 2 and class 3 or 4. The cultivator consists of a frame on which are installed a set of interchangeable working bodies with a flat cutting. Development cultivators produced with the use of technical solutions on the domestic element base.

Prior to the field test laboratory previously determined by the conditions of their realization: site characterization and plantations.

Analysis of the data given shows that the test condition's were typical for the area and characterized by low humidity and high hard-

ness of the lower layers of soil in the summer and autumn periods due to a lack (deficiency) of irrigation water.

When tested vineyard cultivators UK-3 was carried out, with a production test in the economic conditions in the vineyards tapestry type and in the vineyards no tapestries. Laboratory and field studies were conducted to evaluate the quality indicators of the machine [2].

Agro technical evaluation of cultivators vineyard UK-3, inter-row tillage and shrubs (tree trunks) areas vineyards, carried out at a speed of 3,91 km/h of movement of the unit in the vineyards tapestry type and in the vineyards no tapestry type at a speed of 6,0 km/h (on the technical task — 6,4 km/h):

– moisture content of the soil in the vineyards tapestry type was 3,7% and, respectively, in the vineyards without tapestry type 12,1% (on the technical task – 13–20%);

– the hardness of the soil in the vineyards tapestry type was 0,9 MPa, respectively, and in the vineyards no tapestry type 0,35 MPa (on the technical task of not more than 0,5 MPa);

– the depth of tillage operations on the cultivation of row spacing was 18,0 cm in the vineyards tapestry type and, accordingly, 18,5 cm tapestry type (under the technical project – 10 ± 2 cm);

– the depth of tillage operations when hoeing between the rows with processing areas between the bushes bands was 14,0 cm in the vineyards tapestry type and respectively 18,95 cm – without tapestry type (under the technical project – 20 ± 5 cm);

– cropping (destruction) of weeds in the area of the passage of the working bodies in the aisle between the rows hoeing operations amounted to 90,8% and, respectively, between the rows hoeing operations with processing areas between the bushes bands of 84% (on the technical task of not less than 80%);

– the width of the untreated strips in each row in the processing of the bushes was 16,4 cm (on the technical task of not more than 15 cm);

– distance from the treated part of the aisle to a number of axis for hoeing between the rows was 26,8 cm (on the technical task of not less than 25 cm).

Preliminary calculations have shown the use of cultivators UK-3 for row crop and tillage between the bushes in the cultivation of vineyards to reduce energy consumption to an average of 1, 2 times.

According to the results of agronomic evaluation cultivator's tillage vineyard with vines between the bushes, UK — 3 basically meet the requirements of technical specifications of the project. Based on the analysis of the data, in the future plan's of the planned conduct an improved sample test ripper cultivator.

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SAMPLE ENRICHMENT RESULTS OF ORE DEPOSITS BY USING TRADITIONAL AND LOCAL REAGENT "PS" IN KALMAKYR AND SARICHEKU (UZBEKISTAN)

Abstract: The work presents factual results of study of material structure and enrichment of tests of ores of deposits in Kalmakyr and Saricheku.

As a result of the carried out researches the recommended circuits of enrichment of ores with the use of a combination of the traditional collector and "Program Facilities" are developed by 50% of a mix ksantogenats and the concentrates of higher quality are received.

Keywords: reagent, pyrite, chalcopyrite, molybdenite, magnetite, hematite, galenite, sphalerite potassium butyl xanthate, potassium isopropyl xanthate.

In the Republic of Uzbekistan at the concentrators in the beneficiation of various ores using traditional reagents manufactured abroad. Currently, it has become necessary to test local reagents and their introduction to the industry. Replacing conventional reagents new — import-reactants is important. Creating reagents manufactured using local raw materials will replace the traditional hard-reactants and save a significant amount of currency.

Currently, the country has four plants in which floated copper — molybdenum ore — Copper enriching fabric (CEF), Zinc enriching fabric (ZEF) and gold ores — Angren gold enriching fabric (GEF) and GMP — 3 Government company "Navai Mining and Metallurgical Company". As the main agent — a collector of these enterprises used the BKK, as a foaming agent T — 80 or T — 92. In this paper we present the results of research on beneficiation of copper ore deposits Kalmakyr samples and Sarycheku traditional and local "PS" reagents. Ore samples are prepared according to standard procedure.

In order to study the material composition of ore samples taken samples for mineralogical analysis, the mean of the sample prepared for spectral, chemical and particle size analysis.

Chemical analysis of the sample of ore deposits Kalmakir defined in (%): SiO_2–59,22; Fe_{total} – 6.17; Fe_2O_3–5.38; FeO – 3,1; TiO_2–0.4; MnO – 0,14; Al_2O_3–13,26; CaO – 1,68; MgO – 3,2; K_2O – 4.74; Na_2O – 0.32; S_{total} – 0.62; S_{sulf} – 0.56; SO_3–0,15; CO_2–2,75; P_2O_5–0,3; H_2O – 0.98; Cu – 0.48; Pb – 0,04; Zn – 0,05; As – 0.02; Mo – 0,006; Au – 0,6 g/t; Ag – 6,94 g/t. In addition, spectral analysis found: (in%): Ni – 0,003; Co – 0,001; V – 0,002; Cr – 0,03; Zr – 0,006; Ga – 0,002; Be <0,001.

The mineral composition of samples of ore is quite simple, the main ore minerals in them are pyrite, chalcopyrite and molybdenite. Also, there is a marked amount of magnetite, hematite, iron oxides and hydroxides (goethite, hydrogoethite, limonite). Among the accessory minerals are galena, sphalerite, faded ore, chalcocite, bornite and covellite. The main non-metallic mineral samples are quartz, feldspars, chlorite and sericite; secondary — biotite, hornblende, carbonates.

Chalcopyrite — major industry — valuable mineral ores investigated. Its content in the sample is 0.9%. Molybdenite is 0.01% of the ore. This mineral is unevenly distributed in shtufnom material and is confined to the non-metallic minerals [1].

Chalcocite — the content of its 0.05% of the ore. This mineral is closely associated with chalcopyrite. Covellite — content in the sample is 0.03%. Forms switching ON a few thin, hair-like veins in non-metal mass, evolves with chalcocite of chalcopyrite, pyrite less. The high content of the ore sample sericite, muscovite (8%) and chlorite (15%) of ore processing properties deteriorate.

Chemical analysis of the sample number 1 ore deposit Sarycheku defined in (%): SiO_2– 56,3; Fe_{total}– 2,66; Fe_2O_3–1,52; FeO – 1,98; TiO_2– 0,43; MnO– 0,09; Al_2O_3–12,2; CaO – 2,24; MgO – 15,4; K_2O – 5,84; Na_2O – 0,92; S_{total}– 1,58; S_{sulf}– 1,53; SO_3–0,12; CO_2–0,88; P_2O_5–0,13; Cu– 0,36; Pb – 0,004; Zn – 0,008; As – 0.01; Mo – 0,002; Au – 0.2 g/t..; Ag – 4,7. Semi-quantitative spectral analysis in high ore sample is defined (in%): Ni – 0,002; V – 0,004; Cr – 0,003; Zr – 0,004; Ga – 0,001; Be <0,06; Sr – 0,01; Be <0,001; I – 0,001.

Copper ore was floated by the schemes shown in Fig.1 and Fig.2. A copper minerals to float a mixture of potassium butyl xanthate (BKK) with potassium isopropyl xanthate (IPKK) in a ratio of 1: 1.

Driving flotation of copper ore.

In experiments designed mode shown in open and closed loop (on the principle of a continuous process), the results of which are shown in Table 1.

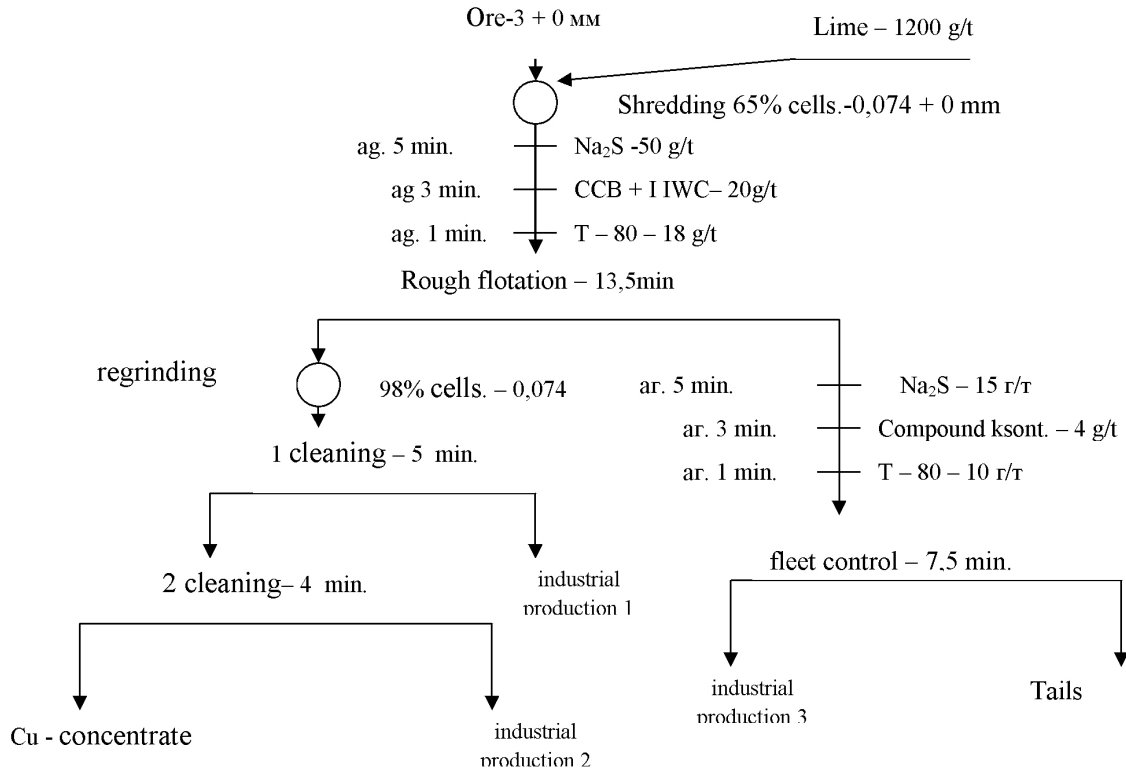Results of experiments samples flotation ore deposits Kalmakyr using conventional reagents optimally.

Ore-3 + 0 мм   Lime – 1200 g/t

Shredding 65% cells.-0,074 + 0 mm

ag. 5 min.   Na₂S -50 g/t

ag 3 min.   CCB + I IWC– 20g/t

ag. 1 min.   T – 80 – 18 g/t

Rough flotation – 13,5min

regrinding   98% cells. – 0,074   аг. 5 min.   Na₂S – 15 г/т

1 cleaning – 5 min.   аг. 3 min.   Compound ksont. – 4 g/t

аг. 1 min.   T – 80 – 10 г/т

2 cleaning– 4 min.   industrial production 1

fleet control – 7,5 min.

Cu - concentrate   industrial production 2

industrial production 3   Tails

Figure 1.

Table 1.

Products	Yield,%	Content,%,		Extraction,%	
		copper	sulfur	copper	sulfur
Open loop					
Concentrate	2,0	18,47	34,56	80,3	10,6
Industrial production 1	5,4	0,26	3,86	3,0	3,2
Industrial production 2	3,1	0,62	7,15	4,2	3,4
Industrial production 3	6,5	0,23	25,76	3,2	25,7
Tails	83	0,051	4,49	9,3	57,1
Ore	100,0	0,46	6,52	100,0	100,0
Closed cycle (according to the principle of a continuous process)					
Concentrate	2,5	16,57	35,86	86,3	13,7
Tails	97,5	0,067	5,81	13,7	86,3
Ore	100	0,48	6,56	100,0	100,0

Using a local agent «PS» flotation tests were carried out in the open and closed loop. The consumption of a mixture of Xanthi-gena-tovreduced 50% with the addition of the reagent «PS» — 150 g/t, the other reagents unchanged [2]. The results of the experiments are given in Table 2.

The experimental results of flotation samples of ore deposits Kalmakyr using a reagent of the «PS»

Table 2.

Products	Yield,%	Content,%		Extraction,%	
		copper	sulfur	copper	sulfur
1	2	3	4	5	6
Open loop					
Concentrate	1,4	28,43	42,71	79,6	9,2
Industrial production 1	4,6	0,39	7,07	3,6	5,0
Industrial production 2	2,8	0,79	11,38	4,4	4,9

1	2	3	4	5	6
Industrial production 3	5,9	0,36	31,73	4,2	28,8
Tails	85,3	0,048	3,97	8,2	52,1
Ore	100,0	0,50	6,5	100,0	100,0
Closed cycle (according to the principle of a continuous process)					
Concentrate	1,8	22,96	42,27	86,1	11,6
Tails	98,2	0,067	5,91	13,9	88,4
Ore	100,0	0,48	6,56	100,0	100,0

Comparing the results shown in Table. 1 and 2, it can be concluded that the indicators on the recovery of copper in the general embodiments similar reagent regime: in open loop extracting copper flotation concentrate is 79.6–80.3%, in a closed circuit 86.1–86.3%. The quality of the content of copper concentrates above the local agent «PS»: 28.43% vs. 18.47% copper in concentrate of open cycle and 22.96 against 16.57% closed. When the sample number 1 flotation of copper ore deposits Saricheku defined the following optimum mode using conventional flotation reagents grinding fineness,% cl. – 0.074 mm – 65; reagent consumption g/t: a grinding lime (CaO on) – 400; a primary flotation Na$_2$S – 40.

BKK + IPKK – 15; T – 80–20; the control of the fleet-tion Na2S – 8; BKK + IPKK + – 7.5; T – 80–10; before grinding rougher concentrate,% cl. – 0.074 mm – 98.0; flotation time, minutes: the main – 10; Control –cleaning-up 1–5cleaning-up – 4. In the developed operation conducted experiments in open and closed loop. The results are shown in Table. 3. If you use a local agent "SS" reagent consumption amounted collectors, g/t; the main "SS" – 100; BKK IPKK + – 7.5; the control BPC IPCC + – 3.5; remaining unchanged [3].

In the developed operation conducted experiments, the results of which are shown in Table 4.

The experimental results of sample number 1 flotation ore deposits Saricheku using conventional reagents optimally.

Table 3.

Products	Yield,%	Content,%,		Extraction,%	
		copper	sulfur	copper	sulfur
Open loop					
Concentrate	1,8	17,56	15,02	83,2	16,9
Industrial production 1	5,7	0,19	1,18	2,9	4,2
Industrial production 2	3,2	0,51	1,9	4,3	3,8
Industrial production 3	6,8	0,16	6,87	2,8	29,2
Tails	82,5	0,031	0,89	6,8	45,9
Ore	100	0,38	1,6	100,0	100
Closed cycle (according to the principle of a continuous process)					
Concentrate	2,1	15,29	15,12	89,2	20,1
Tails	97,9	0,039	1,29	10,8	79,9
Ore	100	0,36	1,58	100	100

The results of experiments flotation ore deposits of Sarycheku using local agent «PS» and 50% of the mixture xanthates.

Table 4.

Products	Yield,%	Content,%,		Extraction,%	
		copper	sulfur	copper	sulfur
Open loop					
Concentrate	1,2	24,15	22,88	82,8	17,6
Industrial production 1	4,6	0,23	1,19	3,0	3,5
Industrial production 2	4,3	0,37	1,34	4,5	3,7
Industrial production 3	5,9	0,18	6,93	3,0	26,2
Tails	84,0	0,027	0,91	6,7	49,0
Ore	100,0	0,35	1,56	100,0	100,0
Closed cycle (according to the principle of a continuous process)					
Concentrate	1,5	21,6	24,65	90,0	23,4
Tails	98,5	0,036	1,23	10,0	76,6
Ore	100,0	0,36	1,58	100,0	100,0

Comparing the results of the experiments are listed in Table. 3 and 4, it can be assumed that the figures for the extraction of copper is almost identical, but the quality concentrate higher in experiments with «PS».

The studies developed recommended flotation circuit samples and ores Kalmakyr and Sarycheku using a combination of traditional collector and «SS» in saving the BPC + IPCC at 50% and obtained flotation concentrate of higher quality.

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SUBSTANTIATION OF THE PARAMETERS OF ARC-SHAPED FURROW-OPENER KNIFE

Abstract: The results of theoretical researches on substantiation of the parameters of furrow-opener, developed for a seeder for sowing cereal crops in the inter-row of cotton-plant are specified in the article. It is determined that in effort to ensure the qualitative performance of set technological process at minimum energy expenditures, the inlet angle of furrow opener knife penetration into soil must be at least 125º, the radius of its curvature shall not be less than 160 mm, and the sharpening angle — 67º.

Keywords: arc-shaped furrow-opener, knife, the inlet angle of furrow opener knife penetration into soil, the radius of its curvature and sharpening angle.

We have developed furrow-opener to seeder for sowing cereal crops in the cotton-plant inter-rows [1]. It consists of an arc-shaped knife 1, a seed-line 2 and is fixed to the muzzle of a parallelogram mechanism by means of post 3 (fig. 1, a).

The following are the main parameters of knife of the developed furrow-opener (fig. 1, b): a_δ – the angle of entry into the soil; R – radius of curvature; γ – sharpening angle.
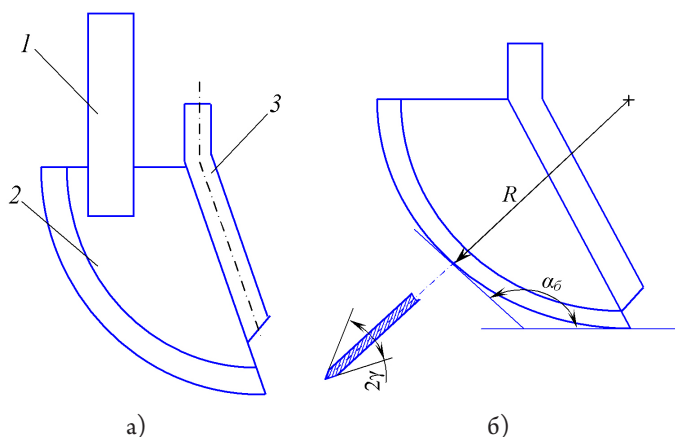
Figure 1. Scheme of arc-shaped furrow-opener (a) and mainparameters (b) of its knife

In let angle of the knife penetration into the soil is determined based on term that ensures the sliding of the plant residues and weeds encountered with it, throughout its blade, as otherwise they are unloaded ahead of the furrow-opener and it outcomes in disruption of the technological process of its operation.

In effort to determine a_δ values of the angle at which the sliding of plant residues and weeds is ensured, let's consider the forces acting on them from the knife side. The normal force N acts (fig.2) and the frictions force $F = Ntg\phi_{p(c)}$ (where $\varphi_{p(c)}$ is the friction angle of vegetable residue (weed) on the blade of the knife) onto the plant residue or weed encountered with the knife. The normal force N is divided into two components: N_v – acting in the direction of furrow-opener movement and N_τ – acting along the knife blade. According to the scheme shown in fig. 2.

$$N_v = \frac{N}{\sin \alpha_1} \qquad (1)$$

and $N_\tau = Ntg\left(\alpha_1 - \frac{\pi}{2} \right).$ $\qquad (2)$

It is obviously that sliding of the plant residues or weeds throughout the knife blade is ensured

$$N_\tau = Ntg\left(\alpha_\delta - \frac{\pi}{2} \right) > F = Ntg\phi_{p(c)}. \qquad (3)$$

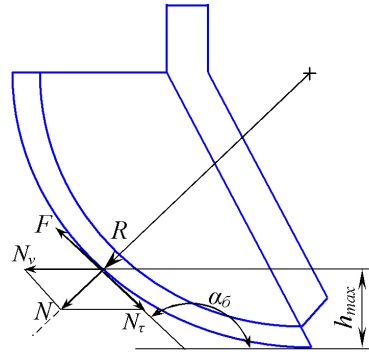From above formula we obtain the following:

Figure 2. Scheme for determination of inlet angle of the knife of arc-shaped furrow-opener penetration into the soil

$$\alpha_{6} > \frac{\pi}{2} + \phi_{p(c)}. \qquad (4)$$

As it seen from fig.2, this term must been sure das minimum at the field surface level, as the distance from the lower point of furrow-opener knife increases the a_{6} angle decreases until the point being reviewed. Taking into account (4) from fig. 2 one can obtain the following formula for determination of the radius of knife curvature

$$R > \frac{h_{\max}}{1 - \sin\phi_{p(c)}}. \qquad (5)$$

where h_{max} – maximum depth of penetration of the furrow-opener knife in to the soil.

Angle of sharpening the knife can be determined on base of term son ensuring minimum soil scattering to all sides for them and not allowing to stick soil to its sharpened part.

It allows to form the qualitative seeding furrow and provide qualitative embedding of seeds as well as reduce removal of the lower moist layers of the soil to the outside of field surface and reduce the energy expenditures for implementing the technologic process.

In this case the following formula is obtained:

$$\gamma = 2arctg\,\frac{tg\left(\dfrac{\pi}{4} - \dfrac{\phi_{n}}{2}\right)}{\cos\phi_{n}}, \qquad (6)$$

where φ_{n} – friction angle of the soil of furrow-opener knife.

Calculations, given base on the formulas (4), (5) and (6) at the event of $\varphi_{p(c)}$ = 35 º, h_{max} = 80 mm and φ_{n} = 30 º [2; 3] showed, that the inlet angle of knife penetration into the soil of the developed furrow-opener on the level of soil surface must be at least 125 º, radius of its curvature — at least 160 mm, the angle of sharpening – 67 º.

Conclusions: So, in effort to implement the qualitative operation of the set technologic process at minimum energy expenditures the inlet angle of knife penetration into soil developed arc-shaped furrow-opener at the level of soil surface must be at least 125 º, the radius of its curvature –at least 160 mm, and the angle of sharpening – 67 º.

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NEW CONSTRUCTION CLEANER FIBER MATERIAL

Abstract: The recommended construction of fibrous material cleaners, mainly for cleaning wool from vegetable impurities, significantly increases the cleaning effect. The essence of the construction is that the fibrous material cleaner contains a conveyor system from the conveyor, corrugated feed rollers, a spear drum, a net surface beneath it, a serrated cylinder, a threading roller and a guiding fiber, a grate flange on elastic supports, a beating roller with an elastic element and Outer sleeve with a tooth on the surface, a working drum of rubber-skin material, a stationary knife, a bump roller with baffles on the surface, detachable brush shafts, a syringe and fiber tap.

Keywords: wool, cleaning, construction, cleaning effect.

In the known construction of the purification unit, mainly cotton from small and coarse litter contains sections for cleaning small and large litter alternate consecutively [1]. The cleaning section for small litter includes pin drums, a net surface beneath them and the large cleaning section contains serrated cylinders and grate bars below them. The main drawback of this construction of the fibrous material cleaner is the low cleaning effect and high fiber damage due to multiple mechanical influences of the working members with fibrous material.

In another known construction of the fibrous material cleaner [2], it contains vertical feed grate, director-plane, a pin drum, a three-lobed beater, firegrate, a horizontal grate, a smooth roller, a pin feeding roller, a table, a main grooving drum with conical pins and ribs, pinion, brush roller, comb drum, burr beater, corrugated drum, knives (grate bars), paddle roller, removable brush drum. The construction allows cleaning the fibrous material (wool) from dust, various impurities, especially from plant-derived impurities.

The drawback of this cleaner is the complexity of the construction, high-energy intensity and low effect of cleaning the fibers of the wool from plant impurities, especially the turnips, thorns etc.

In a known construction of a fibrous material processing apparatus [3], based on an under-life volatilization, which includes feeding seeds and nuggets to the area below the surface of the rotating saw cylinder, pressing the bundles of fibers to the teeth of the saw cylinder, moving the seed through the saw space and removing them by the conveyor. The fiber bundles of the non-gin volutes are compressed in the transverse direction and stretched along the saws, at the same time, fiber separation is carried out by applying the opposing moving forces of the discs to the seeds that changed the position in the vertical direction, after which the fibers from the saws are removed by a detachable device, and the seeds separated from the fibers are removed by the conveyor.

The drawback of this construction is the low effect of cleaning the fibrous material in the processing of non-gin cotton leaf jet stream.

In the next well known construction of a fibrous material cleaner comprising a serrated cylinder and underneath the grate bars [4], which are mounted on elastic, supports.

A disadvantage of this construction is the low cleaning effect and a high percentage of fiber deposition along with rubbish.

The main disadvantage of the known construction of the fibrous material cleaner is the low cleaning effect and high damage to the fibers, as well as the inability to use this structure for cleaning wool from vegetable impurities.

The task in view is solved by improving the construction of the working parts of the fibrous material cleaner.

The essence of the construction is that the fibrous material cleaner contains a conveyor system from the conveyor, corrugated feed rollers, a spear drum, a net surface beneath it, a serrated cylinder, a threading roller and a guiding fiber, a grate flange on elastic supports, a beating roller with an elastic element and Outer sleeve with a tooth on the surface, a working drum of rubber-skin material, a stationary knife, a bump roller with baffles on the surface, detachable brush shafts, a syringe and fiber tap. The beating roller and the bump organ are made composite, from the drive shaft, on which the elastic bush is fitted; the working member is mounted on it. Due to the use of the feeding system from the conveyor, the corrugated feed rollers, the spear drum and the mesh surface under it allows sufficient loosening and uniform feeding of the wool to the cleaning zone. The stringing and guiding brush not only thread the fibers

of the wool into the space between the teeth of the saw cylinder, but also allows an even layer of wool fibers. The knockdown roller, due to the elastic bushing, makes additional torsional oscillations, which increases the effect of the cut-off of the vegetable impurities and separates them from the wool grabbed by the teeth of the saw cylinder. The grate also vibrating due to their elastic supports allows efficient isolation of weed impurities from the fibers of the wool. A working drum made of rubber-skin material; a stationary knife and a bump organ provide additional removal of wool fibers trapped by large vegetable impurities.

The recommended construction of fibrous material cleaners, mainly for cleaning wool from vegetable impurities, significantly increase the cleaning effect. The construction is explained by a drawing, where in Fig. 1 and the general scheme of the wiper of the fibrous material, in the Fig. B is the cross section A-A in Fig. 1 a.

The fibrous material cleaner consists of a casing 1, the feeding systems in it are fed in the form of a conveyor 2 feeding corrugated rollers 3,4, a tumbling drum 5, a mesh surface 6 beneath it, a serrated cylinder 7, which contacts a rotating threading and guide roller brush 8. On the left lateral side of the serrated cylinder 7 with defined gaps, trihedral grates 9 are mounted, which are fixed to the body 1 by means of trihedral elastic supports 10 (elastic rubber supports). A detachable bead roller 11 is installed under the grate 9 at a certain distance and with a certain clearance to the surface of the saw cylinder 7 and a removable brush roller 12 is installed on the right side of the saw tooth cylinder 7, the brushes that contact the teeth of the serrated cylinder 7. A working drum is mounted under the serrated cylinder 7 12, consisting of a set of disks made of rubber-leather material, which is pressed against a fixed blade 14 made of elastic steel with a certain pressure.
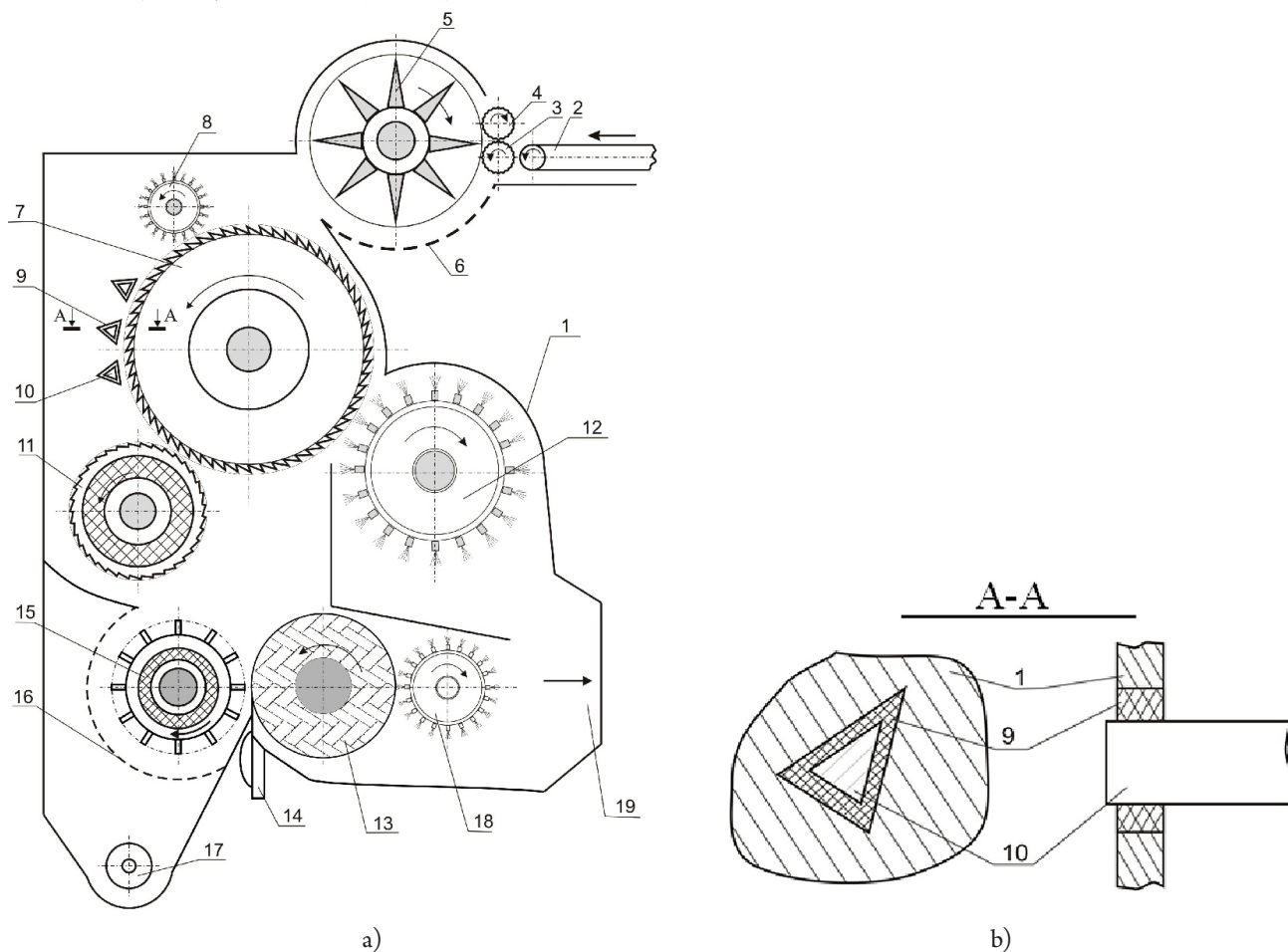
Figure 1. Fiber material cleaner

On the left side of the working drum 13 is installed a baffle roller 15 and a mesh surface 16, beneath it and a scoop-type auger 17. On the right side of the working drum 13, a detachable brush roller 18 and an air fiber spout 19 are in contact with it. The fibrous material cleaner operates as follows. Fibrous material (wool) with impurities enters through the conveyor 2 and grooved feed rolls 3, 4 to the spear drum 5. The toothing rolls the wool fibers through the mesh surface 6, the weeded ones fall into the breech through the opening of the mesh surface 6. The loosened wool falls on the surface of the serrated cylinder 7. The brush roller 8 provides an even coat of wool and thread them into the space between the teeth of the serrated cylinder 7. The teeth of the serrated cylinder 7 graspis the fibers of the wool Carries through the grate 9, which vibrates due to the elastic cushions 10, while providing additional isolation of weed impurities from the wool. However, while the large vegetable impurities can remain in the wool and they continue to move with the serrated cylinder 7. These

large vegetable admixtures (burrs, thorns) are beaten off by a beating roller 11 and separated from the serrated cylinder caught by the teeth of the sawtooth roller. The wool fiberis grabbed by the teeth of the serrated cylinder is then removed from the teeth and diverted to the fiber outlet 19. The separated large vegetable impurities by the sales roller 11 have a sufficient percentage of the fibers of the wool. To separate these fibers from large vegetable contaminants, they are then fed to the surface of the working drum 13. The wool fibers are grasped against the surface of the working drum 13, by performing its surface from the composite material RSM (rubber-skin material). The fibers of the wool adhered to the surface of the working drum 13 are dragged behind the fixed knife 14, and the large vegetable impurities are beaten off and separated from the wool fibers at the edge of the stationary knife 14 by the bobbin rolls 15 and retracted to the scoop by the auger 17. Part of the large vegetable impurities with a part of the wool fibers are dragged to the rolls 15, through the mesh surface 16 and re-enter the working zone. The wool fibers from the surface of the working drum 13 are removed with a brush roller 18 and retracted to the fiber outlet 19.The construction allows a significant increase in the purifying effect of wool fibers from large plant impurities.

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REVALUATION OF SOILS IN THE AREA AROUND THE LANDFILL, IN THE TERRITORY OF FORMER SODA PVC PLANT VLORA, AFTER ITS REHABILITATION

Abstract: This paper refers to the revaluation of soils contaminated with mercury, in the area around landfill, built on the territory of the former Soda PVC plant in Vlora (Albania), after its rehabilitation. The territory of the former Plant of Soda-PVC is described as an "Hot Spot" area in handling the UNEP report, enabling the implementation of the rehabilitation processes, which were finalized with the creation of a landfill. From December 2015 to March 2017 after the rehabilitation of the area around the landfill, several measurements of mercury concentration in the soil have been conducted, to analyze the evolution of the pollution.

Keywords: Soda PVC plant, mercury, contamination, revaluation, CVAAS method.

Introduction

Five kilometers to the north of the city of Vlora and four kilometers to the Narta Lagoon is the territory of the former industrial complex of Soda PVC, which included the Klor-Alkaline Plant.

The PVC Soda Plant has started its normal production in February 1967 with two products: chaotic soda and alkaline soy. Its main products were chaotic soda (produced by ammonia method), soda (produced by limestone method) and PVC (produced by polymerization method of liquid monomers) [1].

Mercury was used as a cathode during the electrolysis process for the production of NaCl in electrolysis baths. During the operation of the plant, as well during periodic cleaning of electrolysis baths and activated carbon filters, periodic pollution of the mercury zone was caused.

During the period of operation of the Plant (1976–1992) about $500m^3$/hour of liquid waste containing about 1.1mg/L mercury are spilled into the sea without any cleaning process. The amount of spilled mercury directly into the environment from 1967 to 1983, is estimated at about 65 tons. The territory of the former plant is contaminated with mercury up to 1.0–1.5 meters depth. High enough mercury vapor levels were measured in the air [2].

Studies carried out showed a high level of pollution, hence this area was declared as the "Hot Spot" area by UNEP. In 2007–2008, a rehabilitation project was conducted for this area. The project envisaged several stages of work that would have aimed thorough cleaning of the area [4].

To re-check the state of pollution in this area, after its rehabilitation, our study, was conducted. For this purpose, during the period of December 2015-March 2017 after the rehabilitation, we analyzed, the evolution of the pollution in this area.

Materials and Methods

Sampling Procedure

Area included in this study is the surrounds of the former Soda PVC plant, located 5 km North of the city of Vlora.

The sampling has been done at 15 points within the study area. Each point are formed by one sample at 30cm depth. The geographical coordinates of the points have been measured using GPS. Soil

samples were collected up to 150 cm deep from the surface, were air dreid, sieved through a 2.0 mm screen, and then grounded and sieved through a 0.063 mm screen. The homogenised samples ëere stored in airtight pure plastic bags. [3]

Analytical Procedure of soil samples

A procedure based on UNEP/IAEA Reference Method for Pollution Studies was used [6, 12–13]. A 0.3–0.5 g sub samples were treated with a mixture of HNO_3+HCl (9:1) in a hot plate at 70-80 °C for 3 hours in closed PTFE vessels. After cooling, 1ml of 5% $K_2Cr_2O_7$ was added and water up to 50ml. Depending on mercury content on the sample, an aliquot of clear solution was used for mercury determination by Cold Vapor Atomic Absorbtion Spectrom-

etry (CV-AAS) [5, 81–82]. All measurements were carried out using a Varian SPECTRAA 10 Plus instrument equipped with a home-made schema having a sensitivity about 0.2ppb Hg. All reagents used for mercury analyses are "low in Hg" quality (from Merck).

Reagents

All reagents were of analytical grade and met the requirements for determination of mercury. Tin (II) chloride was used as a 10% solution in HCl for reduction of Hg^{2+} to $Hg^{0.}$ The solution was purified in the gas wash bottle for 10min with airflow of 2.0 L/min.

Results and discutions

In Table 1 are presented concentrations of Hg (mg/kg DW) in soils taken at 30cm depth, around landfill.

Table 1. – Concentration of Hg (mg/kg DW), in soil samples around landfill, area of former Soda PVC plant in Vlora (Albania)

Points	K1	K2	K3	K4	K5	K6	K7	K8
Hg (mg/kg DW)	100	3.495	1.194	13.092	46.384	4.471	1.327	87
Points	K9	K10	K11	K12	K13	K14	K15	
Hg (mg/kg DW)	3.1	1.024	12.98	43.54	4.76	1.323	1.289	

Referring to Table 1, we note that the mercury concentration in the soils of this zone ranges from the minimum value of 1.024 mg/kg DW to the maximum value of 100 mg/kg DW; with an average of about 21.67 mg/kg DW.
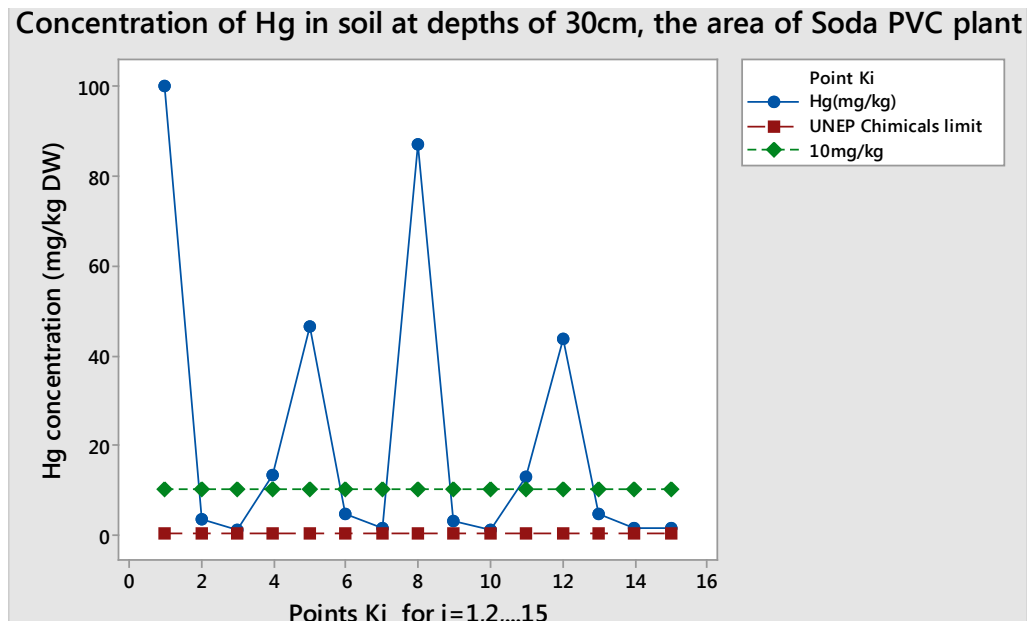
Figure 1. The Hg concentrations Graph in soils, depth 30cm, the area around the landfill in the territory of the former Soda PVC plant in Vlora (Albania)

The above graph depicts, in the same system, the concentration of Hg in the area around the landifill (blue graph), the preliminary concentration limit of Hg in the soil, determined by UNEP Chemicals (0.3mg/kg) (red graph) and the concentration limit of Hg purified in this area (10mg/kg) (green color graph). Graphically it is noticed that about 30% of the values are above 10mg/kg, while all values (100%) are above the 0.3mg/kg level defined by UNEP Chemicals.

From the graph of the distribution of values of mercury concentration in this area we observe a discrete data distribution with

significant value fluctuations. The highest values are observed at points 1,5,8 and 12.

If we look at the distribution of mercury concentration values it is far from the parameters of a normal distribution.

If we look at the standard deviation (stDev=32.72mg/kg), it is far from normal distribution values because its values should be as small as possible.

This fact is also an indication that we have a disproportion of value distribution.

The table above presents a static estimate of the data obtained from the measurements. The confidence interval for the average is 3.5mg/kg to 39.7mg/kg, with 95% confidence. We note that 25% of the values are smaller than 1.3mg/kg, while 25% of these values are greater than 43.5mg/kg.

Confidence interval for the Median is (1.3mg/kg, 32.1mg/kg), and the confidence interval for the standard deviation is (23.9mg/kg, 51.6mg/kg) both with 95% confidence. On the database we can also make a statistical estimate of the hypotheses, although the amount of data is not very large. The following table presents precisely this argument.

We have tested the baseline hypothesis H_o: avarage=0.3mg/kg (the pre-defined limit of UNEP Chemicals) with confidence level of 95%, or for α=0.5. Alternative hypothesis Average > 0.3mg/kg.
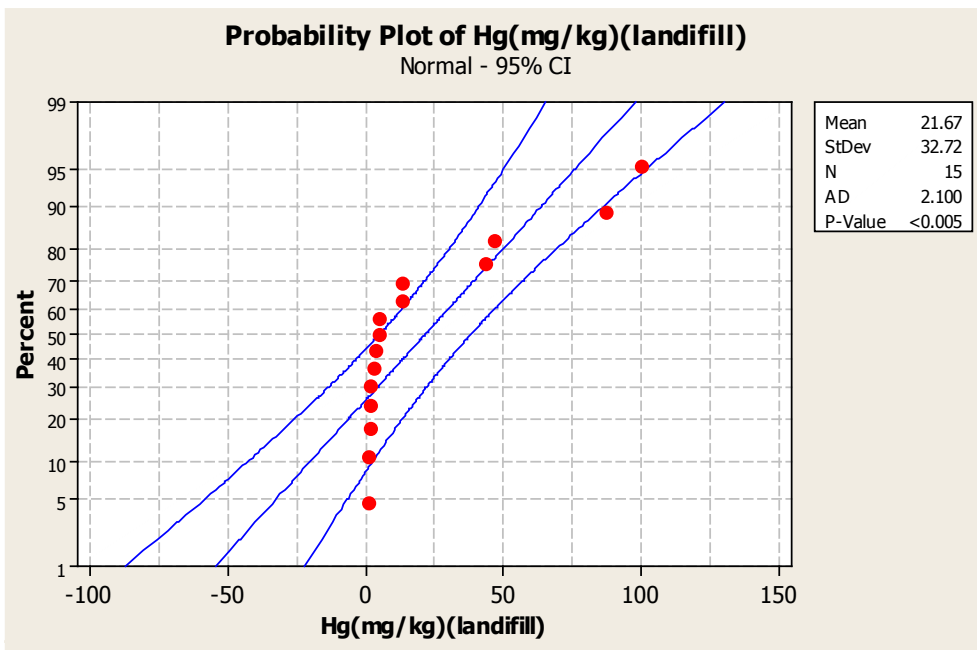
Figure 2. Probability Plot of Hg (mg/kg)
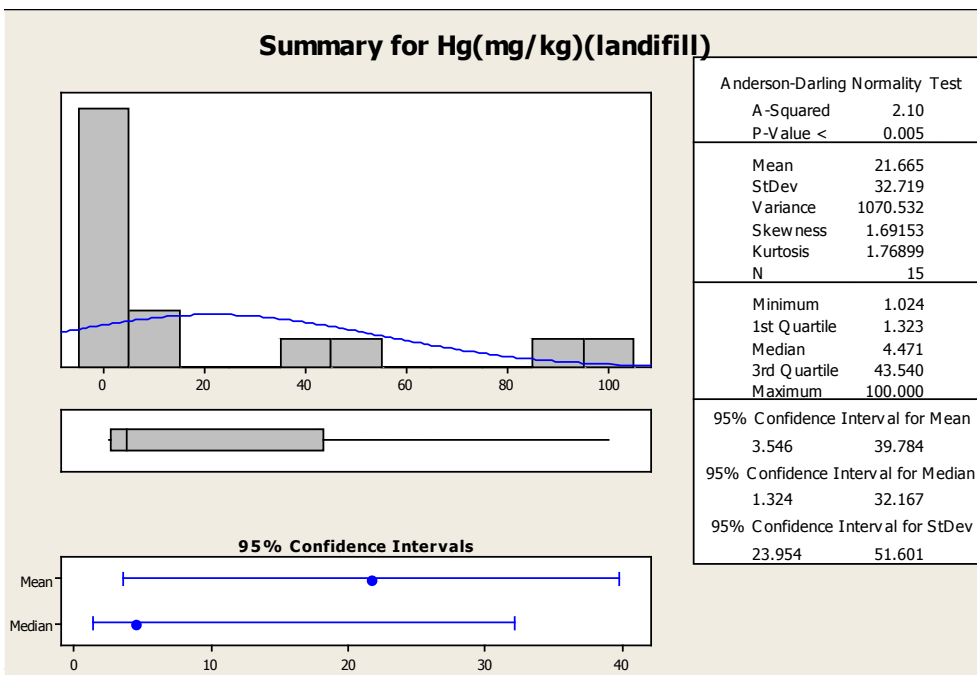
Figure 3. Statistical evaluation of the data obtained from measurements of mercury concentrations in soils around landifillit in the territory of the former Soda PVC plant in Vlora (Albania)
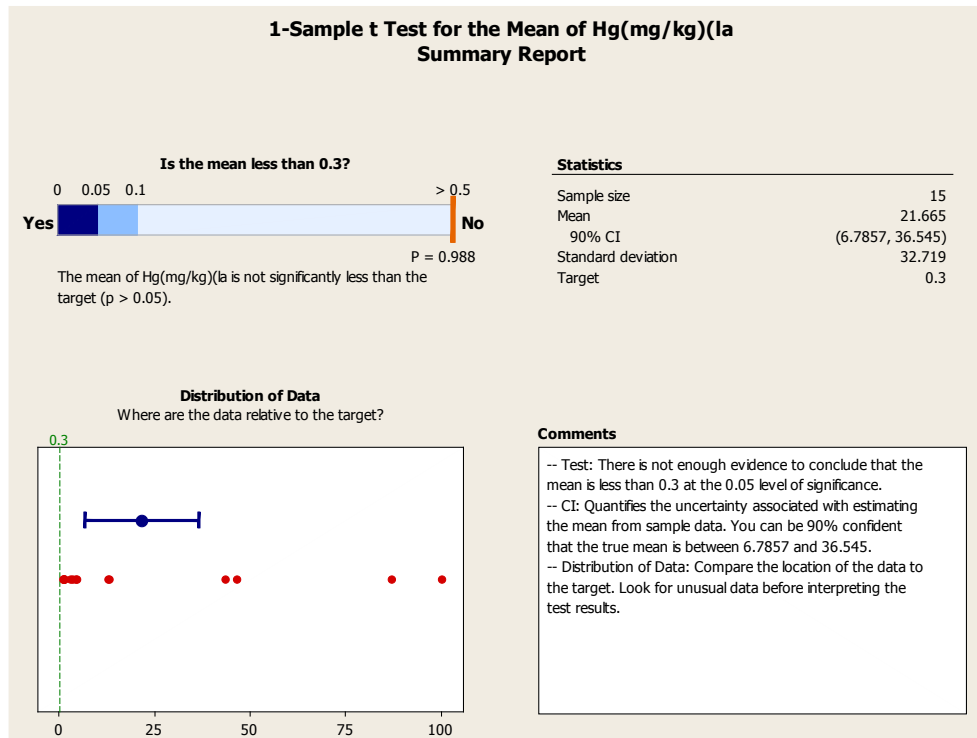
Figure 6. 1 — Sample t Test for the Mean of Hg (mg/kg)

From the table we notice that p-value = 0.98> 0.05 = α. This indicates that H_0 falls, and with 95% confidence, we can state that the average concentration of mercury in this area is above the permissible norms level.

Conclusions

Mercury is one of the most known toxic metals, which can appear in nature in various inorganic and organic forms. Elementary mercury in gaseous state is the most dangerous of all kinds.

Mercury and its components are liberated from a multitude of natural and anthropic sources.

A typical example of an anthropic source in our country is the area of the former industrial complex PVC Soda in Vlora, Albania.

This area represents the area with the highest mercury pollution. This contamination has come as a result of uncontrolled technological waste.

During 2007–2008, rehabilitation of this area was carried out.

Mercury contaminated soil (>10mg/kg DW) has been replaced by clean ground (unpaved with mercury) and the entire surface will be covered with greenery and trees.

Area measurements, in the 30cm depth, include precisely these ground.

Although the area has been rehabilitated, the results of measurements carried out, results an average value of Hg concentration of 21.67mg/kg.

About 30% of the analyzed samples result in a concentration higher than 10mg/kg, indicating that the mercury concentration in the former PVC Soda plant area is still high compared to the rates allowed by UNEP.

Also the average is significantly higher in relation to the claimed value.

As a conclusion we can say that the concentration of mercury in the study area is higher in relation to accepted values, but also in relation to the claimed degree of purity, again we can say that the degree of concentration is higher.

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EXPLOITED THERMOPLASTICS BASED COMPOSITIONS

Abstract: Exploited polymer materials, binders-functional groups containing oligomers and polymers, compositions based on filler mixtures.

Goal of the work: research of scientifically justifiicated secondary threatment and recovery of exploited polymers, study of their structure indices changing during the exploitation process, selecting of modificators, modification methods and technological regimes according to the obtained results and determination of composition materials indices based on them and their use fields.

Research have been carried out using chemical, physico-mechanical methods and devices analyzing polymers.

Analysis of scientific information on the theme has been carried out as a result of research. It has been shown that secondary treatment of polymer waste is the most efficient direction from economic and ecological point of view.

Keywords: thermoplastics, polyethelen, polystyrol, polypropilene, modification, composition rubber mixture, secondary threatment, modificator, filler, vulcanization, structure, functional group polymer, functional group oligomer

Research object: exploited polymer materials, binders-functional groups containing oligomers and polymers, compositions based on filler mixtures.

Goal of the work: research of scientifically justifiicated secondary threatment and recovery of exploited polymers, study of their structure indices changing during the exploitation process, selecting of modificators, modification methods and technological regimes according to the obtained results and determination of composition materials indices based on them and their use fields.

Research have been carried out using chemical, physico-mechanical methods and devices analyzing polymers.

Analysis of scientific information on the theme has been carried out as a result of research. It has been shown that secondary treatment of polymer waste is the most efficient direction from economic and ecological point of view.

Physico-chemical, mechanical and rheological properties of polyethylene and polystrene waste have been studied. Analysis of properties of exploited polyethylene and polystyrene showed that it is impossible to change polymer waste to the raw material which can be used in secondary treatment without modificating them and it is connected with structural-chemical changes happening in macromolecules in treatment process of polymer waste and natural climate condition during the exploitation.

Rheological properties of exploited polyethylene and polystyrene wastes have been studied with capillary viscosymetry method. It has been determined that increase of flow indices of polyethelene and polystyrene wastes melt causes reduce of their viscosity and molecul mass, it makes better secondary treatment of exploited polyethylene and polystyrene and shows possible treatment of thermoplastics by traditional methods.

Nature materials and industry waste have been chosen on the bases of local raw sources. they are used as filler for preparing of various compositions based on exploited polymers and their content and properties have been studied.

Efficiency is obtained due to solution of economic and ecological problems.

Their application field is to use them in substituting initial raw material by new property materials obtained from secondary treatment polymer of wastes contaminating environment and formation of new compositions.

Discussion of the obtained results.

Some low-indices of the compositions obtained on the basis of ethylene-propylene copolymer limit their use in the production of tire and rubber-technical items. By adding polar substances or polymers to the mixture of ethylene-propylene copolymers with other polymers it is possible to improve combined mixing and combined vulcanization and extend application spheres [1–4].

When adding α, ω-methacril (-bis-triethelenglycol phtalat) — (OEA-9) plasticizer to copolymer improvement of their some indices is observed. Its resistance to tearing increases, durability in multi tension, adhesion of the composition to the metal, chemical stability raise and swelling degree in benzole, benzene-benzole mixture reduces. With this purpose rubber composition has been prepared on the basis of ethylene-propylene copolymer with oligoetherakrylate mixture.

Compiling of rubber mixture receipt.

Physico-mechanical and exploitation indices (technical properties) of the rubber mainly depend on the content of rubber mixture.

In the research of modification process of ethylene-propylene copolymer based rubbers filled with oligoetherakrilate the content of rubber mixture has been determined first. For producing rubber items first of all receipt of rubber mixture is compiled.

When compiling rubber mixture receipt the quantity of all ingredients is indicated together with their names.

Influence of each ingredient on the rubber mixture and also its economic efficiency must be considered. Thus, processed rubber with the technical conditions be obtained cheaper.

Ingredients should be written in the following consequence in the receipt: first rubber, then sulphur, accelerators, activators, softers, fillers, substances against aging, dyers and supporting substances.

The content of the studied rubber composition consists of the following components:

Ethylene-propylene rubber
– OEA-9;
– Sulphur;
– Stearine acid;
– Tiurum (TMT);
– Kaptax;
– ZnO;
– Technical carbon (P-234).

Ingerdients in the content of this composition: oligoetherakrylate (OEA-9) modificator, sulphur-vulcanizating agent, stearine acid as softener, tiurum (TMTS)-tetramethyetiuramdisulphide and kaptaxs as accelerators, zink oxide is used as activator of vulcanization process in the obtaining of rubber mixtures, technical carbon is used as filler.

Various contents of rubber compositions have been taken. Rubber composition without modificator (OEA-9) has been prepared for comparison.

Table 1. – Content of modificated and unmodificated ethylene-propylene copolymer based compositions.

Name of components	Quantity, m.p					
	I	II	III	IV	V	VI
SKEP-60	100	100	100	100	100	100
Stearine acid	1,0	1,0	1,0	1,0	1,0	1,0
Tiurum (TMT)	1,5	1,5	1,5	1,5	1,5	1,5
Kaptaxs	0,5	0,5	0,5	0,5	0,5	0,5
ZnO	5,0	5,0	5,0	5,0	5,0	5,0
Technical carbon (P-234)	50,0	50,0	50,0	50,0	50,0	50,0
Sulphur	2,0	2,0	2,0	2,0	2,0	2,0
OEA-9	–	0,5	1,0	1,5	2,0	2,5

100 mass rubber has been used for obtaining rubber mixture.

Mechanico-chemical modification of elastomers makes it possible to improve their phisico-mechanical production properties by simple and effective method and to widen their application fields. In this case special complex equipment isn't required and technical items with necessary properties are obtained in the traditional treatment.

Ozone is the most agressive factor for rubber based on the common direction. Some folds appear on the resin coat due to ozone influence. That's why protecting of rubbers atmosphere influence is urgent and covering of rubber surfaces with polymer coating is one the solution ways of the problems. Preparing and research of compositions for protection coating especially based on elastomers are paid more attention [5–7].

From this point produced ethylene-propylene rubber is great interest. This rubber has a number of complex valuable properties like durability to atmosphere, heat and chemical influences. But disadvantages of the ethylene-propylene rubber like low durability to water and adhesion limit preparing protect rubber coatings and the research of the elimination ways of this disadvantage waits its solution. Research works in the direction of modification of ethylene-propylene with monomers and polymers containing various functional groups have been carried out recently [8–12; 10].

Preparing of rubber mixture in the production of rubber items is one of the main technological processes. Ingredients as powder, solid and liquid forms must be mixed with rubber simultaneously, and equal distribution of these ingredients in the rubber must be supplied. That's why obtained rubber mixture must be homogenous according to its content.

Quality of the researched composition mainly depends on rubber properties and wetting of ingredients in the rubbers.

Precise measuring of the components used for preparing of mixture on the basis of rubber and ingredients, consecutive mixing of ingredients with rubber and the temperature influence on the mixture properties.

Under the laboratory condition preparing of rubber mixture has been carried out in the laboratory mixer.

Mixing regime is determined according to the type, volume of stirring installation, to the rotation speed of the rotor or shafts and rubber mixture content.

Mixer must be operated by defining the distance between shafts 0.2–0.3 mm with regulating screw.

Stirring process has been carried out in mixer at 40–60 ° C within 25 minutes.

During the stirring introduction of ingredients to the rubber is carried out in the following consequence: softeners, vulcanization accelerators, activizators of the accelerators, filler, special ingredient (MGF-9) and vulcanization agent.

Regime time starts at the beginning of mixing process. Rubber is gradually loaded in the form of pieces into the space between shafts from the big gear wheel and this operation repeats 5–6 times. Then the distance increases 1–2 mm and rubber plastics in the front shaft at the same time other ingredients are added. Ingredients are gradually poured on the rubber reserve along the length of front shaft and stirred at the necessary time.

While preparing the mixture shaft temperature is checked 2–3 times with ray thermo pair. Mixture passing through the shafts in the form of paper is coaled in the bath in chalk or kaolin suspension.

Vulcanization of rubber mixtures

Rubber mixtures must be vulcanizated for obtaining friction resisting, solid, high elastic vulcanizates having high durability indices.

It is known that complex physico-chemical processes taken place in the presence of vulcanizing agents in the mixture in a definite temperature that's mechanico-chemical modification process proceeds. As a result, items with any properties are obtained.

Vulcanization process in the prepared rubber mixtures has been carried out at 155 ° C temperature and within various time period (10–40minutes).

Physico-mechanical and exploitation indices of vulcanizates have been investigated (80).

Kinetics of vulcanization process of the mixture of ethylene-propylene copolymer and ethylene-propylene+OEA-9 has been studied.

Durability level, conditional tension at 100% and 300% extension, tear resistance, strength on TM-2 and other indices of the vulcanizates obtained at various temperatures in tensile in TM-60 type cutting machine. The temperature of the optimal regime of vulcanization process has been determined 153 ± 2 and 25 minutes

Dependence of consumption quantity of SKEP-60+ OEA-9 and 2-SKEP-60 based compositions in capillary reometr on the time at 153±2 ° C temperature has been studied. At each 30 minutes consumption quantity of the composition flowing in one capillary is taken and weighed. According to the taken results dependence graphic of consumption quantity on the time has been set up.

The goal is determination of zol fractions of vulcanizate samples given in table 1. That's why quantity of the plastificator (OEA-9) in chemical process has been determined. That's why vulcanizates were extracted in OEA-9 solution (benzol) within 26 years and dried till the constant weight.

Analysis of the obtained results shows that vulcanization process of SKEP-60 + OEA-9 (1.0 m. p.) composition at a given temperature ends within 14 minutes. Vulcanization time of the composition based on SKEP-60 ends within 18 minutes. These results prove again that complex ether group and 2 bond α, ω-metacril-(bis-triethylenglycol-phtalat)-OEA-9 is used as a binder and also can be polymerized in the mixture. These indices prove the results of vulcanization kinetics on the dependence of durability level on the time.

Adding of low molecule additives into oligoetherakrilat-OEA-9 mixture causes reduce of mixture viscosity. Physico-mechanical properties of compositions based on SKEP: OEA mixture improve. These mixtures are used in tyre and rubber-technical item production. Compositions based on the given mixtures in comparison with the compositions based on SKEP-60 have higher adhesion ability, low swelling level in benzene-benzole mixture.

Table 2. – Physico-mechanical properties of rubber mixture based on ethylene-propylene copolymer filled or unfilled with oligoetherakrilate

№	Indices	Rubber, mixture					
		I	II	III	IV	V	VI
1.	Tensile strength level, MPa	20,7	21,1	24,6	21,5	18,5	17,3
2.	Conditional tension in 100% extension, MPa	3,6	3,8	4,1	3,7	3,4	2,8
3.	Conditional tension in 300% extension, MPa	13,6	13,9	14,2	13,5	12,9	12,1
4.	Relative extension, %	380	395	410	430	450	480
5.	Relative residue deformation, %	14	14	14,1	14,6	14,8	15,0
6.	Breaking strenght, kN/m	32,9	33	35,8	33,6	33,1	32,7
7.	Elasticity on bound, %	40	40	40	39	37,5	36
8.	Hardness on TM-2, c. u.	70	70	69	68,5	68	67,5
9.	Bond hardness with metal, MPa	1,40	1,50	1,65	1,54	1,52	1,40
10.	Fatigue resistance in multi tension (ε din = 200%, v=250 rot/min.)	1,25	1,50	1,92	1,98	2,0	2,1
11.	Aging heat coefficient at 393 K temperature, within 140 hours, On fp On ε p	0,76 0,41	0,76 0,42	0,75 0,43	0,73 0,44	0,69 0,48	0,67 0,50
12.	Swelling level at 296 K temperature, within 48 hours (in benzine)	130,5	115,0	90,8	110,7	115,2	120,5

Small quantity of plastificator OEA-9 makes possible to obtain diaphragm compositions having improved properties based on SKEP-60 and butyl rubber. For a long time in the industry exploitation time of diaphragms vulcanizate of the compositions added into OEA-9 is 25–26% is more than the diaphragms from butyl rubber (BR). Thus on the basis of BR diaphragm — 100 tyres after being vulcanized, the diaphragm rubber becomes soft (tarred), and it complicates extraction of tyre out of diaphragm and as the diaphragm sticked to tyre it is damaged, and another defect forms a layer inside the diaphragm tyre, that's it is not restored completely after the complete deformation. To liquidate such problems the receipt in the following content has been prepared (table 3).

Table 3. – Modificated ethylene-propylene and content of BR based compositions

Name of components	Quantity, m. p.		
	I	II	III
SKEP-6	100	100	100
BR			
Stearine acid	1,0	1,0	1,0
Amborol SP-137	6,7	6,7	6,7
Petrolatum	7	7	7
ZnO	5,0	5,0	5,0
Technical carbon (P-514)	35,0	35,0	35,0
Technical carbon (P-234)	20,0	20,0	20,0
Sulphur	2,0	2,0	2,0
OEA-9	–	0,5	1,0

Diaphragm rubber mixture has been prepared in laboratory mixer at 40–60 °C temperature within 20–25 minutes. Prepared rubber mixture being kept 6–8 hours at the room temperature has been vulcanized. Physico-mechanical indices of vulcanizate have been given 4.

Table 4. – Physico-mechanical properties of SKEP-60 diaphragm rubber based on BR modificated by OEA-9

№	Indices	Rubber mixture		
1	Tensile strength level, MPa	10,5	11,3	12,6
2	Conditional tension in 100% extension, MPa	4,1	4,5	4,8
3	Conditional tension in 300% extension, Mpa	7,9	8,5	8,6
4	Relative extension,%	672	640	645
5	Relative residue deformation,%	26,4	25,1	25,5
6	Breaking srtength, kN/m	45,3	54,6	55,5
7	Elasticity on bound,%	6,5	7,1	7,1
8	Hardness on TM, c. u.	54	52,5	53,5
9	Bond hardness with metal, MPa	1,45	1,50	1,60
10	Fatigue resistance in multi tension (ε din 200%, v = 200rot/min)	1,56	2,65	2,75
11	Heat aging coefficient at 393k temperature, within 140 hours, On fp On ε p	0,59 0,46	0,62 120,0	0,63 0,58
12	Swelling degree at 296 K temperature within 48 hours (in benzene)	120,5	120,0	120,8

As it is seen from the table, when adding SKEP-60 modificated by OEA into the BR based composition, its exploitation indices and also aging from heat increases.

From the carried out research results it can be determined that plasticficator α, ω-methacril (bis-triethylenglycol phtalat)–(OEA-9) reducing vulcanization, make possible to improve physico-mechanical and exploitation indices of SKEP-60 and its other elastomer mixtures.

Conclusion

1. Unsufficient properties of ethylene-propylene copolymer based compositions limit their use in tyre and rubber-technical items. Ethylene-propylene copolymer has been modified with oligoetheracrilate (OEA-9) to improve joint mixture and joint vulcanization of copolymer with other components.

2. Convenient receipt of rubber mixture has been worked out, and homogenous mixture has been prepared due to this receipt on laboratory mixer (at 40–60 °C, within 20–30 minutes).

3. Prepared rubber mixture has been vulcanized at the vulca-

nization shop at Baku Rubber-Technical Items factory. Optimal vulcanization regime has been determined (150 °C temperature, within 20 minutes).

4. Physico-mechanical and exploitation properties (tensile strength level, conditional tension in 100% extension; conditional tension 300% extension, relative extension, relative residue deformation, breaking strength, elasticity on bound, hardness on TM-2, bond hardness with metal, fatigue resistance in multi tension, heat aging coefficient at 393 K temperature, swelling level within 48 hours, strength to agressive mediums) have been studied.

5. Adding of definite quantity of OEA-9 cycle oligoetheracrilate plastificator into various mixture compositions improves properties of vulcanizate, including improve of mutual dispersion of components in the mixture. Introduction of plastificators increases strength to multi tensile (E ten =200%, V=250 rot/min) from 1.500 to 1.92 thousand cycles bond hardness with metal. These indices are higher than the indices corresponding to tyre and diaphragm rubber.

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MODIFICATION OF RUBBER MIXTURE BASED ON BUTADIENE -NITRILE RUBBER CKN-40 M BY MODIFIED THIOURED PHENOL-FORMALDEHYDE OLIGOMER

Abstract: Rubber mixtures based on butadiene-nitrile rubber CKN-40M and polyvinylchloride (PVC) containing modified thiourea phenol-formaldehyde oligomer (TPFO) as modifying additive have been developed and complex properties of their vulcanizates have been investigated.

It has been determined that obtained rubbers keeping indices of physico-mechanical and exploitational properties at standard level have significantly improved stability indices of adjacement of rubber to metal, petrol resistance, and stability to tension.

Keywords: rubber mixture, butadiene-nitril rubber, polyvinylchloride, modified thioured phenol-formaldehyde oligomer, modification, compatibility.

At modern stage in creating of the most important types composition materials and items the problem of the increase of their quality and service life has a great significance. Solving of this problem is equal to additional manufacturing of the product without expanding volume of production and provides a significant economy of raw materials resources.

Rubber of various designated purposes is related to widely spread composition material.

Modern rubber industry produces various items to which different requirements are presented depending on the use of the items and conditions of their exploitation. It brings to necessity of the development and research of various rubber receipts distinguished on technological and exploitation properties.

At present reserves of rubber assortment have been exhausted. That's why tendency in the production of rubber-technical items doesn't only consist of synthesis of new rubbers, but the search of rational ways of the use of industrial big weight rubbers. It is achieved by combining various elastomers and their modification in the conditions of traditional processing with additives containing functional groups.

It is known -that chlorine containing polymers find wide use for producing of composition materials having chemical and thermal stability, adheous durability to various substates.

Rubber mixture is used for production of oil field equipment packers of oil extracting industry and other rubber technical items based on butadiene-nitrile rubber CKN-40M, triple ethylene-propylene rubber (SREPT-60) and polyvinylchloride (PVC) CKN-40M-SREPT-60+PVC=70+20+10 [1].

Disadvantage of this known rubber mixture is the low indices of durability in tension, petrol resistance and attachment of rubber to metal.

It is connected with that the initial hardness of polyvinylchloride (PVC) doesn't allow to achieve high level of dispersing and interaction between system phases, as a result compatibility in interphase zone worsens and indices of physico-mechanical properties of compositions containing PVC reduce [2].

That's why at present researches on the development of new compositions are carried out to improve physico-mechanical and exploitation properties of rubber mixture based on butadiene-nitrile rubber.

One of the ways of regulating technological properties of rubber mixtures is introduction into their composition of small quantities of special ingredients-technological additives which promote to improvement and stabilization of technological properties of rubber mixtures not influencing negatively on main complex of physico-mechanical properties of rubber.

Modificators-various reaction capable, functional group containing oligomers have been used for improvement of physico-mechanical properties of vulcanizates of rubber mixtures.

In accordance with it we have developed rubber mixture on the basis of butadiene-nitril rubber CKH-40M and polyvinylchloride (PVC) containing modified theoured phenol-formaldehyde oligomer (TPFO), amine as a modifying additive with and hydroxyl groups in matrix (molecular mass-764, density-1290 kg/m³, viscosity on VZ-1–54 sec.) [3]. Distinguishing technological properties of this class combinations and presence of functional groups, good compatibility with rubbers and fillers, good rheological characteristics condition their successful application for modification of rubber mixtures were prepared on laboratory shafts at 25–300°C.

Total durability of combining of components was 20–25 minutes. Vulcanization of rubber mixtures was carred out at 1500 C temperature within 15 minutes. Elastic-durable properties of vulcanizates were determined on GOST 270–75, durability to thermal aging on GOST 9.024–74, petrol resistance on GOST 9030–74, stability of adjacement of the rubber to metalon GOST 209–75.

Contents of rubber mixtures have been presented in table 1, and physico-mechanical indices of vulcanizates have been given in table 2.

Table 1. – Composition of rubber mixtures

Components	Components contents, mass.p			
	known	developed		
	1	2	3	4
CKH-40 M	70	90	90	90
PVC	10	10	10	10
SREPT-6	20	–	–	
Modified thiourea of phenol-formaldehyde oligomer (TPFO)	–	2,5	5,0	7,5
DUEK-4 (bis-dehydrocycle opentadienyl capromat)	6	6	6	6
Sulfur	2	2	2	2
Kaptax	1	1	1	1
Altax	1	1	1	1
ZnO	4	4	4	4
Neozon	2	2	2	2
Technical stearine	1	1	1	1
Kanifol	2	2	2	2
Technical hydrocarbon				
P-803	20	20	20	20
P-234	50	50	50	50

Note: 1 – components have been taken in mass.p on 100 mas/h of the mixture CKH-40M+PVC+SREPT-60PV 2, 3, 4 – components have been taken in mass/units on 100 mass.p of the mixture CKH-40M+PVC

Table 2. – Physico-mechanical indices of rubber mixtures vulcanizates

№	Name of the indices	Indices			
		known	developed		
		1	2	3	4
1	2	3	4	5	6
1	Conditional stability in tension	16,6	18,1	18,9	18,8
2	Retative extension,%	335	360	380	375

1	2	3	4	5	6
3	Relative residual deformation%	12	12	12,2	12,5
4	Abrasion, sm 3/kvt·h	68	68,3	69,6	69,2
5	Resistance to tear kH/m	56	60	59	58,5
6	Stability of attachment of rubber to metal, MPa	5,5 3,6	8 5,1	9,2 6,2	9,8 6,9
7	Temperature of fragility	245	247	248	249
8	Hardness on TM cond.unit	78	82	82,1	81,6
9	Swelling degree at 296 K temperature within 24 hours in mixture of isooctane-toluene in the mixture of gasoline benzol (3;1)	14,5 23,5	10,1 14,7	10,2 14,1	10,6 13,9
10	Coefficients of heat aging at 379 K wilhin 48 hours: On durability On the relative extension	 1,03 0,88	 0,92 0,83	 0,94 0,86	 0,95 0,90
11	Elasticity on rebound	14	13,7	14	13,9
12	Stability to ozone at 298 K temperature, within 27 hours (deformation 20%, ozone concentration 0,015%)	Does not destroy	Does not destroy	Does not destroy	Does not destroy

Comparison of physico-mechanical and explotation properties of vulcanzates of the developed rubber mixture has been carried out.

As it is seen from the data presented in table 2 indices of stability of adjacement of rubber to metal, petrol resistance, and stability to tension are improved when using developed rubber mixture based on butadiene-nitrile rubber CKH-40 M and polyvinylchloride (PVC) as modifier of the modified thiourea phenol-formaldehyde oligomer (TPFO) containing amine and hydroxyl groups, keeping indices of physico-mechanical and exploitation properties of vulcanizates of the obtained rubber.

Improvement of indices of physico-mechnical and exploitation properties of rubber mixture vulcanizates obtained on the basis of developed receipts is explained as a result of interaction of modified thiourea phenolformaldehyde oligomer (TPFO) containing amine and hydroxyl groups with polymers of the mixture of butadiene-nitrile rubber CKH-4 M and polyvinylchloride (PVC) in CKH-40M+PVC system.

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RECEIVING BODY RESINS ON THE BASIS OF ETHYLENE-PROPYLENE RUBBERS

Abstract: It is also evident from the numerous results that the α-ω-methacryl- (bis-triethylene glycol phthalate) — (MQF-9) plasticizer allows to improve the physical-mechanical properties and maintenance properties of SKEP-60 and other elastomer blends together by reducing the vulcanization time

Inadequate properties of ethylene-propylene sopolymer based composites limit their use in the production of tire and tire technical products. The copolymer has been modified with the propylene homopolymer polyacrylate (MQF-9), which is intended to intermingle with other components and to improve common vulcanizability.

The appropriate mix of rubber mixture is designed and the recipe is prepared in laboratory (temperature 40–60 degrees, time 20–30 minutes).

The prepared tire mixture has been vulcanized. Optimal vulcanization mode (temperature 150 degrees Celsius, time 20 minutes) was determined. The rubber body and the diaphragm rest on the appropriate indicators of resin.

Keywords: rubber, physical-mechanical property, hardness, contact with metal, aging, plasticizer, body resin.

Research object: ethylene-propylene copolymers, coordination-functional groups, composites based on polymers and filler mixtures.

The aim of the study ethylene-propylene, composition, rubber, copolymer, vulcanization, modification is to investigate the ways of taking the resin with high physical-mechanical properties, based on ethylene-propylene copolymers, to examine their changing structural performance in the process of exploitation and to select modifiers, modification methods and technological regimens according to the results obtained.

The investigations were carried out using chemical, physical-mechanical methods and research instruments of polymers.

As a result of the study, the literature information about the research was analyzed. It has been shown that the most economically and environmentally effective way is the recycling of polymer waste.

The physical-chemical, mechanical and rheological properties of the rubber cmixture and the vulcanizate, which were taken on the basis of ethylene polymer, were examined. Research has shown that it is necessary to modify ethylene propylene copolymers in order to obtain them.

For the preparation of various composites based on ethylene-propylene copolymers, wastes of natural materials and industrial materials were selected on the basis of domestic raw material sources such as filler, their structure and properties were examined.

Discussion of available results.

The low content of some of the compounds taken on the basis of ethylene-propylene sopolymer limits their use in the production of tire and tire technical products. It is possible to improve the co-curing and co-vulcanization of these copolymers by adding polyaramines or polymers to other polymer blends of ethylene-propylene copolymers (1–4).

When Sopolimer α-ω-methacryl- (bis-triethylene glycol phthalate) — (MQF-9) plasticizer is added, various parameters are observed to increase. Resistance increases without tearing, stability without multiple weighing, composition with metal adage, increase in chemical resistance, and the degree of swelling in benzene-gasoline-benzene mixture is reduced. For this purpose, the composition of the rubber based on the mixture of ethylene-propylene copolymer with oligoquaacrylacrylate has been prepared and examined.

Compile the tire mix receptor.

The tire physical-mechanical and maintenance displays (technical specifications) are essentially linked to the content of the tire mix.

When the ethylene-propylene copolymer-based resin-resin replacement process filled with oligoqualetic acid was examined, the composition of the rubber mixture was determined first. In order to produce rubber goods, the composition of the rubber mixture is determined first. In order to produce rubber products, the prescription of the mixture is arranged first. When the prescription of the

tire mix is arranged, all the names of the injectors are displayed and their quantities are displayed.

When prescribing, take into account the effect of each inqredient on the rubber mixture, and also the economical syringes.

Thus, the cheapest fiasco should come along with the manufactured tire technique.

It is advisable to make a certain order of writing material in the receptacle. Firstly, rubber should be written, then sulfur, then accelerators, activators, softeners, fillers, materials used against dyes, painters and auxiliaries are written

Tire rubber composition is comprised of a combination of rigorous examination of the following components:
– ethylene-propylene rubber;
– Sulfur;

– Acid stearic;
– Tiuram (TMT);
– Kaptaks (MBT);
– ZnO;
– Technical carbon (P-234).

The composition contains these inqredients: oliqoefirakrilat (MQF-9) modifier, sulfur, vulkanization agent, Stearic acid?, Tiuram (TMTD) — tetrametiltiuramdisulfid and kaptaks accelerator, ZINC oxide taking the vulcanized tire mixtures energizers Process, Technical carbon Use in as fillings.

Different rubber composition were composed.For comparison, without a modifier (MQF-9) in the rubber composition was prepared. (Table 1)Different rubber composition were composed.

Table 1. – Modified ethylene-propylene copolymer to be modified and the content-based compositions

Name of ingredients	Amount (part weight)					
	I	II	III	IV	V	VI
SKEP-60	100	100	100	100	100	100
Stearin acid	1,0	1,0	1,0	1,0	1,0	1,0
Tiuram (TMT)	1,5	1,5	1,5	1,5	1,5	1,5
Kaptaks (MBT)	0,5	0,5	0,5	0,5	0,5	0,5
ZnO	5,0	5,0	5,0	5,0	5,0	5,0
Technical carbon (P-234)	50,0	50,0	50,0	50,0	50,0	50,0
Sulfur	2,0	2,0	2,0	2,0	2,0	2,0
MQF-9	–	0,5	1,0	1,5	2,0	2,5

* To prepare the mixture of rubber by weight of 100 parts by mass of the rubber part is used.

Rubber mixture preparation

A simple and effective method of mexano-chemical modification of elastomers

And thus improve their physical and mechanical properties of exploitation allows you to expand the application fields. This method does not require the complicated equipment and the necessary properties during the processing of elastomers traditional technical articles are technical properties.

For general-purpose rubbers the basis of ozone more aggressive factor. The impact of ozone on rubber coating layers are formed. Therefore, protection of resins from exposure to atmospheric effect is urgent problem and one of the ways to solve this problem. In particular elastomer compositions for protective coatings on the basis of the preparation and study focuses more

Ethylene-propylene rubber produced from this point more interest. The rubber atmospheric, thermal and chemical effects in a number of complex valuable properties as durability. However, the lack of continuity of ethylene rubber protective coatings of waterpropilen caoutchouc its limits and the ways to remove the shortcomings are addressed as a major issue. In this regard, in recent years caoutchouc containing ethylene-propylene monomer and polymer modification with the functional groups of the research work is done (5–10).

One of the main technological processes in the manufacture of rubber, rubber mixture preparation.Pulverized, solid and liquid ingredients together with rubber interfere, and this time it should be ensured equal distribution of rubber ingredients. Therefore, it should

be homogeneous in composition from the rubber mixture. bbmbzx.

Studied composition and quality, according to the properties of rubber and rubber ingredients depend on to get wet.

Based on the development of rubber and ingredients, components, precision measurement, giving a series of rubber ingredients, the mixing temperature impact te properties of mixture.

Rubber mixtures were carried out with roller in the laboratory.

Blender mixing mode device type, size, and speed of rotation of the rotor or shafts are determined by the composition of the rubber mixture.

0,2–0,3 mm minimum distance through the screw regulatory need to start putting the roller.

The rubber mixing of ingredients is done in the following sequence: emollients, vulcanization accelerators, accelerator aktivationsi, filler, special ingredients (MQF-9) and vulcanization agent.

At the beginning of the process of mixing time switches modes. Parts of the operation will be downloaded gradually repeated 5–6 times. Then, the front axle distance of 1–2 mm increased and rubber, as well as other iqredients are added. Rubber ingredients slowly along the length of the front plate, sprinkled with reserves required at the time of the mix.

During the preparation of the mixed plate thermocouple temperature checked by 2–3 times.

After the removal of the sheet in the form of a mixture of shafts roller"s bath cooled suspension of chalk and kaolin.

Vulcanization of rubber mixtures — Rubber mixtures must be vulcanised in order to obtain vulcanizasiya with high mechanical properties, rust-proof, ruggedness and high elasticity properties.

As is known, complex physical-chemical processes occur with the inclusion of mixed vulcanizing agents at a given temperature during vulcanization, which means there is a tendency to mexano-chemical modification. As a result, the goods with the desired properties are collected.

The vulcanization process was carried out at a temperature of 155 °C and for various time periods (10–40 minutes) on tire mixtures designed.

Physical-mechanical and maintenance indications of vulcanizasiya have been examined (80).

The kinetics of the vulcanization process of the ethylene-propylene copolymer and the ethylene-propylene + MQF-9 mixture have been studied.

Vulcanizations taken at various temperatures were tested for strength, 100% and 300% elongation condition, resistance to tearing, resistance to tear, TM-2, etc., without weighing PM-60 type war machine in the laboratory. The demonstrations have been learned. The optimal regime of the Vulcanization process was determined to be 153 + — 2 degrees and 25 minutes.

SKEP-60 + MQF-9 and 2-SKEP-60 based composites have been learned from time to time in terms of the amount of consumption at a temperature of 153 + –2 degrees Celsius. Every 30 seconds, the amount of consumption of the compound flowing from one capillary is taken and it is disappointed. The dependency graph of the amount of consumed according to the removed results is quoted.

It is intended to identify the void fractions of the vulcanizate samples given in the graphs (table 1). For this purpose, the amount of plastificarrone (MQF-9) in the chemical process has been determined. Therefore, vulcanizator MQF-9, was extracted (benzene) for 26 hours and then dried to constant weight.

The obtained results indicate that weight part In the MQF-9, Wale Fraction becomes zero, and the subsequent increase in the amount of the MQF-9 wale growing faction. It allows you to say

any more promiscuous's MQF-9 Stake 1 part weigh.t As well as its polymerization, as well as likely to enter a mixed chemical contact. Therefore, future research studies of the MQF-9 Volume 1 part weight taking ideal.

The dependence of the amount of Zol's faction MQF-9.

Amount of 1-MQF-9–1: 1; 1.5; 2.0; 2.5 (p.w).

An analysis of the results shows that the vulcanization process in SKEP-60 + MQF-9 (1.0 w. p.) is finished in 14 minutes and the vulcanization in SKEP-60 ends in 18 minutes. These demonstrated results further demonstrate that the α-ω-methacryl- (bis-triethylene glycol phthalate) -MQF-9 complex, which is a compound ether group and doubly linked, can be used both as coordination and as a polymer at the given temperatures. These indicators confirm the results of vulcanizasiya kinetic as time dependence of the strength limit.

As you can see, their vulcanization time is 20.0–22.2 minutes. After this, the balance takes 45 minutes, finally reversion starts after 45 minutes. Figure 2 1-SKEP-60 base composition of the SKEP-60 and SKEP-60 + MQF-9 composites with their strength limits without weighing at 153 degrees. 2-SKEP-60 + MQF-9 composition.

When we compare the strength limits of SKEP-60 and SKEP-60 + MQF9 composites without weighing, we can see that the strength grade (20,7–24,6) reaches MP-a without weighing the modified sample with MQF9. From here it is likely that the functional group MQF-9 may also be a polymer at 153 °C.

The inclusion of MQF-9 in a mixture of alcoholic oleic acid and propylacrylate results in a decrease in the contention of the mixture. SKEP: improves the physical-mechanical properties of the composites on the basis of the mixture. These blends are used in making rubber and rubber technical articles. On the basis of the mixtures shown, the compositions are only SKEP-60 based composites having a relatively high adduce ability to metal and a low degree of swelling in the gasoline-benzene mixture.

Table 2. – Physical-mechanical properties of olefouefricrylate-impregnated filled-propylene sopolymer based rubber blends

N	Indicators	Rubber mixture					
1	Strength cuffs, Mpa	20,7	21,1	24,6	21,5	18,5	17,3
2	Conventional strain of 100% elongation, Mpa	3,6	3,8	4,1	3,7	3,4	2,8
3	Conventional strain of 300% elongation	13,6	13,9	14,2	13,5	12,9	12,1
4	Relative extension,%	380	395	410	430	450	480
5	Residual relative deformation,%	14	14	14,1	14,6	14,8	15,0
6	Tear resistance, kN/m	32,9	33	35,8	33,6	33,1	32,7
7	Flexibility on the bounce,%	40	40	40	39	37,5	36
8	TM-2 hardness, (conventional units)	70	70	69	68,5	68	67,5
9	The strength of metal contacts, Mpa	1,40	1,50	1,65	1,54	1,52	1,40
10	Fatigue tolerance in multiple weighing (ε = 200%, v =200 beat/min)	1,25	1,50	1,92	1,98	2,0	2,1
11	At a temperature of 393 K, 140 hours, the temperature coefficient of aging By fp By εp	0,76 0,41	0,76 0,42	0,75 0,43	0,73 0,44	0,69 0,48	0,67 0,50
12	At a temperature of 296 K, 48-hour swelling degree (gasoline)	130,5	115,0	90,8	110,7	115,2	120,5

The small amount of plasticizer MQF-9 allows the removal of diaphragm composites with improved properties based on mixtures of SKEP-60 and butyl caoutchouc. The life of the vulcanized diaphragms of long-acting MQF-9 incorporated composites in the industry is 25–26% higher than the diaphragm of butyl rubber (BK). The diaphragm becomes too soft after the BC-based diaphragm has made about 100 pieces of rubber vulcanizate, which makes it difficult to remove the diaphragm and the diaphragm causes the breast to become damaged due to the chest being inflated, creating another fold within the area of the diaphragm's tire, ie not fully healing after full deformation. The following members have prepared a recipe for such problems. (Table.3)

Table 3. – Composition of modified ethylene-propylene and BK-based composites

Name of ingredients	Amount (part of weight)		
	I	II	III
SKEP-60	100	100	100
BK			
Stearin acid	1,0	1,0	1,0
Ambirol SP-137	6,7	6,7	6,7
Petrolatum	7	7	7
ZnO	5,0	5,0	5,0
Technical carbon (P-514)	35,0	35,0	35,0
Technical carbon (P-234)	20,0	20,0	20,0
Sulfur	2,0	2,0	2,0
MPF-9	–	0,5	1,6

Diaphragm rubber mixture laboratory 40–60 It is done in 20–25 minutes at a very low temperature. The prepared tire mixture is vulcanized after being kept at room temperature for 6–8 hours. Physical-mechanical indicators of vulcanizate are given in table 4.

Table 4. – Physicomechanical properties of SKEP-60 and UK-based diaphragm rubber modified with MQF-9

N	Indicators	Rubber mixture		
1	Nensile strength, MPa	10,5	11,3	12,6
2	Conventional strain of 100% elongation, Mpa	4,1	4,5	4,8
3	Conventional strain of 300% elongation, Mpa	7,9	8,5	8,6
4	Relative extension,%	672	640	645
5	Residual relative deformation,%	26,4	25,1	25,5
6	Tear resistance, kN/m	45,3	54,6	55,5
7	Flexibility on the bounce,%	6,5	7,1	7,1
8	TM-2 hardness, (conventional units)	54	52,5	53,5
9	The strength of metal contacts, Mpa	1,45	1,50	1,60
10	Fatigue tolerance in multiple weighing (ε=200%, v=200 beat/min)	1,56	2,65	2,75
11	At a temperature of 393 K, 140 hours, the temperature coefficient of aging By fp By εp	 0,59 0,46	 0,62 0,59	 0,63 0,58

As shown in the table with a UK-based OEA modified the composition of its economic indicators added SKEP-60 also increases the coefficient of thermal aging.

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Section 11. Economics

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TAXATION REFORM AS ONE OF THE INNER INVESTMENTS PROMOTION PRE-CONDITION IN GEORGIA

Abstract: the work considers the key problems existing in the Georgian economy, the possibility to achieve high growth in economy, taxation reform and the measures that should be held from the inner investments promotion standpoint.

Keywords: direct foreign investments, inner investments, object burdened with income tax, budget income before tax, taxation burden, market diversification.

The economic growth in Georgia cannot answer the challenges the country faces, which is still the consumer country, the foreign trade saldo is negative and amounts more than 5 mlrd. US dollars. The largest amounts of exported products are: [1]: copper export, ferrum export, LMV export (actually re-export), medical preparations export and vine export, when the country's resources in the effective management conditions, it is possible to significantly increase the export potential, provide the economic safety. From the 90-es up to the present, the economy restructuring and market transformation are not finished yet, and this impedes the economy diversification and the innovative development. It is necessary to conduct the effective agricultural and industrial policy, make significant changes in the educational system. Proceeding from the above mentioned, the urgent necessity for the country is the economic growth high temps, which can really be achieved with more investments, than it was before (see tab. No. 1).

Direct foreign investments [2]

Table 1.

Years	2011	2012	2013	2014	2015	2016 (Preliminary data)
mln. US dollars	1 117.2	911.6	941.9	1 758.4	1 564.5	1645.4

If we will analyze the data of the last 6 years we will find out, that the economic growth temp from the year 2011 has decreased (7.2%), and in 2014 it was 4.6%, in 2015–2.9%, and in 2016–2.7% [3]. The forecasted for economic growth index the 2018 is 4% [4].

It is necessary to get the economy out of the existing condition, which cannot be achieved in the terms of foreign investments. In fact, there is no connection between the direct foreign investments and the economic growth. For example, in 2013 compared to the year 2012 the direct foreign investments were increased from 911.6 mln. dollars to 941.9 mln. dollars. In the same period the economic growth temp decreased from 6.4% to 3.4%.

In Georgia as well as in some other countries, there is disproportion among the economic financial and real sectors, which should become basis for the proper assessment and analyses.

Central banks of the developed countries try to help their financial system to stimulate the economic growth "we intend to use the money, fiscal and structural policy instruments for several countries and groups of countries, to achieve the set goal — the strong, stable, balanced growth" [5] — says the September resolution of the G 20.

In the process of business favoring the European Central Bank has contribution, which buys the debt obligations from private sector. For example, Bank of England after the Brexit as a result of referendum, has forced the stimulating measures and the volume of corporate bonds program was increased by 10 mlrd [6, 13]. In Georgia the securities market is such a weak, that stimulation of private sector is practically impossible.

In Georgia the situation is that the money means existing in the country are not satisfactory for the economy. According to the data of March, 2017, the money resources existing in the banking system, the deposit obligations were equal to 16.1 mlrd. GEL. [7]. However, the demand for banking resources is low because of high interest rate, which even for the large business representatives increases the expenditures a lot. In such a situation central banks decrease the interest rate and in order to avoid the discrepancies, they declare the interest rate several years prior (USA, the European Union), in several countries, there are negative interest rates set.

In the country one of the main problems of business development is the national currency rate decrease and the currency insta-

bility, which causes the fact it is not trustworthy and increases the expectation of inflation. Weak national currency increases the foreign debt payment costs. Despite this, the artificial hardening of the national currency in the long-run under the US dollar strengthening background is impossible towards other currencies. Such policy is held by the National Bank of Georgia, because artificial hardening of the national currency will cause the import stimulating and impede the structural transformation of the country's economy.

In the Georgian economic conjunction conditions, high temps of economic growth should be found in the inner investments stimulation and promotion.

Modern world has the inner investments promotion experience. In particular, in 80-es of the previous century the Thatcher government in Great Britain and Reagan administration in the USA have implemented the supply stimulation, shown in the private entrepreneurship promotion and subsidies. The government role was decreased there. They thought that state expenditures were to be decreased to free place for the private sector. They should decrease also the taxes and promote the competitiveness [8, 387–388].

In Georgia in order to stimulate the economic growth and the inner investments, from January 1, 2017 for enterprises the income tax object was changed, in particular:

Object for resident enterprise income tax [9]:

a) allocated income;

b) expenditures spent or other payments, not connected to the economic activities;

c) product/service supply for free and/or money means passing;

d) representation expenditures above the limit number, set by Tax Code.

The Georgian Tax Code offers also the income tax sum calculation rule, received by dividing the expenditures by 0.85 [10].

The mentioned rule can be shown using the following formula:

$$P_T = E \cdot \frac{1}{0,85} \cdot R$$

where:

P_T – value of the income tax payable to the budget;

E – value of the enterprise's expenditures or payables;

R – income tax rate, equal to 15% in Georgia.

In case the income tax is calculated using the mentioned rule, the income tax interest will equal to 17,647%.

As we can see, the enterprise subject pays the income tax not from incomes (which is the difference between the general revenue and the expenditures set by the tax code), but from the expenditures and expenses, not connected with the economic activities. Thus, if the enterprise implements non-economic expenditures, subject to the income taxation, then it will have to pay the tax of 17,647% and not 15%. Before January 1, 2017 the rule was that the income tax was not payable for the part of the agricultural income, which was re-invested during 3 years from the proper taxation year end. It was possible to spread the rule on other branches of industry, or decrease

the income tax rate, which would give the enterprises possibility to reinvest the income. However, the new rule for income tax regulation stipulates taxation of the allocated income and is to certain extent the mandatory rule from state and to put the investments to widen the business.

In case if the production is free from income tax, its reinvestment, which is the possibility to get the great income in future, the enterprise can deny to re-invest the income, if it sees no realization market for its production or services. In such condition it will be made to allocate the revenues, and the taxed will be higher rate of the income tax, than it was set before January 1, 2017. It means that the tax burden will be increased and finally, instead of getting the surplus of money resources in the economy, which is the key goal of the reform, it will go to the budget. For example, if an enterprise gives 1000 GEL dividends, then according to the new rules, should pay the income tax (1000/0.85*15%) 176.4 GEL; in case of physical persons dividends should be taxed by 5% rate.

As for today's situation, in the real sector in Georgia if the enterprises will be widened, it can be difficult for them to find the additional places and enter the new markets because of the following reasons:

1. Georgia is a country of small economy and accordingly, the inner market is limited;

2. in the inner market local entrepreneur is often in unhealthy competitive environment, because the analogous imported production has comparatively low price;

3. entering the outer market is mostly difficult because the production produced in Georgia, does not satisfy the international standards;

4. for the production produced in Georgia, the outer market is not diversified enough for its realization risk decrease.

As we have mentioned above, the essence of the income tax reform is possibility to leaving money means in the cash resources economy, instead of the budget allocation and this should be used for re-investments. If we will analyze the state budget tax income inflows in 2017 (see tab. #2), we will see, that in 2017 compared to the year 2016 the income tax payments to the budget decreased, and in the economy stays (10559365–681000) 374 936 thousand GEL. If we will take into the account that from January 1, 2017 the tax for oil products and gas (apart from gas moved via pipelines) the expenditures rate was increased from 80 to 200 GEL per 1000 cubic meters, increased was also the rate for the oil products and fuel distillates (from 250 to 500GEL per 1 ton, and for several positions — from 400-to 800 GEL). This, in its turn, has caused the budget taxation revenues (1 627 000–1 069 658,1) 557 349 thousand GEL. The sum taken out of the economy for 2017 is more than the residual for this period.

The expenditures growth will increase the expenses and decrease the net revenues volume.

Taxation revenues to the state budget [11] (thousand GEL)

Table 2.

Name	Planned for 2016	Actually received in 2016	2017 Annual plan
1	*2*	*3*	*4*
income tax	2 086 000	1 978 136. 4	2 570 000

1	*2*	*3*	*4*
revenue tax	980 000	1 055 936. 5	681 000
VAT tax	3 802 000	3 286 393. 4	3 779 000
expenditures	1 012 000	1 069 658. 1	1 627 000
import tax	75 000	70 040 6	76 000
other taxes	25 000	526 585 3	87 000

In order to significantly increase the inner investments to the economy, apart from the revenue tax reform, the state should necessarily get concerned with the following:

1. stimulate the inner market competitiveness and create healthy competitive environment;

2. for production, produced in Georgia, diversify the outer markets;

3. significantly decrease the state expenses;

4. really decrease the business and taxation burden;

5. for normal functioning of free market, legally regulate the impeding factors.

Without such complex measures the results of the state reforms will not be yet satisfactory for high temp of economic growth and its maintenance.

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Contents