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Section 1. Biotechnology

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BIOTECHNOLOGICAL METHOD OF CONTROLLING THE CONTENT OF GOSSYPOL AND ITS VALUE

Abstract. The article presents the results of research on the emergence of gossypol, a new way of managing the content of gossypol and its value.

Keywords: Gossypol, cotton, biotechnology, poison, vitamin, soil, manure, water memory, the position of the Earth's axis.

Researchers conducted numerous experiments on the study of gossypol. Gossypol is a product obtained by processing cotton seeds or from cotton roots (Gossypium sp.), Malvaceae family (Malvaceae). Fine-crystalline powder from light yellow to dark yellow with a greenish tint. In the light darkens. Practically insoluble in water, slightly soluble in alcohol [1].

Gossypol is easily absorbed in the gastrointestinal tract, slowly released from the body. Symptoms of poisoning (increased peristalsis, persistent diarrhea, frequent and painful urination, then cough, pulmonary edema, venous stasis of the blood) usually appear after a few days [2].

To understand how gossypol appears, $(H_{30}C_{30}O_8)$, we conducted a series of experimental studies, analyzes, and observations. The following describes the causes of gossypol.

1. Changes in the soil. In the soil where uncultivated plants are found, the content of hydrogen ions increases and reacting with chlorine to form chloride acid. $H_+ + Cl_- = HCl$. Gradually, the field is covered with chloride acid. The root hairs of such plants dissolve fertilizers, which cannot be dissolved and absorbed by the roots of cultivated plants, and in a dissolved form absorb mineral fertilizers and thus contribute to an increase in the soil of the hydrogen ion H_+. If you sow cultivated plants without first clearing the soil of the hydrogen ion, the roots rot, the growth of plants slows down, and they die. After irrigation, the process of ripening the soil is accelerated, if not plowed in a timely manner, the soil quickly hardens. In the cotton field, where uncultivated plants grow, there are strong changes in the seed and fiber of cotton: the content of gossypol in the seed grows. The average value of gossypol in the seed, if we conditionally assume equal to 0.7%, [3], then 0.23% of them are formed due to changes in the

soil produced by uncultivated plants. The change in the composition of the seed under the action of uncultivated plants is called a combinational change. In such cases, uncultivated plants fulfill the role of mutagenic substance. Mutagenic substances have a direct effect on cotton seed. In order to get rid of combinational changes in cotton seed, it is necessary to act on it with a biological solution – prepared by mixing cattle manure in water. As a result, 0.22% gossypol is synthesized for vitamins and hormones, as well as for strong antibiotics, the characteristics of which should be studied in further studies.

To get rid of the hydrogen ion, which contributes to the combinative changes in the soil of the Earth, it is necessary to treat the soil with livestock manure. Research results show that if 2 tons of manure are poured onto 1 hectare of land, the effect of uncultivated and cultivated herbs becomes imperceptible. Gossypol, formed by combinational changes, disappears from the seed, the oil becomes healing.

2. The impact of mineral fertilizers. All changes in the soil structure of the Earth, and the plants planted on the soil and the harvest obtained from these plants, occurring through the use of mineral fertilizers can be called ontogenetic or phenotypic. Under the influence of ontogenetic transformations, 0.22% of gossypol is formed in the composition of cotton seed. To get rid of this gossypol, it is enough to soak the seeds on a solution of sheep's manure in water.

3. The impact of water memory. Contamination of the memory of water has a strong influence on the world of plants and all living things. In humans and plants, strong mutational changes occur. Human health is deteriorating, there are genetic diseases in front of which medicine is powerless. For example, bone cancer, liver cancer and others. In the seed of

plants, a strong poison appears and increases. The content of gossypol in cotton seed increases by 1.5%. This gossypol can be destroyed by soaking the seed in bio-solution, which contains chicken droppings and a very small amount of mineral fertilizer, which is used as a catalyst. The second way is irrigation of plants with water with a purified memory. Gossypol is not eliminated – it is synthesized into hormones and vitamins.

4. The impact of changing the position of the axis of the earth. Changing the position of the axis of the earth has a strong impact on planet Earth, including the content of gossypol in the seed of cotton. This change is expressed in quantitative form as follows.

1. Changes in the soil .... 0.23%.
2. Changes under the influence
   of mineral fertilizers .... 0.22%.
3. Changes due to water memory .... 0.15%.
4. The impact of changing the position
   of the axis of the earth .... 0.11%.
5. Atmospheric pollution......................... 0.05%.

Studies show that gossypol, which appeared under the influence of air pollution, can be eliminated by soaking in a solution containing three types of natural mineral fertilizers (cattle manure, lamb, chicken).

Gossypol, which appeared under the influence of a change in the position of the axis of the earth, as studies have shown, is not subject to liquidation. However, research is continuing on the elimination of such gossypol. The predominant side of these works is that gossypol is not separated from the composition of the seed, it turns into vitamins B_1, B_3, B_5, B_7, B_9, B_{11} and two hormones. This oil can be used in medicine.

We have developed ways of processing cotton seed with a drop (with residual fiber), without a drop and for sowing after wheat harvest [4] and applied for the patent office of the Republic of Uzbekistan in 2006. We called the cultivation of cotton with seeds treated in this way "a biotechnological method of growing cotton." Fiber and cotton seeds grown by the biotechnological method have special physicomechanical and biological properties. Experiments show that when processing with special biosolutions there are profound changes in the composition of cotton seed. Especially in the content of gossypol. It provides genetic changes in the cotton seed. Seed properties change over time.
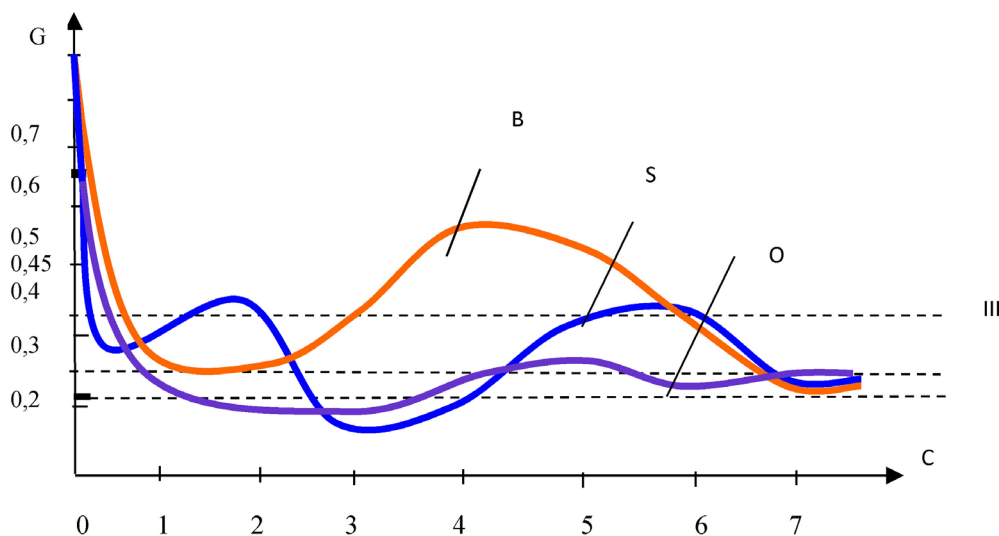
Figure 1. Seed properties change over time: G – free gossypol, C – concentration of bioliquor (symbol); I – average value of free gossypol in herbicide treated seed; II – is the average value of free gossypol in biosolvented seed with fiber;III – average value of the free gossypol in the biosolven-treated seed without fiber

Research results showed that under normal conditions, in such cotton fiber, instead of decomposition, maturation continues. This process continues until the fiber completely absorbs the moisture inside the bomb. Thus, the process of fiber decomposition stops and the shelf life of explosives increases. From the graph it can be seen that in cottonseeds processed by herbicides (O curve) the amount of gossypol decreases rapidly, it is spent on decomposition of the poison in the seed. When the air temperature is low and when the moisture content in the seed is exceeded, gossypol spreads over the seed volume and the seed decomposes, accompanied by a peculiar heavy smell. Gossypol does not turn into a beneficial substance, on the contrary, the content of poison increases. The graph of a seed that is not treated with herbicides shows (S curve, seeds with fiber) that, with a small amount of bio-solution, as well as with maximum content, the presence of gossypol will be minimal (0.007%), because gossypol begins to move towards the surface of the seed, and without reaching on the surface under the influence of a special

bio-solution turns into vitamins, that is, the main part of gossypol in the gossypol's nodule turns into vitamins B_9, B_{12}. With increasing moisture, two opposing processes continue, and the gossypol content will be high. With an increase in the amount ofbioliquor content gossypol will be relatively large. The high content of bioliquor contributes to an increase in evaporation, the temperature begins to decrease, and the decomposition of gossypol into vitamins decreases. With the passage of time, the temperature of the seed increases, the disintegration of gossypol increases the temperature of the bio-solution, the disintegration of gossypol increases into vitamins, the formation of vitamins increases. In every two months, an analysis of gossypol is carried out, the analysis is carried out 3 times, and the result is obtained, where the content of gossypol is reduced to zero.

The graph of the seed that is not treated with herbicides shows (curve S, seeds without fiber) that the content of gossypol first decreased to 0.09%, and then with the passage of time, gradually increased and at the end of the experiment it was 0.11%. A comparative analysis shows that in a seed with a descent (with fiber), the gossypol decomposition process is better, it indicates the need for the presence of fiber in the seed.

The seed oil obtained by harvesting cotton sown pretreated by the biotechnological method has antidote properties, i.e. quickly heals a mortally poisonous wounded soldier during hostilities. And the fiber of such cotton serves to increase the shelf life of explosives, because in the fiber obtained by the biotechnological method, [5; 6], the maturation process continues every day. This fiber is of great strategic importance. In addition, at the present time, parachutes are made of mulberry. When you add them this material with a certain moisture loses the necessary properties. Therefore, it is recommended to use for the manufacture of parachute cotton fiber grown by a new biotechnological method. First, different rodents and microbes do not eat and do not spoil this fiber, secondly, the fiber of this new material ripens in wet conditions, that is, the quality is monotonously improved and the shelf life of the parachute increases.

Findings:

– gossypol is a poison for a living organism;

– the content of gossypol increases due to environmental degradation;

– proposed a new way to control the content of gossypol, leading to its disintegration into vitamins: this means cottonseed oil obtained from cotton seed, processed by the biotechnological method, can be used as a healing;

– prospects for the use of cotton products in the military sphere are being opened.

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Section 2. Geography

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CLIMATE CHANGE IMPACT TO THE BEGINNING OF VEGETATION CROPS IN THE CONDITIONS OF UZBEKISTAN

Abstract. The article discusses the impact of modern climate change on the beginning of the natural vegetative regeneration of desert-rangeland crops and the initial date of cotton planting, taking into account their demands for air temperature in the Republic of Uzbekistan.

Keywords: Agrometeorology, climate change, cotton, rangeland plants, Karakul sheep breeding, air temperature, transition date, trend line.

Introduction

The planet has experienced an increase in average air temperature, the winter has become milder, and the summer months – hotter and drier. The world ocean level is rising. Glaciers are melting in the mountains. Dangerous meteorological phenomena have become more frequent. According to media reports, it is noted that in different parts of the world, floods, typhoons, hurricanes, strong winds, droughts, etc. are often observed. Current global climate change is considered to be the cause of the events. Currently, one does not deny that climate change is occurring. Now there is no doubt about climate change. Exposure of the agriculture sector to climate extremes is threatening to reverse gains made in ending malnutrition. Climate events have the biggest impact on acute food insecurity and malnutrition of world population. In 2017, the number of undernourished people was estimated to have increased to 821 million [3].

The work does not attempt to identify the cause of the change or assess the opinions of scientists on climate warming. Our task is to consider, using the example of Uzbekistan, how much quantitative changes occurred at the beginning of

vegetation period of rangeland plants in the harsh agro-climatic conditions of the Kyzylkum desert and at the beginning of the sowing period of cotton crop. The results of this work are relevant and have practical importance, since desert pastures, which occupy more than 70% of the territory of Uzbekistan, produce such important products as karakul wool, meat and cotton growing yields valuable fiber for the textile industry, oilcake for livestock, oil for the food industry.

The aim of the work is to investigate the influence of modern climate change on the beginning of the natural vegetative regeneration of desert-rangeland plants and on the beginning of the cotton sowing period in Uzbekistan.

The discussion of the results. In Uzbekistan, quite large research work has been carried out on rangeland and cotton agrometeorology [1]. However, to date, less attention has been paid to the impact of climate change on the initial stage of the natural rangeland crops regeneration and on the cotton planting period, since these dates are closely related to the further occurrence of different interphase periods.

Agricultural organizations in their current activities need a constant assessment of past and expected meteorological

conditions in order to make an expedient choice of a solution that carries the least risk for crops and their yield.

For karakul sheep breeding, the main and important cheap fodder base is natural pastures, the productivity of which is closely related to climatic conditions. The yield of karakul pastures ranges from an average of 2 to 4.5 centner per hectare, and depends on the occurring weather changes.

In the spring, the mass development of the main pasture vegetation is closely related to air temperature. The lower limit for the natural regeneration of the growing season is considered to be above 5 °C.

Dates of a steady transition of air temperature through above 5 °C for particular years were found by climatic database materials of meteorological stations of Uzhydromet (Uzbeki-

stan), which is located in the Kyzylkum desert, where the main base of karakul livestock feeding zone is concentrated.

Comparison of the dates of transition of air temperature in the karakul growing zone through above 5 °C for the current period of 1991–2018 with the base climate period of 1961–1990 showed a shift of dates towards earlier values, reaching 4 days in the northern areas (Akbaital), 5 days in the western (Buzaubai), 7 days in the central and western (Tamdy and Mashkuduk), 2 days in the southern (Ayakagitma). That is, on average, there is a shift of 5 days.

Along with the shift of the steady transition dates of the air temperature through above 5 °C, there is a shift in the beginning of the dates vegetative renewal of various pasture crops to earlier periods. This is clearly seen from (table 1).

Table 1. – The value of the shift of the beginning terms of natural rangeland regeneration to the earlier days in the Kyzylkum desert zone in Uzbekistan

Latin name of rangeland plants	Shift to earlier terms (days)
Artemisia Krasch (sagebrush)	2
Salsola arbuscula Pall (saltwort	9
Calligonum leucocladum Bge (juzgun)	4
Carex pachystylis Gay (Ilak)	2
Ferula assa-foetida L. (ferule)	6
Poa bulbosa L. var vivipara (bluegrass)	4
Bromus tectorum L. (campfire)	2

From (table 1), it can be seen that the response to climate change for dates of the vegetative renewal desert-rangeland plant for different species manifests itself differently depending on the biological characteristics of the crops.

Analysis of these materials and table allows to note, that the beginning of the growing season is shifting to earlier terms, due to climate warming in Uzbekistan [2].

Further development of the pasture crops depends on the dates of the onset of their natural regeneration, including the dates of the onset of various interphase periods, which is clearly shown in figure 1 on the example of *Haloxylon persicum (a)* and *Ferula assa-foetida L (b)*. Mathematical-statistical processing of materials are carry out. The trends are calculated by linear approximation and the regression equations are obtained, which like this:

for *Haloxylon persicum* $y = 0.99x + 18.55$ (1)
for *Ferula assa-foetida L.* $y = 1.12x + 9.58$ (2)

In these equations *x, y* is the date number starting March 1. For example, the number 1 corresponds to the date of March 1, 90 – corresponds to May 30. The strength of relationship between these parameters for *Haloxylon persicum* and *Ferula assa-foetida L.* (r = 0.87) showed that this is quite enough for practical use.

In recent years in Uzbekistan, a number of research were conducted for agrometeorological support karakul sheep breeding. Among them developing of a method for calculating reserves of productive moisture under rangeland plants and preparation of a scientific applied reference book "*Average Perennial Moisture Supply in the Desert Zone of the Kyzylkum*". Additionally dependencies of rangeland vegetation yield on air temperature and moisture reserves in different layers of soil were found and used in operational practice.

Uzbekistan belongs to the cotton-growing countries, and cotton (*Gossypium hirsutum)* is a crop that is largely dependent on weather conditions, and also requires timely agrotechnical measures. Therefore, it is of practical interest to study the influence of climate change on the date of sowing of cotton seeds in spring season.

Based on the materials of the meteorological stations of Uzbekistan located in the irrigated zone where cotton is cultivated, the dates of a steady transition of air temperature through above 10 °C, at which the germination of cotton seeds occurs, have been considered for more than 50 years. On the base of the materials the corresponding statistical processing was carried out. In the result diagrams on transition date change of temperature in spring through above 10 °C were plotted and the trend line equations were obtained.
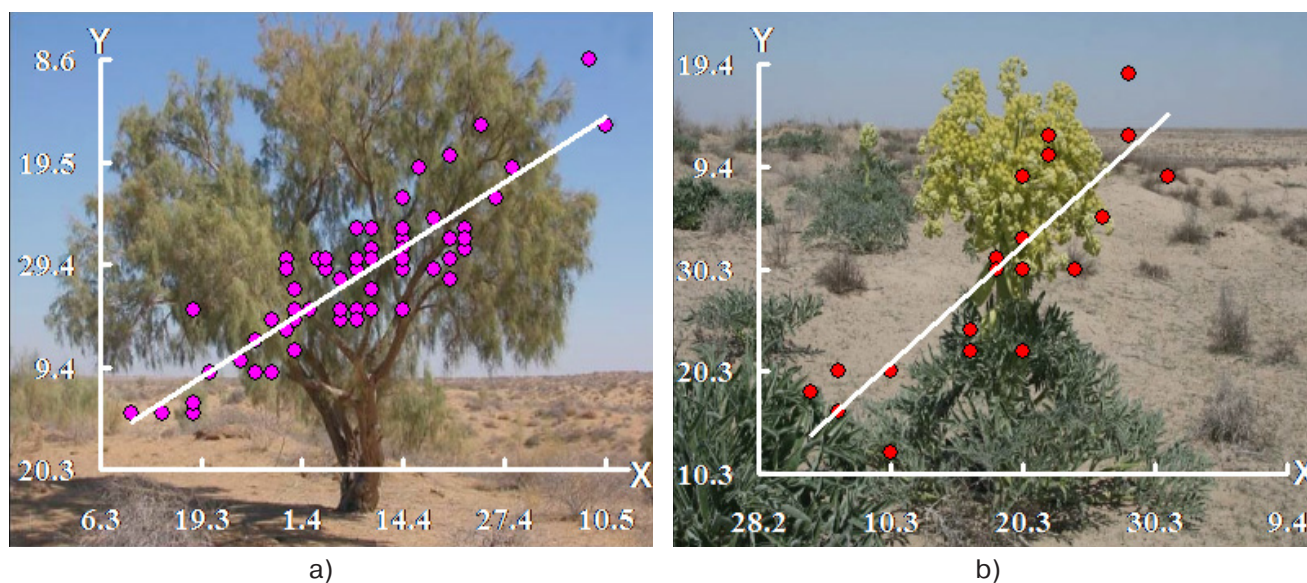
a)

b)

Figure 1. Relationship between the date of the beginning bud formation period
Haloxylon persicum (*y*) and the onset of the growth shoots phase
Ferula assa-foetida L. (*y*) from the date of the beginning vegetative renewal phase (*x*)

Comparison of the dates of transition of air temperature in the cotton growing zone of Uzbekistan through above 10 °C for the current period of 1991–2018 with the base climate period of 1961–1990 showed a shifts of dates to earlier values which were reaching 6–10 days in the northern regions, 2–4 days in the south, 1–6 days in the central, 2–5 days in the east.

Analysis of the materials allows us to state that climate warming is observed not only in the desert zone, but also in the irrigated regions of Uzbekistan.

In the cotton growing in Uzbekistan, an important role in increasing the yield plays the timely implementation of agrotechnical measures, which include thinning, top removal, defoliation of plants, etc. These measures are dedicated to each interphase period of plant development.

Based on observations made under production conditions in the vicinity of meteorological stations, dependencies were obtained between different dates of occurrence of the phenological phases of cotton, which is necessary for agrotechnical measures (thinning, watering, fertilizing, top removal, defoliation, etc.).

t has been found that in order to ensure optimal plant density in our conditions, cotton thinning is required during the onset of the first leaf deployment phase. To solve practical problems, it is important to have information about the date of the onset of the flowering phase and the opening of the first bolls in advance during the period of productivity formation, which are necessary for planning such important agrotechnical measures as top removal and defoliation. Removing of top foliage in cotton (the alienation of the upper part of the main stem) is carried out with the aim of directing nutrients to form

the productivity of the plant, and not on the growth of the main stem. Usually, top removal is carried out in 30 days after the onset of the flowering phase.

Defoliation is carried out to accelerate the disclosure of the formed boxes and create conditions for the timely harvest before the onset of inclement weather.

In (Figure 2) shows the relationship between the important dates of the onset of phenological phase development of cotton.

In practice you can use (Figure 2) to calculate the date of flowering and opening of the first boxes, respectively, if the dates of emergence of seadlings and flowering are known.

It is necessary to underline that adverse weather and agrometeorological conditions may interfere with the implementation of agrotechnical measures in the required time frame. It has been scientifically proven that deviations from the dates of planned activities in the interphase periods lead to a decrease in cotton productivity and a deterioration in the quality of the fiber.

Summing up, generally, it should be noted that karakul and cotton growing is extremely important to the development of the agricultural sector of the country economy. But no matter how the food base grows in the desert and new agrotechnical measures are introduced in cotton growing, the role of meteorological factors will always play a major role. The developed methods for assessing the state, growth, development and forecast of phenological phases of both pasture vegetation and cotton, as well as assessments of the formation of the quality of cotton fiber based on agrometeo-

rological and agroclimatic indicators will always be a reliable means in the hands of agrometeorologists.

In conclusion, we note that the topic concerned, of course, is very complex, controversial, and requires continuation of research in these fields.

a)   b)
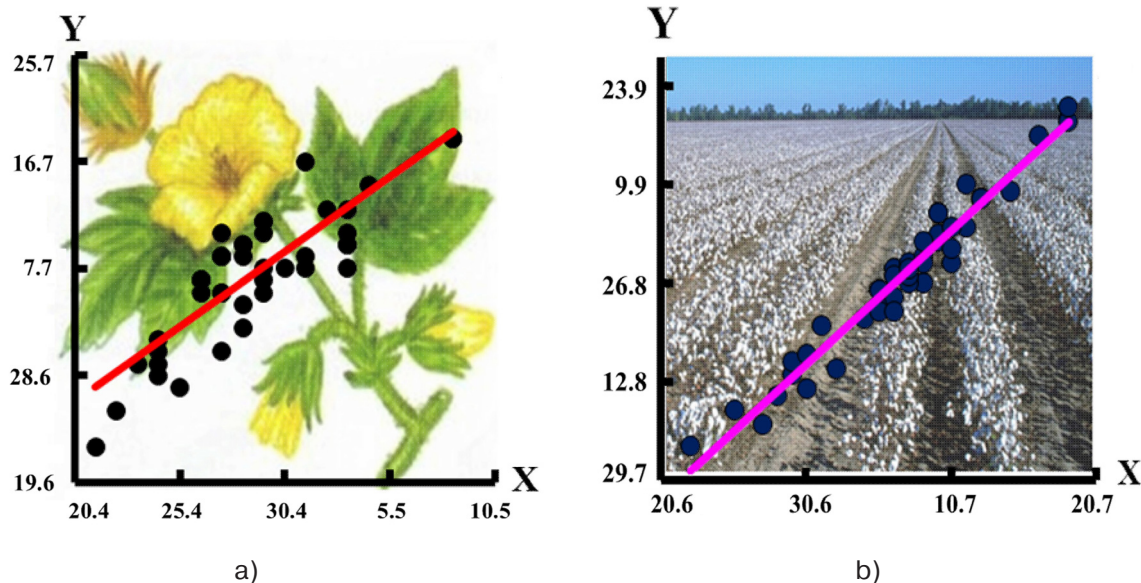
Figure 2. Relationship between the date of the onset of the flowering phase (*y*) from on the onset of the seadling phase (*x*) (fig. 2a) and the opening of the first bolls of the cotton (*y*) from the date of flowering (*x*) (fig. 2b)

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LADSHAPT POLLUTION OF THE AHANGARAN VALLEY UNDER EXPOSURE TO THE TECHNOGENIC FACTORS AND ITS CONSEQUENCE

Astract. The article deals with the pollution of the environment by mining facilities as a result of the extraction and use of the natural resources of the Akhangaran valley in Uzbekistan.

Keywords: mineral resources, landscape, GDP, recreation, economy, atmosphere, lead, exploitation.

The current stage of development of society is not possible without the use of natural resources, in particular, mining of minerals in the mining industry. The main territories where mining operations are carried out and the natural landscapes are being polluted are mountainous areas, which in particular are the mountainous and foothill regions of Uzbekistan. Uzbekistan is extensively exploiting mountainous areas, where various mineral resources and the use of the territory for recreation are developed. One of the most widely used areas in Uzbekistan is the valley of the Akhangaranriver. The mining industry of Uzbekistan is represented here by the extraction of brown coal, copper, gold, tungsten and other minerals.

Extraction, transportation, storage and use of minerals is associated with the pollution of natural components, in particular the lithogenic base, surface and groundwater, soil and plants. There is general pollution of the lower layers of the atmosphere.

Contamination of the lithogenic base occurs in the process of extraction, transportation and processing of mineral resources, as well as due to man-made processes [2].

Pollution of natural landscapes in the extraction of minerals in Uzbekistan is associated with an increase in the production of non-ferrous metals. In particular, in the valley of p. Akhangaran, as a result of the impact of the mining industry on landscapes, a number of metals are pollutants of the natural environment. These include lead, cadmium, tin, copper, arsenic, strong, nickel, molybdenum, tungsten, vanadium, uranium, radium and other metals.

In areas under the influence of industrial enterprises in the cities of Angren and Almalyk, the presence of chemical elements in the leaves of plants is determined by atomic adsorption and is mainly determined by the degree of their danger.

Pollutants are divided into three groups according to the degree of danger: Group I – lead, cadmium, arsenic, tin; Group II – copper, molybdenum, selenium, nickel; Group III includes uranium, radium, vanadium, tungsten [1].

Lead is a highly toxic substance found on the leaves of almost all tree species in the study area. Its content is from 6.5 mg/kg to 17.8 mg/kg of rock or from 1 to 3.2 ounces. Studies conducted in most of the studied region show that the lead content in plants did not exceed the permissible limit concentrations accepted by the state control service of the Republic of Uzbekistan. The condition of the trees is satisfactory.

In the north of Angren, lead poisoning was detected in the Yangiabad-2 industrial zone. Its natural content in the residential zone is 20 mg/kg, in industry – 18 mg/kg. On the III–IV terraces of the Akhangaran river in the Yangiabad-2 zone, the total lead content is 27 mg/kg or 1.5 times higher than the natural background (low pollution) [1].

In the southwestern part of the city, in asphalt concrete and building materials, lead content ranges from 14 mg / kg to 49 mg/kg or up to 3 times the natural content in nature. Its content on the territory of the rubber products plant reaches up to 40 mg/kg.

Cadmium is also a first-order pollutant. In the study area its content is small. Only in the southern part of this region

there is little pollution; in the mountainous region, the content of cadmium in the grass and leaves of trees ranges from 0.58 mg/kg to 2.09 mg/kg.

Arsenic is included in the 1st group of toxic substances, and is found mainly in the mining and industrial zones of the study area. Industry its content is 0.4 mg/kg, and in the residential area – 0.5 mg/kg. On the I–II terraces of overburden of a coal seam, its content is 0.45 mg/kg, to the northeast it rises to 1.03 mg/kg. In the same area, the amount of arsenic in the area between Dukent and the River Karubusey is from 0.66 mg/kg to 1.66 mg/kg, or the excess of the background level is from 1 to 3.3 units per m^2. Next to this site there is a plant for the production of asphalt concrete and building materials.

Zinc also belongs to the first risk group. In the residential area its content is 73 mg/kg, and in the industrial – 30 mg/kg.

In plants located on the upper terraces of Angren, its concentration in the mining industry is 70–85 mg/kg or 2.8 times higher than the background content. In the eastern part of the city, on 1 and 2 terraces of overburdening of a coal mine, in a river valley, in coal fields and in adjacent areas, the zinc content is from 70 to 157 mg/kg or the excess is 2.8 times. In the northern part of the city, on the terrace, the zinc content ranges from 35 to 47 mg/kg, or 1.7 times higher than the natural level, that is, there is "weak pollution". In the central part of the city, the level of pollution ranges from 29 to 69 mg/kg, there is "low pollution" [3].

The most polluted areas are coal mines, railways and highways. The zinc content in natural foliage in rural and industrial areas is only 0.08 mg/kg. In the eastern part of Angren, on terraces I and II, it ranges from 0.09 to 0.18 mg/kg. In the central part of the city, on railway lines, on the upper terraces of the Akhangaran river, its value ranges from 0.1 to 0.12 mg/kg or the excess is from 1.3 to 1.5 times. There is "weak pollution".

Copper is a pollutant of the second group, being a very toxic element and is found in almost all types of trees. Its content ranges from 12.5 mg / kg to 22.9 mg / kg. Anomalies are found on I, II, III above-flood terraces of the Akhangaran river. The spread of copper is associated with industrial production, with roads and railways. Its background content in the residential area is 14 mg/kg, and in the industrial area – 12 mg/kg. In the Nurobod-2 area, in the northern part of Angren, the copper content is from 12 mg/kg to 16.7 mg/kg or the excess is from 1 to 1.3 times. There is "weak pollution" on the railway. Excessive copper content in the human body leads to changes in brain tissue, skin, liver and pancreas.

On the left bank of the northeastern part of the city and on the Syrdarya terrace, in the area of sedimentation and in the upper part of the coal layers, copper pollution is 1–3 times more than the background. In the rest of the territory, the copper content in the region is less than the maximum permissible rate.

Nickel. It is in the second group of pollutants. It is distributed on the I, II, III and IV terraces above the floodplain. This is especially true for the southwestern part of the Yangiobad-2 industrial zone. In the residential area, its background content is 1.9 mg/kg, and industrial background – 1.9 mg/kg. In the I–II overburden terraces of a coal mine, its content ranges from 2.4 to 38 mg/kg. On the first terrace of the coal seam, next to the water treatment (opening), the amount of nickel is 4.8 mg/kg or the excess is from 1 to 2.4 times.

Molybdenum pollution in 80% of the area is very low. In the vicinity of Angren power plant there are areas with low pollution. In areas contaminated by molybdenum, there are also old and new sedimentary ponds. On precipitation (background content of 0.2–0.7 mg/kg), maximum accumulation of molybdenum was observed up to 2.5 mg/kg. The average amount of molybdenum in sedimentary rocks is between 2 mg/kg and 4 mg/kg in soil.

Molybdenum diffraction zones include 1, 2, 3 upper terraces. The background content in the residential area is 1 mg / kg; industrial background – 1.9 mg/kg. The pollution area extends from north to east to south and covers the main areas of 1, 2, 3 above-floodplain terraces. Molybdenum is mainly found near coal mine facilities. Its content is 1.5–2.1 mg/kg or the excess is 1.5 and 2.1 times [3].

Horizontal tungsten pollution is widespread in this area. Its natural content is 2.5 mg/kg. Heavy tungsten pollution is observed in man-made landscapes. The surface area of tungsten tissue is 10 times greater than perforation (2.5 mg/kg), in some areas – 69.1 mg/kg (27 times more), especially in the north-eastern part of the region (around old and new developments).

The degree of pollution is exceeded 5–10 times in wastewater, in irrigated areas of the southwestern zone (below cesspools). The irrigation zone is mainly located on the Syr Darya basin. In the vast majority of the territory (30%), tungsten pollution is 3–5 times higher than background (7.5–12.5 mg/kg).

The area is slightly polluted by vanadium. Its lithogenic content is much higher than in coal seams, a large amount of vanadium is emitted into the atmosphere during the burning of coal. As a result, vanadium spreads throughout the river valley. The content of vanadium in the soil is 150 mg/kg.

The uranium content has an average of 3.2 mg/kg in the rock and 1 mg/kg in the soil. The radioactivity of uranium has a strong effect on organisms through the kidneys. In Angren, in the industrial zone, the amount of natural uranium according to Kiziltepageologiya information is 4 mg/kg, and in the rest of the area and adjacent areas, in a quarry, in coal dust, its content is from 4 to 12 mg kg four.

While studying the distribution of pollutants in the Akhangaran valley, it was found that they are mainly found

in the mining, transport and processing industries of the mining industry. The plants around the industrial area are contaminated with heavy metal waste. Excessive amounts of metal in landscape content adversely affect human health. The total mass of heavy metals and their distribution zones are controlled by geomorphological conditions.

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DEVELOPMENT OF TOURISM IN UZBEKISTAN

Abstract. This article highlights the development of tourism in Uzbekistan and the problems and prospects for its development. Also, given information about tourism in Uzbekistan and an assessment of the place of Uzbek tourism in the economy.

Keywords: tourism, GDP, hotel, motel, sanatorium, resort, recreation, economy, services.

Modern tourism is a global phenomenon of the twenty-first century, which is not only a form of recreation and leisure, but also one of the most active forms of communication among people, the development of new territories and a key sector of the economy. Tourism is characterized by the selectivity of spaces, depending on the characteristics and properties of the territory, and on modern motives of tourist and recreational activities. The modern needs of tourists underlie the formation of specialized territorial tourist and recreational systems, which change in space and time [4].

Up to the present time, tourism has become one of the leading sectors of the global economy.In this regard, Uzbekistan pays special attention to the modernization of the tourism industry, the development and improvement of the regulatory framework for the sustainable development of the industry, and the organization of services for foreign guests in accordance with international standards.

During the years of independence, Uzbekistan made a significant breakthrough in this area, coupled with the preservation and enhancement of the historical and cultural heritage of the people, the revival of national traditions and customs, the restoration and arrangement of the sights of the republic.

The sphere of tourist interests in Uzbekistan includes both active forms of recreation and sports tourism, such as climbing and alpine skiing, as well as traveling for educational purposes, where the object of knowledge is the rich archaeological and religious history of this country.

According to the State Statistics Committee of Uzbekistan, the share of tourism in GDP was 2.4% in 2016, in 2014 this figure was 2.7%, in 2015–2.6%. Whereas, the share of tourism in exports was 11.4% in 2017, and in 2014 this figure was 7.8%. But Uzbekistan has a huge tourism potential in order to increase the share of tourism in the country's economy [2].

In order to create a modern, highly efficient and competitive tourist complex in the republic, a solid legal and regulatory framework has been formed, the core of which is the Law "On Tourism", adopted on August 20, 1999.

An important step in shaping the national model of tourism was the creation in 1992 of the National Company Uzbektourism by decree of First President Islam Karimov. Since then, the structure has been coordinating the activities of sectorial organizations, has been training relevant personnel, facilitates the flow of domestic and foreign investment in creating new and expanding existing material and technical base, stimulates the development of all types of tourism, actively participates in foreign events, organizes major international forums. In 2016, Uzbektourism was abolished and the State Committee of the Republic of Uzbekistan for the development of tourism was established on the basis of the abolishing Uzbektourism. The State Committee for the Development of Tourism is designated by an authorized state body in the field of tourism.

From the first years of independence, Uzbekistan has been actively increasing cooperation with international organizations, and regularly comes up with initiatives to deepen cooperation in this promising direction.

An important milestone in the annals of domestic tourism was the accession of the republic in 1993 to the UN World Tourism Organization (UNWTO). Within the framework of cooperation with it in 1994, 19 countries of the world adopted the Samarkand Declaration on Tourism along the Silk Road. In 1999, the Khiva Declaration on Tourism and the Preservation of Cultural Heritage was adopted, supported by UNWTO, UNESCO and the Council of Europe. In 2002, the Bukhara Declaration on Tourism along the Silk Road, which emphasizes the benefits of sustainable tourism and identifies concrete steps to promote cultural and ecological tourism in this direction.

The presence of Uzbekistan is evidenced by the presence of over seven thousand sites of material cultural heritage of different eras and civilizations, including the historical centers of Bukhara, Khiva, Samarkand and Shahrisabz, included in the UNESCO World Heritage List.

The efforts of the leadership of the Republic of tourism infrastructure in recent years raised to a fairly high level. According to the State Statistics Committee of Uzbekistan, about 550 tourist organizations successfully operate in the country. Over the past 5 years there has been an increase in the number of firms and organizations engaged in tourist activities. So, for example, in 2012 their number was 345 units. And by the beginning of 2018 increased by 104 and amounted to 449 units.

In the regions of the Republic of Uzbekistan in 2017, there is a tendency that the main number of firms and organizations are registered in the city of Tashkent (321 units) and 70.8 thousand foreign visitors. In Samarkand region there are 57 tourist organizations and 20.8 thousand foreign visitors. In the Bukhara region – 18 tourist organizations and, accordingly, 13.1 thousand foreign visitors.

In the Khorezm region – 8 tour firms and 51,2 thousand foreign visitors.

In 2017, there are 676 hotels in the country, the number of rooms is 17703 rooms and 34140 places. There are 143 1-star hotels, 2 -star 19 units, 3-star hotels – 96 units, 4-star –38 units, 5-star hotels – 9 units and 371 hotels without a category [2].

In recent years, new types of travel, including ecological tourism, have been actively introduced in Uzbekistan. The presence in the republic of reserves, national parks, nurseries, wildlife reserves, natural monuments, biosphere reserve makes ecotourism in a very promising direction.

In addition, geotourism, medical tourism, sports tourism, as well as mountaineering and rafting have developed in Uzbekistan. Recreation areas and comfortable infrastructure fa-

cilities are being built in the regions. For example, in the sports and recreation centers "Chimgan", "Beldersay" and "Charvak", located in the Tashkent region, the necessary conditions for skiing and other winter sports have been created. Here are built mountain trails of different types with a length of 300 to 3 thousand meters. Vacationers can climb the cable car using a special lift.

The Uzbek mountains are attractive for those who love active forms of recreation such as mountaineering, mountain hiking and climbing. The most popular highlands of Uzbekistan are the Chimgan Mountains with the dominant Big Chimgan peak, 3309 meters high. This area is the beginning of many climbing paths, hiking routes, climbing, horseback riding routes, ski slopes, etc.

A popular rafting route on the rafts is the Chatkal River, which flows into the Charvak reservoir and has rapids of several categories of complexity.

For cavers, the Baysuntau ridge with deep caves is of interest: Boy-Bulok (amplitude 1415 m), Festival-Icefall (−580 m), Ural (−565 m); Kiev Cave (−990 m) on the Kirktau Plateau; Zaidman cave (−506 m) on the Chatkal ridge and others.

Winter holidays in the mountains of Uzbekistan are organized only in Chimgan and Beldersay. There are several modern guesthouses of hotel type and hotels. In addition, there is a large selection of private sector cottages.

Chimgan and Beldersay are located relatively close to the capital of Uzbekistan – Tashkent: at a distance of only about 90 km. Therefore, many lovers of skiing prefer to make day trips to the mountains. The longest ski trail in the mountains of Uzbekistan is Beldersay (3017 m.). Chimgan also has a chairlift, although it is not as extensive as in Beldersay. Its length is 800 m, the upper station is at an altitude of 1925 m. The length of the route is 1500 m.

In Uzbekistan, the gastronomic direction of tourism is also gaining popularity, the development of which allowed making pilaf and other national dishes to be a recognized brand of the country.

In addition, a sanatorium-resort business is developing in the republic.

Sanatorium-resort business (activity) – a set of all types of scientific and practical activities on the organization and implementation of disease prevention, treatment and rehabilitation of patients based on the use of natural healing resources, studying their properties and mechanism of action, a set of measures for the organization, construction, management of resorts, providing treatment and cultural and community services for citizens at a resort, exploitation and protection of natural therapeutic resources and health protection of resorts [3].

The main type of treatment and prophylactic institution in Uzbekistan is a sanatorium (sanare, lat. -Heal, improve) -a

treatment institution intended for the treatment, prevention, and medical rehabilitation using natural therapeutic physical factors in combination with artificial factors, therapeutic physical culture, medical nutrition and other methods in a specially organized mode [3].

There are 71 sanatoriums for adults, 33 children's sanatoriums in the country.

Of them, the sanatorium "Mersian", "Chinobod", "ZangiotaZam-Zam", "Botanika", "Buston", "Chatkal", and "HumsonBulak" are the best sanatoriums.

Significant role in ensuring the accelerated development of the tourism sector of Uzbekistan, the formation and maintenance of the country's image on the world market are played by major events regularly held in the country. One of the most important annual events is the Tashkent International Tourism Fair "Tourism on the Silk Road", etc.

Representatives of Uzbekistan also regularly participate in international fairs and exhibitions held abroad in order to present the tourist potential of the republic. Participation in them allows you to stay abreast of the latest trends in the global tourism market, enter into business contracts, and develop cooperation with foreign partners. According to the State Statistics Committee of Uzbekistan, from year to year there is a tendency of growth in the number of foreign citizens entering the Republic of Uzbekistan. Over the past 15 years, the number of foreign citizens visiting Uzbekistan increased 15.5 times – from 442.1 thousand people in 2002 to 2847.9 thousand people in 2017.

The citizens of Uzbekistan who went abroad amounted to 5182.5 thousand people in 2017, which is 6.5 times more than in 2002.

In the CIS countries, the dominant stream of foreigners falls on Kazakhstan – it is 1.783.8 thousand persons (67.7% of the total number of foreigners from the CIS countries), then on Kyrgyzstan – it is 375000 persons (14.2%), on Tajikistan – this is 261900 persons (9.9%), to the Russian Federation – 143000 persons (5.5%) and to other states – 16.9% (this is Turkmenistan (62500 persons), Azerbaijan (4300 people), Belarus (3000 people), Ukraine (0.7 thousand people) for 2017.

In far-abroad countries, the largest flow of foreign citizens is accounted for by citizens from Turkey (55200 people), then from Korea (37400 people), from China (19700 people), from Germany (7800 people), from the UAE (5800 people), from France (5700 people), Israel (4200 people), Japan (4100 people), Pakistan (3800 people), Great Britain (3300 people), Malaysia (3200 people), USA (1500 people) and from other states (61000 people) for 2017 [2].

Architectural and historical sights of Uzbekistan:

Tashkent: Khazrati Imam and Sheikhantaur ensembles, Abdulkasim Sheikh, Barakhan and Kukeldash madrasahs;

Samarkand: Region Square, BibiKhanum Mosque, Gur-Emir Mausoleum, ShakhiZinda complex, Ulugbek Observatory;

Bukhara: Poi-Kalyan ensemble, Ark citadel, Samanid mausoleum, Lyabi-khaus;

Khiva with its preserved inner city Ichan-Kala, numerous mosques, madrasahs, minarets, walls and gates are all world-recognized landmarks

Although it is often mistakenly believed that there are no attractions in Tashkent, there are also historical monuments, including the mausoleum of Sheikh Zainudin and the mausoleum of Sheikh Hovendi at-Tahur.

Thus, the intensive development of the tourism industry in Uzbekistan, including respect for the historical and cultural heritage, the creation of infrastructure that fully meets international standards, the strengthening of international relations have turned our region into one of the most visited countries in the world.

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GLACIERS OF THE PSKEM VALLEY

Abstract. This article describes the types, size, retention and reduction of mountain glaciers and their characteristics in the Pskom River basin. The article also lists the major mountain glaciers in the Pskom River basin.

Keywords: glacier, parallel, mountain, the Ugam ridge, regions, active melting, the meantime, eradicate, evolution, adjacent, watercourse, tributary, the territory, Western Tianshan, axis, remarkable, breakdown, altitude, cryogenic plains.

A source of information on the retreat of mountain glaciers in Central Asia, including the territory of Uzbekistan, and some of them are completely eradicated (Shetinnikov A. S., Podkopaeva L. D., Ni A. [1; 3]). Scientific research works by gliaciologists and observations that mountain glaciers in the territory of Uzbekistan are currently undergoing a regressive phase. Uzbekistan's mountain glaciers are currently undergoing regressive stagnation (melting, diminishing the area), but their decline is continuing. At the same time, the interval period decreases, and then goes into growth. However, the glaciers are gradually retreating. There is no clear scientific information about the time when the glaciers' retreat from Uzbekistan began.

In today's global climate change, the glaciers are increasingly facing upstream in the hilly mountain regions of the Republic of Uzbekistan, which results in shortening of their area, breakdown and, finally, some of the glacial abolition.

In the natural habitats of the mountains of Central Asia and Uzbekistan, the snow line passes about 3.500 m, but the high altitude rates make up less than 20% of the country's territory. Therefore, mountain glaciers are formed in the territory of Uzbekistan along the Western Tyanshan, Gissar mountain ridges. According to recent data on Uzbekistan, 564 mountain glaciers are located in Pskom and Chatkal, Kashkadarya and Surkhandarya basins. These glaciers are 100%, 52% of which are mountainous glaciers (about 3% of the Chatkal basin in Uzbekistan) are located in the Chirchik river basin. The total area of mountain glaciers in the basin is 127.8 km².

Early researches on mountain glaciers in the territory of Uzbekistan began with the study of mountain glaciers in the western Tianshan. In this regard, D. L. Ivanov's research on the existence of mountain glaciers, formed in 1879, at the beginning of the Maydontol's right tributary, is remarkable. In his research, he informs us about 9 smaller glaciers in the Maydontol area.

Most of the mountain glaciers in Uzbekistan are located in the Western Tianshan mountain ridges, and the western Tianshan is located in the northeastern part of Uzbekistan, forming its bases in the western foothills of Qorjontog, Ugam, Pskom, Kuksuv, Chotqol, forming ridges, which are parallel to one another and extend from the northeast to the south-west. Here are some of the most favorable conditions for mountain glaciers: glacial valleys, tannins, and cryogenic plains adjacent to the mountain slopes. Therefore, large and dozens of smaller glaciers such as Tekishsai, Tachoshuv, Chotan, Tuzoshuv, and TalasOlatov's western part of the Uzbek territory have been formed.

One of the largest ridges in the northern part of the Western Tien-Shan is the Ugam Ridge, with an average altitude of 3.500 m above sea level. This situation creates favorable geomorphological conditions for glaciers in Ugam Mountain. However, due to the fact that the Ugam ridge is part of Uzbekistan's southernmost part of the watercourse, its offspring constitutes an unfavorable environment for the formation of glaciers. Therefore, glaciers along the main water-bearing parts of the Ugam ridge are only very rare.

The highest point of the Ugam ridge in the territory of Uzbekistan corresponds to the place where it connects with Talas Olatov, reaching 4.131 meters. The main glaciers of the Ugam range are formed in these regions. These regions are divided into two groups: the first region is the southern Maydontol group, which has developed in the right corner of the Ugam ridge toward the Maydontol Ridge. It is about 20 km south-west. In the meantime, 33 glaciers were formed. The second group has 47 glaciers, the largest of which are Chotan-1 (length 4.1 km), Chotan-2 (3.9 km) and Chotan-4 (3 km) long.

The Pskom mountain range is more stable than the Ugam mountain range. In the north-eastern part of the Pskom ridge, it rises to more than 4000 m. On the northern slopes of the

Pskom ridge, we can count up to 19 smaller (up to 1.2 km) glaciers to Beshtor (4291 m).

There are 19 smaller (up to 1.2 km) glaciers before the cliff. After the peak of BeshtorShovursoy rises to a height of 4318 m. Therefore, in the Pskom ridge, there are 71 major (3,6 km long tropical) glaciers. Although Talas is located at Olatov, the highest point of the Western Tianshan is Manas (4484 m in Kyrgyzstan), but its overall altitude is slightly lower than the Pskom axis. Hence, here, Tuzoshuv, Shovursoy, seven, with a length of up to 1.8 km and an average of about 1.0 km are formed.

The Tekishsoy mountain valley, located in the Pskom River basin, is experiencing a decline. Its length in the 1960s was 3.2 km long. This ice cover has dropped by 1.3 km over the next 30 years. Thus, the glacial language dropped to 3.9 m annually. In the upper part of the Bariran River, the Bariran, the Left Bariran and the Lower Bariran glacier were actually a massive iceberg. In recent years, their rapid evolution has led to the separation of three glaciers separately (Table 1). The following table shows the glaciers in the Pskom and Chatkal Basins of the Republic.

Table 1. – Geographical distribution of mountain glaciers along Pskom and Chatkal river basins

№	River Basin	Number of mountain glaciers	Total area glacier (km²)	Additional information
1.	Pskom	250	127.8	–
2.	Chatkal	–	–	Total 124 ice caps in the basin area, of 51 km² in Kyrgyzstan

Note: The table was made up based on date of Podkopayev L.D., Shetinnikov A. S.

Table 2. – Large mountain glaciers, located in the Pskom River basin (over 1 km²)

	The name of the mountain ice	Location (river basin)	Area (km²)	Length (km)	Ice-capped slopes
1.	Ayutur-2	Pskom	3,9	3,8	North
2.	Ayutur-3	Pskom	3,8	3,8	North
3.	Kalesnik	Pskom	3,6	3,6	–
4.	Chotan-2	Pskom	3,4	3,9	North
5.	Chotan-4	Pskom	3,0	3,0	Northwest
6.	Barqroq	Pskom	2,9	3,2	–
7.	Paxtakor	Pskom	2,8	3,6	North-East
8.	Chotan-1	Pskom	2,4	4,1	South-East
9.	Tastorsoy	Pskom	2,8	3,6	North-East
10.	Torshuv-6	Pskom	2,1	2,2	North –1
11.	Termatosh	Pskom	2,0	3,0	Northwest
12.	GeneralAyutur	Pskom	1,8	3,2	North-East
13.	Onaolgan	Pskom	1,8	3,2	North-East
14.	LowerTuproqbel	Pskom	1,8	1,0	South-East
15.	Tuyaqorin-1	Pskom	1,8	3,6	North-East
16.	Shovursoy-2	Pskom	1,8	2,8	North
17.	Lower Lake	Pskom	1,7	1,1	Northwest
18.	Ayutur-2a	Pskom	1,7	2,2	North-1
19.	West Isinoman	Pskom	1,4	1,1	North-East
20.	South-EastOqqopchigoy	Pskom	1,4	1,8	North-East
21.	Middle Lake	Pskom	1,4	0,4	Northwest
22.	Tastorsoy-1	Pskom	1,6	3,2	North-East
23.	NorthOqqopchigoy	Pskom	1,2	2,7	South-East
24.	Chotan-3	Pskom	1,1	about 1 km	North
25.	Tastorsoy	Pskom	1,0	2,4	North-East

Note: The information was created by the author on the basis of the data

The glaciers in the Pskom River basin account for about 11% of the annual flow of the Pskom River. The active melting of glaciers in the basin falls on July-September.

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LIFESTYLE AND ITS GEOGRAPHICAL CHARACTERISTICS SOME OF THE THEORETICAL ISSUES OF LEARNING

Abstract. The article describes the role of research in the field of social life among socially-geographical areas, and scientists' research on this subject. The regional differences regarding the livelihoods of the population and their geographical characteristics are explained.

Keywords: lifestyles, quality, bisexivism, behavior, geography of tradition, intuition, mentality and character, ethics, ethnography, ethnos, sotcy, social space.

Human development has been shaped and developed over the centuries on the basis of different sciences and their achievements. From this point of view, the science of geography has its own place in the system of science, and it is natural that there are many new developments in its development. In particular, in the years to come, our republic has become a social geography of the traditional economic geography and its broader social geography, which is certainly a positive process.

In recent years, attention has been paid to social spheres in modern geography sciences. This, in its turn, puts new challenges to the geography of life, one of the specific areas of social geography. It should be noted that the geography of life style is one of the least studied areas of social geography. Although there is a close relationship, there is a difference between the geography of life and geography of behavior.

The lifestyle of the population is a concept that represents a person's daily life, and in Latin it is called "modus vivend". The daily life style of the population depends on its living environment, its belief in religion, race and nationality (ie national customs and traditions). For example, a religious-minded human lifestyle may be based on religious principles (including non-alcoholic beverages, worship, religious ceremonies, Christianity, religious ceremonies, churches life, and buddhists and idol worshipers) together with the differentiation of the types of worship due to the rise and fall of the society; and the way in which the environment and health pay particular attention to the environment, protection from pollution, the family is characterized by their health to their loved ones [3].

Lifestyle is a social category and has a broader meaning than the socio-economic concept called lifestyle. Lifestyle is characterized by a high level of quantity, style, quality of life,

the essence and content of lifestyle, and the way of appearance, often in the form of lifestyle, living conditions, work, health, and even behavior of the population. The lifestyle of a particular nation, nation, and people is shaped and shaped in relation to their habitats. The moral qualities of the population, such as humility, respect for elderly people, respect for young people, hard work, tolerance, honesty, play a special role. These qualities of the peoples of the world are reflected in national traditions and traditions, in everyday lifestyles and in interethnic relations. The traditions and traditions of the peoples of the world are of great importance in the traditions of morality.

The study of the lifestyle of the population has begun from ancient and medieval times (from the time of great geographical discoveries), and in recent years the attitude of the population towards the outside world has been closely linked to its nature, living standards, lifestyle, environment and social relations. It should be noted that studies in this field have been described in the works of great thinkers long before. The well-known Greek scholar Hippocrates (460–377 BC) also states that human life has a significant impact on his health. The Hippocrates was a physician and a traveler, so he traveled a lot and studied the customs, traditions and customs of those people in different countries. The scientist said: "The nature of the human body determines the external environment. Society can change the nature of human beings by its own rules." Hippocrates has acknowledged the impact of the social environment on the human body [4].

Abu Nasr Farabi, one of the scholars living in medieval ages, expressed the opinion that people living in a particular area would influence their way of life, customs, morals, morals, morality, association, and division of religious beliefs and

people into different groups. Beruni, a prominent Central Asian thinker, wrote in his work "The Remarks of Ancient Peoples" that he was the first to propagate the idea of geographical relevance by emphasizing the color, appearance, nature and morality of the people, including the soil, water, air, and soil. According to Beruni, the outward and inner appearance of man is the result of the natural influence. At the same time, his inner appearance can drastically change over infinite attempts. Everyone is deeply involved in the ideas of the scientist that he is the owner of his behavior. Beruni was literally an ethnogeography of his era. It is about the different peoples, including Persians, Greeks, Jews, Magians, Constantinople, Arabs, Arabs, Turks, and India, where the Indians live their lives, their customs, dates, months, and historical dates, family relationships, marriages, and marriage. Beruni's scientific work widely used scientific observation, comparisons, and coincidences in the study of the life of the community [4].

Research on life-style geography The first time in Russia was carried out in the 1940–1950s, and in this case, there was a need for information in the field related to population migration. In his opinion, E. Zyablovsky considers it necessary to use the term "customary geography" instead of the term "geography of life style".

The interest to the standard of living was studied by tourists such as E. Rekly, S. Monteske, A. Gumboldt, K. Ritter in the 18th-19th centuries, and paid special attention to the lifestyle, traditions and customs of the peoples.

One of the most important events for social geography in the early twentieth century was the development of anthropogenographic research. The founder of the National Anthropogeography School V.P Semenov Tyan-Shansky learns about people: geographical location, names and lifestyle of people. Similar research was carried out by F. Ratsel L.D Synin, A. A. Kruber, who lived in different regions of the population. In his own research, he has directly explained how human beings live, how they adapt to a specific geographical environment, how they live, how they live, their physical conditions, the structure of their homes, and their cultural environment.

The founders of anthropogeography F. Ratsel and S. Voban, along with the socio-geographical and ecological conditions of the population, have developed recommendations for improving the living conditions of the population with practical research tasks for the development of new zones and demonstrated regional differences in the living conditions of the population. In particular, the lifestyle of the population

has changed dramatically for urban and suburban farming. This has resulted in a distinct lifestyle of urban and rural populations, and has led to the formation of a cultural lifestyle [2].

The second volume of Anthropogeography illustrates the existence of similarities between animal groups and humans, their place of residence, their surrounding nature, and the fact that both of these creatures must fight for survival. Also, in studying the peculiarities of the geographical situation and the lifestyle of the people. Tyurgan's works are mentioned in detail.

In the mid-19th century, Russian geographical society members (V. N. Tatishchev, X. A. Chebotaryov, E. Zyablovsky, A. I. Voeykov, P. P. Semenov-Tyan-Shansky were involved in scientific research related to the lifestyle of the population) are also worthy of praise.

From 60–80s of the 20th century, the study of the social and economic conditions of the human being has become an important issue in the study of mechanisms of social life, including the study of individual social groups, and highlighted the significance of living standards for the development of society. The term "lifestyle" is defined as the concept that expresses the peculiarities of everyday life in the seminal dictionary.

Russian medical geographor B. B. Prokhorov describes the lifestyle of the person as his direct life, work activity, material and spiritual needs, participation in political and social life, human behavior and rules [6]. Similarly, G. E. Glezerman, S. Vishnevsky and M. N. Rutkiewicz states: "The collections of important features have revealed the forms and conditions of human activities by the unity of peoples, classes, social groups, individual socio-economic organiza-tions, and the lifestyle of subsequent researchers not only in the socioeconomic system but also in the historical period, place and so on.

Lifestyle is a complex system of people's interaction with the environment, which is a component of the natural, historical, economic, social and cultural environment that can be accomplished during their recurring activities [1].

Russian scientist I. V. Bestujev-Lada combines "lifestyle", "living standards", "quality of life", "lifestyle" and "lifestyle" in his research. The scientist describes, "The way of life is a way of life described by its quality of life, its quality and its conditions." Yu. P. Lisitsyn explains the problem as follows: "It sets out the human lifestyle for four categories (economic, living standards, social life, socio-psychological, lifestyle, socio-economic, lifestyle) [7].

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SOME THEORETICAL ISSUES OF BEHAVIORAL GEOGRAPHY

Abstract. The article outlines some of the theoretical issues of geography of behavior, including the role of geography in behavioral social geography. The disciplines of the Central Asian and Chemistry Sciences disciplines have been disclosed.

Keywords: Bikhivorizm, behavior (There is a synonym of geography of idols such as morality, character, behavior, behavior, and behavior), geography of tradition, intuition, mentality and character, ethics, ethnography, ethnos, lifestyle, sociology, social space.

The essence of man and his place in the society, his behavior, the spirit of science are widely studied. Different scientific and religious doctrines have different interpretations of these issues. It is natural that human beings as a socio-historical and cultural entity will strive to deeply understand themselves in new historic-geographical conditions, deeply adapt to new circumstances, and realize their human essence.

The wise word of Socratic, "Know Yourself," also has a new meaning in everyday period. Indeed, man has the essence of the whole world and society. The great mujtahidAbdulkhalikGijduwani considers the human being a "small world". If the above points are broader, it can be seen that their essence is closely related to one's behavior, attitudes and behavior.

Man is an intelligent creature combining biological, social, and spiritual qualities. Its biological features include nutrition, protection, procreation, adaptation to the conditions, and social features of language, behavior, knowledge, consciousness, product development, distribution, consumption, management, self-control, artistic creativity, ethics, speech, thinking, values can be added.

Human (In deep philosophical analysis of the essence of human beings, it is important to know the essence of the concept of personality, individually and individually, and to distinguish them from each other. The person is a person who has a social quality) beings form a single system through these features. It fulfills its needs as a perfect and complex creature and ensures the continuity of humanity. At the same time, overcoming the biological characteristics of the human being over social features or aggravating the psychological features leads to a distorted interpretation of its essence.

Spiritual qualities of a person include spiritual emotions, emotions, anxiety, sadness, suffering, pleasure, mood and others. The effects of the environment and its territorial aspects are studied by behavioral geography. It should be noted that studies in this field have been described in the works of great thinkers long before. An outstanding Greek scientist, Hippocrates (460–377 AD), who left an indelible mark on world medicine, also underlined the effect of the external environment in the human mind. Hippocrates was a physician and a traveler, so he traveled a lot and learned about the lifestyle and traditions of the people in those countries, the effects of climate, water, air, and other natural conditions on human beings. Hippocrates observed that people lived in different geographical conditions and found that they differed in their own body structure and behavior. The scientist described this in his work "Air, Water, and Places": "The nature of the human body determines the external environment. Society can change the nature of human beings by its own rules." Hippocrates also knows the impact of the social environment on the human body. Beruniy, in his book "The Remarks of the Ancient Peoples," first proposed the idea of geographical relevance, emphasizing that the color, appearance, nature and morals of the people depend on the soil, water, air, and soil on which they live. According to Beruni, the outward and inner appearance of man is the result of the natural influence. At the same time, his inner appearance can drastically change over

infinite attempts. Everyone is deeply involved in the ideas of the scientist that he is the owner of his behavior. Also in his works, the opinions of our compatriot Abu Ali ibn Sino on the nature of the hot lands and their impact on the human body can be found. In particular, it was said that in the hot regions, the body's darkness, the curvature of its hair, and the sharp decrease in the air as a result of excessive moisture evaporation could lead to the rapid deterioration of the human body. The scientist has provided a detailed description of the negative effects of the water content in the low-density population due to the constant heat and dimension of the population, as well as the abundance of saline and bogs in such areas. It is remarkable that the population of these regions is quite high in the spirit of jealousy and aggression (Abu Ali Ibn Sino, 1994). V. Semyonov-Tianshansky describes as geography as the most important feature of the Russian anthropo-geography – a science that can be seen through vision, vision, and memory. As in many areas, 'intuition' plays an important role in geography. It's exactly what the intuition is like to do with geography science. These thoughts are one of the main ideas of the geography of behavior.

Research on the geography of ghosts was first conducted in Russia in the 1940s and 1950s, and in this context it was necessary to provide information on this field related to population migration studies. In particular, L. I. Mechnikov studied the impact of various natural geographical factors in the history of humanity and created the concept of civilization or river culture in the great river. E. Zyablovsky considers it necessary to use the term "custom geography" instead of the term "geography". E. G. Milyukov also pointed out that crimes related to crime should be studied by the same geography. Scientists such as B. Bodoman and V. Kagansky expressed their views on the "landscape and character of the landscape, especially in relation to cultural landscapes". K. Zauer emphasizes the harmony of natural and cultural landscape with the outside world.

It is worth noting that Friedrich Roussel and Vidal de la Blanc, both of whom have contributed to the different socio-economic and social characteristics of the soil. In particular, Blash: "Man is a reliable reader of the soil. Therefore, learning it will help identify the character and tradition of the population. " At the end of the XIX century anthropoegraphy was founded by F. Ratsel in Germany. The idea of the scientist was based on geographical determinism, that is, a decisive influence on the natural environment of human beings, nations and peoples. On the basis of this idea, the geography of behavior was later developed. In his view, F. Ratsel differentiates the impact of the environment on social life, and has highlighted its natural and psychological impact. In the 1960s Karl Zauer, Dj. Wright and U. The services of American scientists like Kirk

were great. Dj. Right has expressed his view that the regions will also affect the current mentality of people living in the area. U. Kirk interprets the concept of "ethical environment" in his view. The cultural level of people living in certain areas is reflected in their eyes. Likewise, the criminals have recognized that their actions are reflected in their eyes and eyes. It also has a great deal of respect for the inhabitants of the irrigated farms (Nile, Gang, Amudarya, Syrdarya, Zarafshan and other regions), where the inhabitants of the area feel special love for their country, including mountainous peoples, h.) have expressed their scientific views on divinity. In our opinion, the impacts of human beings on human habits and morals are great. This will help to prevent misdiagnosis related to crime or ethical standards among people living there. Consequently, in some sources, geography of behavior is also seen as a concept that represents a mental picture of the place.

In the study of geography of the countryside, special attention is paid to the symbolic aspects of space. Here are some of the important symbols of the place (environment): snowy, rainy, windy, windy, noisy and other; – Quotas by nature (quintessence): sacred places, centers of fashion, centers of music culture, gambling centers and so on.

To be honest, the geographical attitudes of the past are the incomplete aspects of social and human geography research. The regions (space, location) are interpreted as follows:

1. Social space should first be borne in mind that the nature of the person's relationship with the natural and cultural environment (awareness and behavior) occurs in a certain area. The region or territory inhabited by humans is formed by the needs and needs of the community.

2. Individual space is the invisible boundary that separates people from other people around their body.

People in the geography of the world are divided into several types, depending on their way of life and behavior:

Home Space – a place where security is served by a person with a high level of vital activity; – neighborhood – social zones (groups).Some of the same phenomena are observed, the level of their activity is lower, behavior is open; – Temporary residence, where the social space and social law and norms are applicable; One of the important concepts in the geography of behavior is the concept of biohevior ism, a set of scientific views that explore the diverse aspects of human behavior. He also learns the effects of such an environment on people's natural and social environment, their minds and their actions. Environment and biohevior ism are the essence of geography of coexistence.

Human behavior, tradition, behavior and mental experiences have regional differences. As the regions are characterized by their climate, relief, water and soil, their socio-economic aspects. All of them explain the territorial aspects of human

behavior and its geographical characteristics (Research on "mental illnesses" is reflected in the works of scientists such as the cities of Chicago and Rhode Island – Faris and Dunkin.; In 1972, American architect, Newman, founded a high "stress" situation amongst residents in high-rise buildings; In Botswana and Boldu, in 1976, the highest levels of "crime" among the population in high-rise buildings have been substantiated; In 1958, American scientist Nelson conducted research on the features of the urban environment and consumer behavior).

In S. Melinda's Medical Geography, Kevan and Chapman's 1980's Canadian study revealed that many diseases and mortalities are related to winter, such as pneumonia, bronchitis, influenza and circulatory illness, and poisoning, violence and accidents in the summer. The book also highlights the impact of mortality on the population. It should be noted, however, that the mortality rate of the population is seasonal and is not identical to all diseases. The seasonal climatic changes include heart, vascular hypertension, cardiac ischemic diseases, brain diseases, brain sclerosis, stroke, cerebral infarction and respiratory diseases (bronchial asthma, bronchitis, upper respiratory tract diseases, etc.), diseases of the digestive tract (intestinal infections, gastritis, colitis, pancreatitis and hepatitis are also seasonal), as well as mental disorders related illnesses and related mortality rates vary considerably in different seasons depending on sensory factors. Among them are schizophrenia, epilepsy and epilepsy. Among these diseases, one of the most common diseases in our country is suicidal deaths, which is one of the most important problems not only for physicians and psychologists, but also for general public, sociologists and medical geographers. According to this table, the mortality rate due to suicides has decreased in all regions compared to previous years. In 1998, this disease was characterized by the highest incidence of Namangan (9.90), Kashkadarya (9.10) provinces, the Republic of Karakalpakstan (8.36) and Tashkent City (8.28), respectively, in 2010 and 2016 has dropped further. Analysis shows that in 2016, Samarkand (2.32), and Tashkent (2.76) provinces and Tashkent City (2.9) are the highest. In the course of the study of the changes in the index for these years, it was revealed that almost all the regions and cities of the country experienced mortality rates due to the above-mentioned reasons (only in Navoi region there is a tendency for growth). Generally, suicide mortality rates have declined over the past two decades. However, it was discovered that during the spring and autumn seasons, the growth of these types of disease among the population was the result of studies. Suicidal behaviors are associated not only with the territoriality, but also with climate factors. Suicide rates increase due to mental illnesses during the flowering or sprouting of the rich trees. Among deaths, mortality, poisoning and injuries are also among the major causes of mortality. In Uzbekistan, the death rate is about 6.6% of total deaths.

In Uzbekistan, the deaths of children over the age of five cause accidents, and two thirds of them are traffic accidents. Most of these catastrophic events are commonly referred to as climates of the year. Adolescence is a difficult and dangerous period of transition from childhood to adulthood. During this period, both sexes (including accidents at school and suicide cases) are more frequent. Similarly, men have higher rates of males (Not only in Uzbekistan but also in the developed countries of the world, similar information can be seen. In Canada, suicide rates are seventh in the cause of men's death, with death rates higher than those associated with road accidents. One of the major causes of death in the United States is diabetes-related death. However, suicidal mortality rates in this country have even higher than those of the illness (Michael E. Emch, Elisabeth Dowling Root, Margaret Carroll, Health and Medical Geography, P-517.) From psychological point of view suicide is more common among men (6–24 years). Once a person is trying to commit suicide, it is dangerous to try again. It is therefore desirable to focus on them during mental depression and stress. According to statistical data, these mortality rates are more frequent in late autumn and early spring.

In summary, the mortality rates vary according to their specificity in each region. Therefore, the timing of increased mortality helps maintain proper medical procedures.

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SOME THEORETICAL ASPECTS OF THE DEVELOPMENT OF THE CHEMICAL INDUSTRY

Abstract. The article describes the role of research in the field of chemical industry among economic geographical areas, as well as scientists' research on this subject. Processes related to the development of the chemical industry in Uzbekistan, as well as the geographical aspects of the factors affecting the territorial division of these industries, have been disclosed.

Keywords: chemical industry, mining, energy, metallurgy, machine building, chemical and petrochemical, gas processing, electrical engineering, pharmaceutics, natural gas, oil, coal, sulfur, ozocerite, mineral, limestone, graphite, non-ferrous metallurgy, processing, waste, raw materials.

As you know, industry is the leading manufacturing industry of the national economy and constitutes the material basis of society. The acceleration of economic development of the country, increasing the efficiency of production depends on the development of the industrial sector. Today, the development of the national economy of any country can not be imagined without the industry. From this point of view, modernization and diversification of the industrial sector is a crucial issue in the development of the national economy of Uzbekistan.

The socio-economic development of our country is largely based on raising its industrial potential. At the same time, the development of the industrial sectors of the republic has been shaped differently by the natural and socio-economic factors in the regions. In particular, the Fergana region has a unique position in the republic.

With the theoretical and practical issues of placement and development of industrial sectors in Uzbekistan, Z. M. Akromov, S. K. Ziyodullayev, K. N. Bedrintsev, Sh. N. Zokirov, M. A. Abdusalomov, B. I. Iskandarov, T. M. Ahmedov, E. A. Ahmedov, R. Ya. Dosumov, Sh. B. Imomov, A. N. Ruzimov, O. B. Otamirzaev, N. T. Tukhliev, A. S. Soliev, A. A. Kayumov, N. S. Sultonov, A. M. Sodiqov, A. T. Yusupov and other scientists.

It is worth noting that the issues of increasing the efficiency of production and saving on the basis of the forms of territorial and social organization of industry play a crucial role. First and foremost, the principle of «planned and proportionate» placement of industrial enterprises throughout the country will be eliminated, and a free and healthy regional competition will be created instead. Also, the traditional factors of territorial organization and placement of industries

change their influence. In particular, the importance of consumption, ecology, and social factors in this period will increase dramatically [1].

The efficiency of the enterprises of different degrees and stages of the country's economy is of great importance. It is essential that each of the farms be developed so that the country should have advantages over certain selected sectors of the farm (according to Smith Smith, D. Ricardo). It is essential that such a regional organization of the national economy not only requires the production components, but also the harmony of national traditions to the ideology that unites the living conditions of a person [2].

The role of such branches as chemistry, petrochemical and gas chemistry is exceptionally large enough to fully satisfy the growing socio-economic needs due to modern economy, economic activity and sustainable economic growth, and to increase their mobility in the context of resource constraints.

Today, the chemical industry plays an important role in the national economy. More than 750 titles are produced in the chemical industry of Uzbekistan. The share of the chemical industry in the total volume of industrial products of the republic makes 4.6%, the number of industrial workers is more than 50000 people.

The chemical industry of Uzbekistan is used as a raw material for natural gas, oil, coal, sulfur, ozokerite, various minerals, limestone, graphite, as well as non-ferrous metallurgy, cotton and canopy processing waste. The bulk of the raw materials used in the chemical industry of Uzbekistan (around 70%) and spare parts and equipment are imported from abroad. Currently, chemical products (mineral fertilizers, caprolactam, chemical fibers and threads, synthetic ammonia, varnish and etc.) are exported.

Despite the fact that Uzbekistan is a source of raw materials, until the 1930s there was almost no chemical industry. In 1910, there were many small businesses engaged in lime, vegetable dyeing, alkaline preparation, and soap.

Formation of the modern chemical industry began in 1932 with the launch of Suzhou Sulfur Field (Fergana), which was previously extracted sulfur. Chirchik electrochemical combine started production in October 1940.

In 1940, the share of the chemical industry in the total industrial output was 0.8%, the number of employees employed in the chemical industry was only 1% of industrial workers, and the share of the chemical industry accounted for 7.4% of industrial production.

In general, the history of the development of chemical industry in Uzbekistan can be divided into four stages in the evolution of evolutionary complex:

• In the first phase involving 1913–1940, the sharp decline in industry could be attributed to the construction of the Central Asian railroad. Because of the factories to build factories they need a lot of equipment. The equipment was mainly imported from Russia. When the railway was built, it was easier to bring the equipment. They were imported mainly from Russian-made machine-building factories located along Volga and Ural rivers. Through these rivers and the Caspian Sea, the equipment was delivered to Krasnovodsk in the parakhs (the first direction of the railway was Krasnovodsk-Andijan), where it was railed to the inside of the Republic. This made it easier for the equipment to be built, and plant factories were gradually being built. In the twentieth century, a soap factory, an oil refinery, two paint factories and other facilities were commissioned;

• The second phase involving 1940–1950 was the Second World War, leading to a sharp rise in industry. Because some of the strategically important factories and factories located in the western cities of the former Soviet Union have been moved to Asian components of the country. Some factories and factories have also been shifted to Uzbekistan. In particular, Tashkent aircrafts, varnish and tractor factories; canopies processing plant, chemical plant in Namangan and others. Similar cities have been evacuated and relocated to similar cities. Together with the enterprises, leading engineers came to the factory and started the factories together with the local people and contributed to the development of the republic's industry. The only significant increase in industrial output can be seen in the example of electric power generation in Uz-

bekistan. For example, the electricity generated in 1940 was $481.4 million. In 1950, 2682 mill. kW/h;

• The third stage involving 1950–1970. As it is known, in 1957, the government issued a special decree envisaging the development of the chemical industry in the country. According to the resolution, several chemical plants were built and put into operation in Uzbekistan. In particular, chemical fibers in Fergana, nitrogen fiber plants in Navoi and others. At the same time, due to the attention paid to the training of cadres, a number of chemistry departments were opened at institutes and universities, several scientific research institutes were established and the work on the implementation of relevant research works was expanded.

The fourth stage – the period of independence. During these years, the direction of industrial development has radically changed. Basing on the industrial development, the raw material base in our country was taken up, with a focus on increasing the mobilization of local resources to the economy. Cotton processing enterprises have been completely reconstructed, cotton yarn production factories and fabrics fabrication plants have been commissioned. In the chemical industry – the production of cotton cellulose, paper factories, and many jobs are being created. This creative work is still going on.

As a result of the structural transformations undertaken in our country, the modernization, technical and technological modernization of the industry, many achievements have been achieved in the industry. Over the years of independence a number of large industrial objects have been commissioned to meet modern requirements. In particular, the automobile industry produces cars for cars in Asaka, buses, trucks for Tashkent and Samarkand, bukhara oil refinery in fuel and energy sector, Shurtan gas chemical complex, Kungrad soda plant in chemical and petrochemical industries, Dehkanabad potassium fertilizer plants, Ustyurt Gas Chemical Complex was commissioned. It is noteworthy that industrial production growth rates are always higher than the average level of GDP. In Chevron, oil and petrochemicals were rapidly developing in the country, a number of new products, such as calcium soda, potassium fertilizer, polymethylene, sugar, were not produced in our country, and a cycle of gas and chemical energy production was formed. This cycle is made up of Shurtangaz and gas-chemical complexes currently constructed in Ustyurt. As a result, the share of industry in the gross domestic product of the republic has significantly increased.

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IMPACT ASSESSMENT OF CLIMATE CHANGE ON THE WATER SURFACE AND NOSOGEOGRAPHIC SITUATION OF THE TASHKENT REGION

Abstract. Using nosogeographic and multidimensional analysis, it is possible to identify the main risks of growth of diseases diversityin the Tashkent region, which will allow to identify the main causes of diseases and to develop effective measures to reduce the risk of an increase in the number of diseases of the population.

Keywords: climate change, rivers, surface waters, risk, nozogeography, agglomeration, disease.

Due to climate change, there is an increase in water deficit, especially in rural areas. The chemical composition of the surface water used will inevitably affect the health of the rural population. The article outlines the approach to the use of nosogeographic methods for assessing the risk to the health of the rural population. Surface waters of the Tashkent region are a whole complex of surface waters – rivers, irrigation canals, drainage collector canals, and drains of industrial enterprises. The growth of infectious diseases, including acute intestinal infections, is due to an increase in temperature, changes in the nature of precipitation, and seasonal fluctuations. The article proposes a nosogeographical method for assessing the chemical composition of surface waters on the example of the Tashkent region.

Observed climate change and aridification of the Asian continent will inevitably increase the burden on surface water, particularly in terms of their deficit, and as a consequence, improve re-use and saturation with various chemical elements, often of anthropogenic origin, which ultimately will lead to inevitable consequences for the health of the population.

Climate change is likely can have a very large impact on water resources and sanitation in those cases when there was a real decrease in water and water-supplies. Episodes of drought cause an increase in the concentration of pathogenic microorganisms in reservoirs where raw water is stored.In addition, the scarcity of water cause necessitates the use of sources of fresh water with poorer quality, often, rivers that are polluted. Increasingof quantity precipitation causes floods, erosion and flooding of sewerage systems. All of these factors contribute to the increased incidence of acute intestinal infections.

It is known that there is a close interaction between surface and groundwater. Often in rural areas there is no unified system of water supply. In the household often used well water. In the highlands population use water springs and rivers for their needs.

In connection with the observed climate changes that directly lead to the risk of increasing the number of diseases related to hydrochemical changes in surface watercourses and changes in the hydrological regime, there are also high risks of growth of general morbidity.

Analysis was conducted on the example of Tashkent region in (Fig 1). On the territory of Tashkent region there is not only the Tashkent city agglomeration, which is a cluster of settlements united in a complex multi-component dynamic system with intensive production, transport and cultural ties, but also a vast agricultural land.

Significant anthropogenic impact on the environment invariably leads to risks of changes in health status of the population who are living in the area. Urban agglomerations with industrial production is confined to surface waters (rivers, channels), which are the source of their existence. With the growth of agglomerations and growing water demand that lead to higher dumping used water into rivers and canals.

Agricultural production and industrial discharges are the main source of pollution in surface water. The main cause of surface water pollution is the discharge into water bodies an untreated or inadequately treated sewage, by industrial enterprises, utilities and discharges from agricultural land. The mineral salts leached from irrigated lands, often uncontrollably using the pesticides, phosphate and nitrogen fertilizers pollute the water bodies. Excess chemicals are poisoning the flora and fauna of reservoirs.

Chemical substances can accumulate in agricultural products of crop and livestock production that poses a threat to the health of the person who is consuming the products.

Most agricultural production is sold directly within the Tashkent region, which has a significant impact on the health status of the population.

Property of watercourses to self-clean due to ongoing biological processes can self-clean, but that is still not enough. The accumulation or the excess of MPC (maximum permissible concentrations) of pollutants in the water affect the food chain, the final link of which is the human body.

The accumulation of various chemical elements or their compounds, especially carcinogenic oneshave a harmful effect on the human body and lead to deteriorationin his health.

The most significant impact on the risks associated with the health of the population is the change in the hydrochemical

composition of water supply sources, water and air pollution by industrial discharges, direct discharges of waste water in agriculture into open water.

Water for domestic livestock is almost always water used from open rivers, canals and collectors, which ultimately ensures the entry of individual chemical elements in the human body, and therefore has an impact on health.
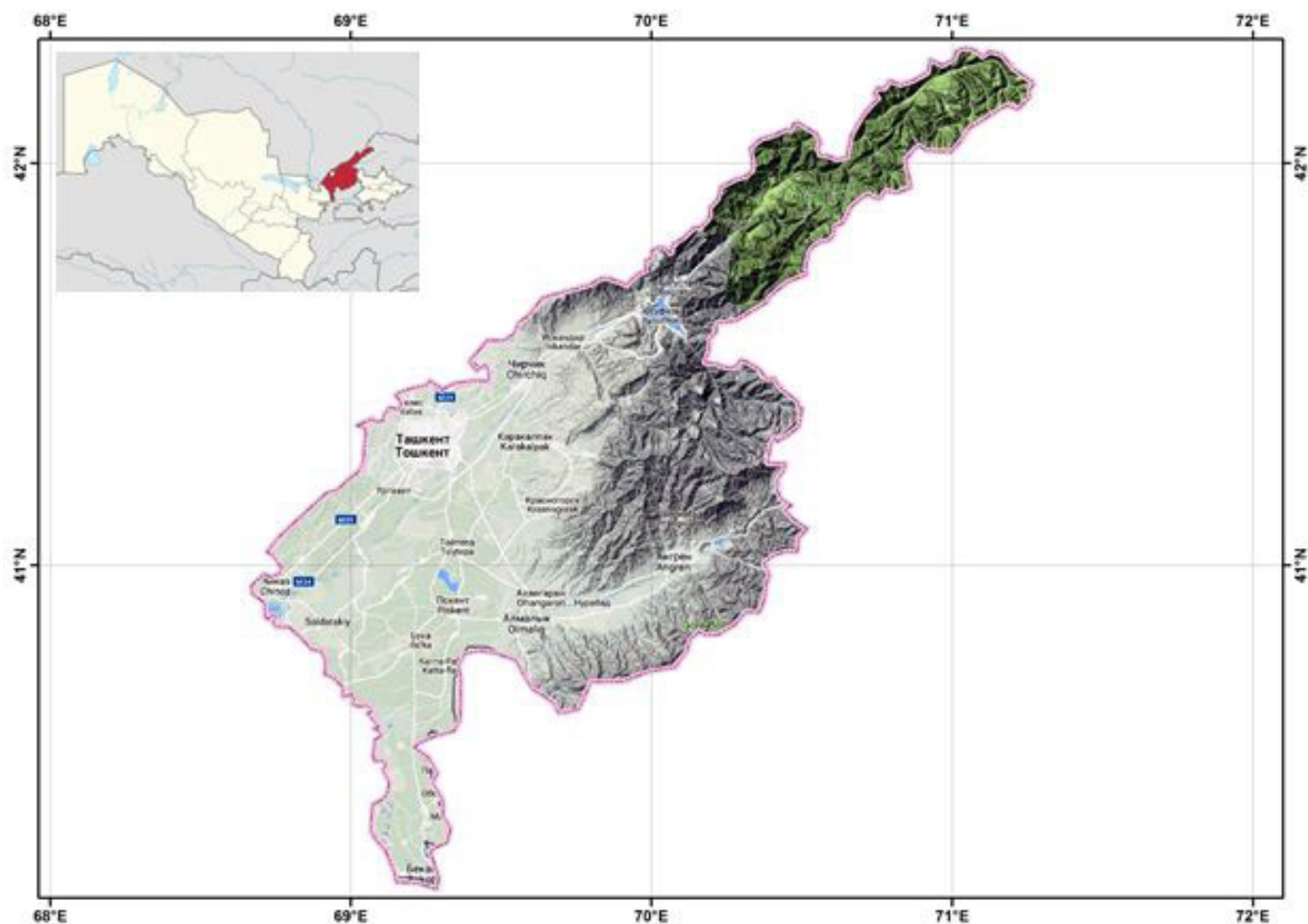

Figure 1. Analysis was conducted on the example of Tashkent region of Uzbekistan

In addition, watering with surface waters the fruit plants can lead to the accumulation in them of certain chemical elements, which can lead to an excessive content in fruits, and also with insufficient control over the production, to subsequent get into the human body.

For the analysis of risks to public health, were conducted nosogeographic studies of the Tashkent region on statistical materials in relation to administrative areas for a long-term observation period. As the medical statistics, the data were used on the indicators of the general incidence, which were recorded at medical posts in the case of complaints that fell ill. In our case, nosogeography is used as a tool for the analysis and comparison of incidences, depending on the chemical composition of surface waters. An analysis of the links between medio-biological factors and characteristics of the geographical environment is carried out by two main methods:

cartographic and mathematical. The first is the comparison of maps with medical-biological, and geographic information (conjugate analysis of different types of maps); based on the results of the conjoint analysis, nozogeographical maps are constructed, which are often may have a value for public health.

Mathematical methods (paired and multiple correlation, regression and information-logical analysis etc.) allow to determine the degree of correlation between the spread of the disease and environmental factors (natural and socio-economic), in our case is using the concentration of some chemical elements in surface watercourses that flowing through the territory of the investigated districts in Tashkent region.

In the result of comprehensive study revealed that the area most liability at risk of growth of general morbidity of the population (maximum risk) in Tashkent and Zangiota,

Yangiyul andChinaz areas, the average risk of morbidity in Kibray, Yukorichirchik, Urtachirchik, Kuyichirchik, Akkurgan, Buka, Pskent, Bekabad, less risk in Bostanlik, akhangaran-

sky, Parkent districts. In (Fig. 2) had shownnozogeographical map of the distribution of general morbidity on districts of Tashkent region.

Figure 2. Distribution of the number of overall morbidity by districts in Tashkent region between 2005–2015. The density of the points on the territory corresponds to the higher number of registered cases of appeals to medical institutions

This circumstance is due to the geographical location of the districts. Mountain and foothill areas remote from industrial areas and areas dense agricultural of using and located in the upper reaches of the rivers. In the middle and lower reaches of the rivers Chirchik and Akhangaran population is forced to use water from sources subjected to the saturation of the chemical elements, although not exceeding the MPN. In areas located in the vicinity of Tashkent agglomeration and industrial centers the risk of morbidity is increases from concentrations of harmful substances not only in water sources, but perhaps and atmospheric air.

The change in the concentration of chemical elements along the length of the river Chirchik.Against the background of increasing the total concentration of chemical elements in the water downstream of the river, notably a significant increasinC in the concentration of chlorine, magnesium, sodium. Due to the discharges from industrial facilities and runoff from agricultural fields.

Growth increase the risk of morbidity in the areas which are situated in the lower part of the basin of the Chirchik river, may explain the high content in water of the chemical elements of anthropogenic origin. However nozogeographical map shows that the areas located in the upper part of the river basin, also observed elevated values of total morbidity in the rural population. This fact can be explained by the fact that in drinking water there is a lack of necessary for the overall health of some chemical elements.

The territory of Tashkent region faces tremendous anthropogenic pressure on surface waters, in terms of their multiple and re-using, especially in uncontrolled discharges of return waters and industrial-domestic sewers.

It should be noted that health services, monitoring the quality of water sources, hygiene and environmental monitoring in the Tashkent region is at a high level, but nozogeographical study and identification of possible impact of chemical composition of surface waters on the health of the

population will allow improve situation.Application nozo-geographical analysis and identification of possible linkages of the chemical composition of surface waters and public health will allow us to monitor and predict the spread of certain types of diseases and apply preventive measures to reduce the risk of side effects, and as a result increase the level of environmental safety.

Defining the territorial distribution of incidence it is possible to conduct special medical research to identify the main reasons for the emergence and spread of certain types of diseases and determine their causes and develop methods of their elimination.
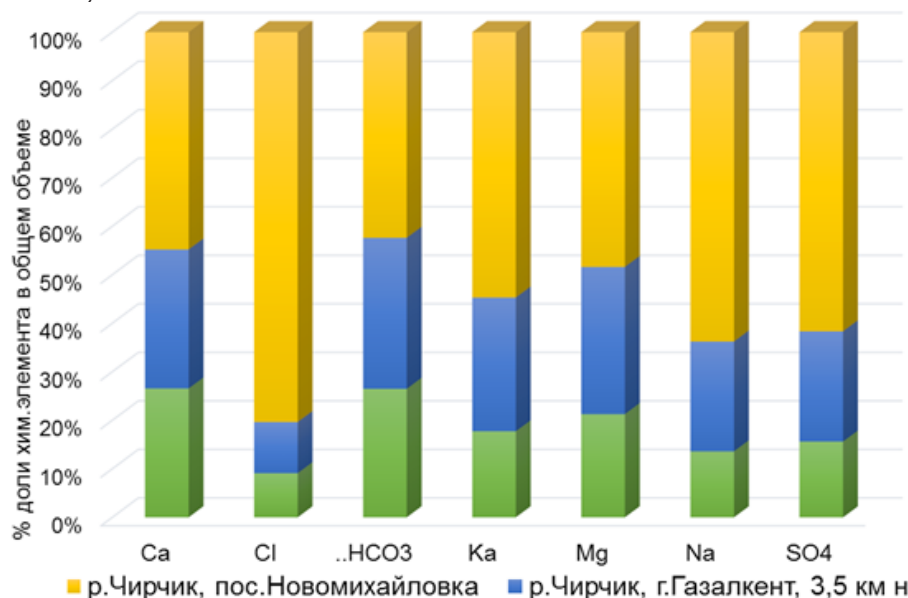

Figure 3. Changes in the content of chemical elements along the length of the river Chirchik

On the basis of nozogeographical analysis and using the methodology of multivariate analysis can to identify the main risks of growth of various types of diseases in the territory, allows to identify the main causes and to develop effective measures on reducing the risk of occurrence of diseases of the population.

The obtained results of the scientific analysis will allow extending the experience on the other areas, as the global and national level there is increasing process of urbanization and intensification of land use for production of different products.

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SOME ISSUES OF IMPROVEMENT OF URBANIZATION PROJECTS IN UZBEKISTAN

Abstract. The article deals with the issues of the urbanization process in Uzbekistan and the scientific research on measures to improve this process.

Keywords: urbanization, urban and rural, rural, urbanization, demographic potential.

While the integration of the economy of the Republic of Uzbekistan into the global economic and financial-economic system is gradually deepening, the influence of social factors on demographic processes is increasing. In particular, the urbanization process plays an important role not only in socio-economic development, but also in demographic issues. Because of demographic processes, birth, death, marriages, divorces have a direct impact on the level of urbanization. All of these, except births and marriages, are the highest in the urbanized areas.

In the territorial structure of the population of Uzbekistan, the number and size of urban population varied widely in different periods under the influence of internal and external factors. These direct access to the settlements is given to the status of "city and town", territorial organization of production, formulation goals. For many years, significant changes have taken place not only in the number of cities and urban-type settlements, but also in its territorial, socio-economic development. This led to the rapid development of small and average urban settlements. However, no changes were observed in the number of the largest urban settlements.

Most of the cities that emerged in the second half of the last century are significant because they are used to dig and bury their land to dig different minerals. Nevertheless, in spite of the demographic policy of the former Soviet regime, the rural population in the territorial structure of the country has been growing in numbers for many years. The size of the demographic potential of rural areas and its continued growth, in turn, determined the total population size of the urban population. In 1991, the urban population of the city was 40.5 percent, and in 2008 it was 35.8 percent. At the same time, the share of rural population in the national population increased from 59.6 percent to 64.2 percent.

In accordance with Article 12 of the Law of the Republic of Uzbekistan "On the order of settlement of administrative and territorial structure of the Republic of Uzbekistan, names and renaming of toponymic objects" and in 2009 "On Measures for Further Improvement of Administrative and Territorial Structure of Population Settlements of the Republic of Uzbekistan" According to the decision of the Cabinet of Ministers on execution of PQ-120 in July, 966 rural settlements of the country were converted into urban settlements. As a result, the share of the urban population in the total population has risen by 52 per cent (2009) [2].

The analysis shows that the level of urbanization in the republic has been steadily declining for many years. Consequently, the diversity of the population and the active mechanical movement of the urban population, ie the intensity and natural movement of the migration, have been reflected in a relative and absolute amount. Since 1991, the government has been focusing on the construction of infrastructure facilities and capacity building of low-income regions, accelerating the urbanization process, and the emergence of new urban settlements.

Therefore, the number of urban settlements has changed constantly. For example, in 1959 their number was 101, in 1984 it was 124, in 1989 it was 221, in 2008 it was 233, in 2009 it was 1199. In 1990–2009, the number of cities in the country decreased by 5, and the number of urban-type settlements increased by 976. The level of urbanization rising in the country in 2009 did not justify itself, as the majority of urbanized villages remained village. Therefore, in ten years after that, ie in 2019, this issue again rose and a special decree on the radical improvement of urbanization processes was adopted.

The decree states that «*along with the implementation of major strategic investment projects within the framework of structural reforms, the urbanization process has not been properly considered as a driving force for the growth and sustainable*

development of urban populations. As a result, in recent years there has been a tendency towards declining urbanization, while the number of urban settlements has increased from just 1065 to 1071. Despite the measures taken to transform large rural settle- *ments into urban settlements, today's urbanization does not meet modern urban development needs and remains largely unchanged from global trends. At the same time, the level of urbanization is still unstable* [1] *It is critically assessed.*

Table 1.– Changes in urban settlements and urban population in Uzbekistan (1989–2019)

years	total city address their teeth	population, percent	including			
			cities	population	city type settlements	population
1989	**221**	**40.7**	**124**	**7282.0**	**97**	**758.9**
	100	100	56.1	90.5	43.9	9.5
1990	**228**	**40.7**	**124**	**7310.5**	**104**	**931.5**
	100	100	54.4	88.7	45.6	11.3
1995	**234**	**38.6**	**119**	**7717.1**	**115**	**953.8**
	100	100	51.3	89.0	48.7	11.0
2000	**233**	**37.4**	**120**	**8108.1**	**113**	**1057.4**
	100	100	51.5	88.5	48.5	11.5
2005	**232**	**36.3**	**120**	**8350.5**	**112**	**1091.4**
	100	100	51.7	88.4	48.3	11.6
2008	**233**	**35.9**	**119**	**8570.4**	**114**	**1127.8**
	100	100	51.1	88.3	48.9	**11.7**
2009	1199	**14131.1**	**119**	**8582.9**	**1080**	**5548.2**
	100	100	10.0	60.8	90.0	39.2
2019	**1190**	**16532.7**	**119**	**10140.9**	**1071**	**6391.8**
	100	100	10.0	61.3	90.0	38.7

*Note * In the pace of acceleration, the absolute number is in the range – the percentage of the population*
The author's note based on the data from the State Statistics Committee of Uzbekistan population of settlements

According to the statistical data analysis, in 2019, 1071 towns were demographically older than 119 cities [3]. The Decree was further promoted in the Decree to further improve the demographic potential of the urban population by improving the system of administrative regulation of migration processes to create conditions for free movement of population from rural areas to cities. *Living in 119 cities with high demographic potential, 61.3 it is desirable to increase the standard of living* [3] by ensuring the full and productive employment of the population, increasing the welfare of the population in the services sector, and enhancing the use of economic and industrial resources.

The reason is that "*despite the measures taken to transform large rural settlements into urban settlements, today's urbanization does not meet modern urban development needs and remains largely out of the world trends*" [1].

The results of the study indicate that it is necessary to improve the criteria for obtaining city status at settlements in order to develop a comprehensive urbanization process in the country. During demographic modernization, demographic relations, urbanization, urbanization, urbanization and suburbanization accelerate. As a result, it is desirable to set expectations for the formation of satellite cities.

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Section 3. Study of art

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SOLUTION OF PERFORMANCE PROBLEM IN MODERN WORKS WRITTEN FOR WOODEN WIND INSTRUMENTS

Abstract. The article has been dedicated to the research of the solution of performance problems in the works intended for wooden wind instrument in the creativity of Azerbaijani composers in the modern era. There are opinions on new performing methods occurred related to the modern writing style, traits and their performance in the article. The author has expressed theoretical and methodical opinions related to the works of J. Abbasov, E. Dadashova and others for wooden wing instruments.

Keywords: wooden wind, instrument, work, modern traits, performance, tendency.

There are so many types of wooden wind instruments in the world music practice. These instruments have passes fast development process besides being in the line of the most ancient music instruments, having long history. In these stages performance techniques have been improved by developing besides the structure of the instruments and have gained modern professionalism criteria. It includes the issues such as creation of new performance methods, strengthening of performance techniques, as well as new sound effects. During the development processes, instrument-researchers, performers and compositors have acted together, emphasized the performance merits, literary composition and technical demands belonging to the age they belong. In this process master of instrument – compositor and performer trio are of significant importance. Because just this trio forms the main factors of performing culture by preserving the same interest in different historical environments of the instrument. Timbre, characteristic of consonance, used technical methods are of significant importance in the correct understanding of work as its other components –such as melody, harmony, facture, form, etc. Each historical environment creates its style in the forming of performance culture and the process continues constantly by being calculated for the future. One of the main issues faced by modern performance culture and the science of instrument-study is to learn the factors playing role in the forming of the art of performance in different eras.

There are many works for wooden wind instruments in the world music literature. There are both solo and ensemble works in their line. Different compositors have evaluated the literary and technical opportunities of these instruments and applied them in individual creativity laboratories, made rich performance repertoire with the colorful works having high literary value. The creativity of Azerbaijani compositors takes specific place in this work. In national composition creativity solo works have been written for mostly flute and clarinet, group members have had important position in the composition of different orchestra works.

The more strengthening of the place taken by wooden wind instruments in the creativity of Azerbaijani compositors in II part of XX century is seen clearly with the application of literary-aesthetic, performing, content and form, modern writing styles in the works existing in this field. The number of these works has been increased notably in modern age, modern performance methods, traits and nuances have been to be applied. Their creation has lead to the strengthening of performing culture, increasing of professional level. The works written in modern age for wooden wind instruments have been awarded with the diplomas and rewards in the world music festivals and contests; have been included to the repertoire of world-class musicians. On the other hand theses works have influenced the modern performance art strongly, stimulated to the mastering of professional performers.

Works intended for wooden wind instruments created in the II part of XX century reflect different directions, composition techniques, styles and tendencies of the modern music art besides having different genres, volume and performing characteristics. There are the samples composed on the basis of mughamimprovision traditions benefiting from national music

genres, besides classic, modal, series, dodekofonia, puantilism, atonal technique and styles in the line of these works.

J. Abbasov, E. Dadashova, F. Garayev, R. Gadimova, V. Allahverdiyev, J. Guliyev, I. Abdullayev, Y. Imanov, T. Gasimzade, A. Gambarli, S. Gani, F. Fatullayev, R. Ramazanov, R. Khalilov, S. Rahimova, Z. Karimova, L. Jafarova, N. Naghiyeva, R. Huseynova, F. Allahverdi and a number of composers have created both solo and ensemble works with different composition for these instruments. The samples reflecting high professionalism created in this field by our compositors such as A. Malikov, Kh. Mirzazade, F. Alizade plays stimulating role conditioning its development besides making rich the national performance art.

It is observed that miniature formed works are more than large-scale works for wooden wing instruments. This can be related to different tendencies of modern era. Inclination to miniature forms is also related to performing issues. So, organizing the performance of such works is easier than large-scale symphonic works. Other reason is related to the individual creativity principles of compositors. Particularly, younger compositors incline to miniature genres. The miniatures of T. Gasimzade, R. Ramazanov, F. Fatullayev, N. Naghiyev can be samples in this respect. Furthermore, it should be noted a number of miniatures in the creativity of outstanding compositor Kh. Mirzazade. Sonata, concertino and a number of ensemble works are among the large-scale works. The works of A. Malikov, L. Jafarova, J. Abbasov, S. Ganini, A. Gambarli and others can be sample.

The compositions of "(K)einKleinesSchauspiel" by F. Garayev and "L'identification de la vengeance d'Eurydice" by E. Mirzayev that are among the literary source, poetic text, plotted works with or without program of compositors express the clear sample of instrumental theatre. In these works actor play also stands among the requirements before the performers. This acts as one of the characteristic features of modern instrumental works. Performers of these works should know plot, literary or poetic text, and actor play consisting of the conception of the work, besides being aware of literary and technical opportunities of the instrument they play.

There are instructions related to modern performance methods, performance methods of trait and nuances in the works of T. Gasimzade, A. Gambarli, E. Mirzayev, S. Gani. This feature is specific for modern works. Showing methodical instructions by the compositor help to introduce the work more excellently and at the same time the young ones gain many knowledge related to the implementation of new performance methods. The compositors have uses modern performance methods such as cluster, slap, multiphone, glissando, trill and mordents, frullato.

A. Gambarli has related the work of "Composition resolved to dots" we analyzed with writing technique (puantilism), T. Gasimzade the work of "Solo for Erin Lesser" with the

natural event, R. Ramazanov the work of "Gussa" with painting, E. Mirzayev the work of "L'identification de la vengeance d'Eurydice" with an ancient legend (Orpheus-Eurydice), used the citations of philosophers and outstanding artists for the sake of the relation of idea and literary-emotional expression. Writing techniques, performance methods, used for the realization of all these ideas have contributed to the performance practice of wooden wind instruments.

So, we can note a number of conclusions related to the influence of modern works written for wooden wind instruments to the performance art:

– The place taken by wooden wind instruments in the creativity of Azerbaijani compositors has been expresses mostly by miniature genres. Furthermore, serial works are also encountered. "SuraAtur" by Z. Karimova, 5 plays serials by Kh. Mirzazade can be sample in this respect. At the same time the samples written for flute and clarinet is more among the solo works: solo works for oboe and bassoon are not seen;

– Unusual instrument choice in the ensemble works requires displaying special sensitivity from the performers. "L'identification de la vengeance d'Eurydice" by E. Mirzayev (flute and 5 percussion instruments), "(K)einKleinesSchauspiel" by F. Garayev (bas flute and two guitars), "Controle+[" by T. Gasimzade (flute, percussion instruments, violin, chellos and mezzo-soprano) can be sample. At the same time it is observed registry compliance it the party of instruments with different timbres in these works;

– The compositors benefit from national music genres with different ways. Mughamimprovision style, dance, the application of color genres can be sample in this respect. At the same time European music genres such as waltz, ballade, rondo, march, scherzo also consist of the basis of the works.

– One of the specific features of ensemble works is encountered in that solo and accompanying instruments, as well as all instruments have the same position. Works of J. Abbasov, E. DadashovT.Gasimzade, Kh. Mirzazade, S. Rahimova can be samples in this respect;

– The compositors have used slap, vorschlag, mordent, trill, glissando, frullato, cluster, multiphone in both solo and ensemble works. Furthermore, the embodiment of performance culture is typical in the performance of different technical passages, leaps, small notes in fast temp, correct breathing, choice of positions, different applications;

– Additional abilities are required from the performers in the works distinguished by instrumental theatre traditions (F. Garayev, E. Mirzayev, T. Gasimzade). Here each performer should also perform the plot, the images embodying literary idea as an actor.

So, modern performance art in wooden wind instruments requires from the musician professional relation

being interested closely in the achievements of modern music, having individual creativity qualities, with comprehensive erudition, besides the enlargement of technical opportunities, besides being characterized by a number of qualities. So, it is possible to realize the excellence performance of the works in the creativity of national and world compositors, as well as to develop the performance art at professional level.

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CLASSICAL CROSSOVER STYLE IN THE INTEGRATION SPACE OF CONTEMPORARY ART

Abstract. Hybridization of all spheres of culture and art, the integration of their various forms, expressive means generate new phenomenon, which are most fully reflect all the options of modern life. One of the most relevant today is the Classical Crossover, which originated as a symbiosis of academic music and mass culture. This phenomenon is examined in the article.

Keywords: Classical Crossover, music art, music style, integration process, mass culture, contemporary art.

The globalization of all spheres of public life has led to the fact that modern human being is immersed in the global flow of integration processes. The multi-vector system of modern means of mass communication is aimed at the destruction of artistic and style boundaries. New polysynthetic art forms that have emerged in recent decades as products of hybridization are become unique art phenomena.

Today there has been a cardinal turn in the forms of existence of classical music the time has come for new phenomena. The tendency to increase metabolic processes has led to the emergence of special genre-style "alloys", artistic hybrids that are not amenable to strict classification (for example, co-creation of pop artists and classical musicians, rock musicians and opera singers, ballet artists and professional athletes). Classical music is used to create a business image of both an individual and commercial companies and social groups. Classic sounds in the space of everyday life, is included in the context of modern design, fashion, quickly adapts to the rhythms of modern society. Classical music demonstrates the desire of modern human being to erase the boundaries of the era, style and genre, to neutralize the presence of the author, is able to create a mixture of associations and phenomena in space and time.

European contemporary music represents by the wide use of different styles and genres. It is right to state the fact that stylistic diversity has become one of the main features that can characterize the contemporary musical performance. Currently, there are quite a number of studies in the field of variety music, which are devoted to the coverage of many problematic aspects. However, it cannot be entirely argued that the problems of existing inter-relations contacts are sufficiently developed. On the basis of this, there is a need for a study of one of the leading musical styles of the late 20th and early 21st century, which identified as Classical Crossover.

The *purpose* of study is to reveal the peculiarities of the formation and development of Classic Crossover style in the context of integration process space of contemporary art.

Methodology and research methods. The specificity of the phenomenon is based on multipurpose to research on the presentation of art form, which is implemented on the basis of the comprehensive consideration principles and objectivity. The comprehensive approach is used in combination with historical, comparative methods, the method of art history analysis, sociocultural and functional analysis. The usage of other methods (induction, deduction, empirical methods, analytical, descriptive) helped with the solution of the tasks assigned in the article.

In recent years, due to the special popularity of the Classical music Crossover, a large number of articles are published in periodicals, as well as on Internet pages in which the musical crossover is studied in academic disciplines and as a form of modern pop culture. The work is based on research materials of such authors as R. MacDonald, D. J. Hargreaves, D. Miell [6], Yu. Astafieva [1], L. Danko [2–3], E. Semenchenko [8], E. Dukov [4], A. Morahan [7], P. Klevakin [5], and others. The phenomenon of Classical Crossover and Mass Culture is a special scientific discussion subjects. Works of such scientists-musicologists as L. Danko, P. Klevakin, Yu. Astafieva, E. Semenchenko, Yu. Verevkina, A. Tsukerand others are devoted to this issue.

There is a paradoxical situation in contemporary pop music, when the classic music works continue to live in the format of new standards; they are transformed and begin to function as objects of mass culture. Attributes and problems unusual for it actively penetrate to mass culture. Such integrative way formed a new phenomenon of "high" art or Classic Crossover.

Classical Crossover (literally "to cross classical music", to go beyond it) is a musical style based on synthesis and harmonic combination of elements of classical music with pop, rock and electronic music. The style emerged in the 1970s as a result of combination of classical and rock music. Later it included elements of pop and electronic music. This style gained wide popularity, since it can be used not only in vocal

music but also in instrumental and electronic music, and quite often in their close interaction.

The definition of "Classical" indicates that this style represents a connection with academic music. In the Classic Crossover, various genres and styles of music from the 20th and 21st centuries got together: jazz, rock and roll, rock, electro, disco, pop music and hip-hop. There are a lot of performers who work in this style on the modern stage. The name was officially established not so long ago, having entered the list of nominations of the music award "Grammy", annually awarded by the National Recording Academy of the USA. Sometimes as applied to the vocal music of this style, the definitions of "operaticpop" or "popera" are used. The crossover as a musical style was formed gradually, over several decades having overcome the path from eclectic experiments on the combination of rock and classical to widespread recognition.

The concept of a Classic Crossover combines works that have completely different origins, such as modern interpretations of classical works, works of new genres created using academic musical instruments (rock -, pop- and folk operas, combining different styles, etc.), academic "cover versions" – author's musical compositions, reworked in an academic manner performed by a symphony orchestra or operatic vocals ("Metallica", "Scorpions", "Deep Purple", "Bon Jovi", etc., performing together with a symphony orchestra, Russian group "Turetsky Choir", vocalists A. Bocelli, S. Brighton, etc.). It should be recognized that this kind of music today is incredibly popular with audiences with a wide age range, as evidenced by the number of performances in this genre on the show "Voice" in different countries of the world.

The Crossover style has become a music phenomenon thanks to the work of the opera masters Domingo, Carreras and Pavarotti. The principles of harmony of classical and pop music were embodied in the unions of famous performers, including Kaballe and Mercury, Kaballe and Baskov, Fabian and Krutoy, Hvorostovsky and Fabian, Netrebko and Kirkorov and others. Among the famous performers of the classical crossover it is necessary to mark out Luciano Pavarotti – one of the greatest opera tenors of the 20th century and the most great singer in style of the classical crossover, whose talent helped the whole world to hear and fall in love with beauty and harmony of a sound. A classic of the modern crossover is the Italian tenor of Alessandro Safina popular on a domestic platform. Among the famous performers it is necessary to mark out also Emma Shapplin – one of the most courageous authors and performers of the world classical crossover. When speaking about crossover, we cannot but mention the so-called "Latin explosion" that continued in the late 1990s. Among the rising stars there were Ricky Martin, Thalía, Marc Anthony, Enrique Iglesias and Jennifer Lopez. Collaborations between classical

and popular performers have included Sting and Edin Karamazov's album Songs from the Labyrinth.

It is necessary to mention the features for creation of a classical crossover composition. The basis of it is a classic work or a part of it, or the main theme with added elements of pop, rock or electronic music or all of them in many cases. For example, the Neapolitan songs "O sole mio", "Santa Lucia", and Vivaldi's "Four Seasons" have already received a "modern, not classical interpretation". The opposite situation is also possible: a pop song can be mixed with operatic vocal and performed by a symphony orchestra, e.g. the Italian song Volare performed by a popular British singer Russell Watson received a new, "classical interpretation". Collaboration between the late pop singer Freddie Mercury and prima opera Montserrat Caballé resulted in the worldwide hit "Barcelona".

Every performer today has the utmost freedom to interpret and manipulate classical music, such wise becoming co-author. Classical works in modern practice are arranged in various ways in the styles of pop and rock music, are reduced, divided into fragments and arranged in accordance with the context in which they are included. Any structural elements are freely excluded (or included) from the classics which leads to a partial or complete change in the semantics and architectonics of the work.

For Classical Crossover products, a combination of symphonic instruments and electronic, including fully synthesized sounds is characteristic, in addition, they use computer voice processing. A striking example is the composition of Eric Serra "The Diva Dance" from the film "The Fifth Element" (1997), where the singer's academic vocals are "refined" by means of sound engineering (including montage and morphing) and combined with dynamic electronic orchestration. This example demonstrates the phenomenon that is characteristic of synthesized musical art projects, namely, the directed sounding.

The classical crossover also develops new currents in modern music. For example commercial projects of French musicals "Mozart: rock opera", "Notre Dame de Paris". It should be noted that many of arias of a performance "Notre Dame de Paris" became hits of the classical crossover. The demand of the classical crossover as the industries is confirmed by its rapid development in Russia (Netrebko, Bashmet, Gergiev, Spivakov, Matsuev, pop artists Krutoy, Baskov, Kirkorov, group "Turetsky Choir").

The concept of "Classic Crossover" does not have a strict terminological definition. It applies to both vocal music and instrumental music, solo and ensemble creativity. The Crossover is interpreted as a contemporary musical style, as well as a genre of pop music. Semenchenko states that phenomenon Classical Crossover has huge potential and demands the deep scientific analysis and judgment. Author proves there is a kind of entertaining art so far as the popular music focused on wide

audience of listeners; it is necessary to pay special attention to mass culture and popular music in general. Semenchenko considers different aspects of popular music through a prism of mass culture [8, 165–167].

Today popular music succeeds traditional, classical music. The last, however, does not disappear from musical space at all, and on the contrary – there are its "modernization" and acquaintance of musical public with the famous classical works. Zurkovaobserves that classical music as filler of free time and waiting time. According to the author, classical music fills "time with esthetic impressions which can be regarded by the individual" as a kind of valuable acquisition, possession" [11, 4].

According to the opposite view (critical direction) of musicology, pop music was underestimated, had negative characteristics. Confirmation to that are the words of the famous Russian musicologist Tsuker. Tsuker emphasizes the importance of scientific and technical progress is which significantly affected culture in general and mass music in particular. A. Tsukerdeclares that "the technical means which arose in the second half of the 20th century transformed all culture, having brought to life new forms and the musical registration corresponding to them" [9, 45–46]. New level of a research seems in A. Tsuker'swork who claims that "mass musical culture is in the difficult relations with the academic musicology, being for it in many respects the closed book". The scientist emphasizes insufficient attention to mass music, its importance and the importance in modern culture. He also notes a tendency to the shift of characteristic signs of different types of arts and mobility of borders between them.

Musicologists differently define a role and value of mass culture and music, their value in culture, for example, the lack of the esthetic and practical value or a standardization and primitiveness. In spite of the fact that the majority of mass musical production is recognized spiritually both esthetically primitive and directed to commercial success and profit, the classical crossover as one of types of popular music is an exception of the general rule. This musical style represents a peculiar synthesis, a harmonious combination of elements of classical music and pop rock of electronic music. It is directed to granting esthetic and intellectual pleasure. In this regard classical music stops being "boring" for the general public that demonstrates the general growth of level of culture.

Let's return to the characteristic of the classical crossover. For many years classical works won popularity among fans of mass culture, pop music in particular. Practice of use of a subject, genre and style, etc. in a format of citing, arrangement and stylization was also widely adopted from 1920s. One of widespread examples of the crossover is execution of the classical repertoire in modern processing: jazz interpretations of traditional classical works or modern classical works. Zurkova

notes that this movement is also known "as classical pop, operatic pop, neoclassical, contemporary classical or just crossover, however a set of examples not only in vocal, but also tool creativity left the name Classical Crossover as the basic" [11].

Stylistic diversity became one of the main features which can describe contemporary pop music. Currently, there is considerable number of studies in the field of pop song art, covering many problematic aspects. But it cannot be stated strongly enough that problems of existing interstyle relations are sufficiently developed. For this reason, there is a need for studying one of the leading musical styles of the second half of the 20th century and the beginning of the 21st century –Classical Crossover.

*Conclusion.*Classical Crossover is the style which has resulted from a compromise between elite art and modern mass culture. Thanks to the synthetic nature the genre has the sufficient flexibility of development allowing to combine an academic background with the most current musical trends. Elements of the academic sounding, inherent Classical Crossover, in combination with a staginess factor (invariable attribute of pop culture) provide to a genre commercial success among the wide age audience which is far beyond adherents of exclusively academic music. Thanks to it one of the major Classical Crossover functions which consists in promoting of the academic music is carried out.

The term of Crossover applied to music that deliberately mixes genres. "Fusion" is a more common term for this phenomenon. *From our scientific point of view, the crossover phenomenon conditionally is considered as: 1) creation of a resolute music hybrid; 2) the crossover as extension of musical style through the collaboration music art and pop culture sphere; 3) new possibilities for creativity, also advance and promoting of performers and their works.*

Classical Crossover can be identified as a kind of synthesis, a harmonious combination of elements of classical music and jazz, pop, rock, electronic music. Analysis of modern projects allows us to conclude that the tendency to present the Classical Crossover phenomenon in synthesized music and art projects is a widespread practice. This testifies to the commercial profitability of this phenomenon and its wide recognition by the mass audience. Examples of forms of implementation lead to the conclusion that Classical Crossover can be described as a project of variety-academic genesis, hybrid phenomenon of contemporary art due to the peculiarities of the synthetic nature.

The analysis of examples revealed that the expressive possibilities of the Classical Crossover phenomenon are emphasized and multiplied due to the obligatory presence of the entertainment factor, the integration of modern audiovisual technologies.

The results of this research have a social importance and can be applied to researches (training of specialized scientific publications and monographs), education (the development of the learning courses in educational institutions with artistic profile), and music practical (vocal classes, master-classes, concerts) activity.

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FOLKLORE TRADITIONS CONCEPTUALIZATION IN THE RUSSIAN ART OF THE LATE18TH – EARLY 20TH CENTURY

Abstract. The article analyzes distinguishing features of folklore conceptualization in the art culture of Russia, which began with the rise of interest in traditional folk culture sparked by pre-romanticism and ended on the eve of the formation of Soviet aesthetics with its attitude to folklore, which determined the development of this artistic phenomenon for many decades to come.

Key words: folklore; history of art.

Public and science took interest in folklore in the art of Russia in the second half of 18th century. The theoretical development of folk art concept was first undertaken by Russian preromantics. Its paradigm found its basis in sense of national identity and rise of patriotism, strife to realize the beauty of national life and to know the essence of Slavic-Russian spirituality. "National spirit" concept defined as "attachment to our uniqueness" by Nikolay Karamzin in his works, is viewed by modern researchers as an equivalently significant for Russian science and culture with the role of J. G. Herder in German philosophy and literature [1]. Furthermore, J. G. Herder quite naturally combines the talent of a philosopher and religious thinker, poet and cultural historian, ethnographer and folklorist, and, like N. Karamzin, had a great influence on many other Russian thinkers of this historical period (M. Derzhavin, A. Radishchev and others.).

The preromantics declared a special type of attitude towards the world, namely, an awareness of reality from the point of view of historicism, sociality, nationality and national identity. It was they who sparked the public interest to national history, mythology and folklore. For example, researchers consider that first attempts at describing and studying Russian traditional folk culture were taken in the second half of 18th century. As I. Keldysh wrote, starting from the 1760s, the pages of popular magazines and almanacs for general public began to publish texts of Russian folk songs, fairy tales, proverbs and sayings [2, 219]. In addition, the first collections of Russian folk songs (M. Chulkov, V. Trutovsky, and others) were very popular with readers. However, as I. Keldysh says, publications of this period did not fully reflect the specific nature of Russian traditional folk art due to the fact that the materials were presented in processing and they were recorded not from authentic performers, but it was "second-hand". As for the study of folklore directly from the mouths of the traditions bearers, this method of research will become characteristic only in the mid – 19th century.

The development of the nationality idea was continued by the romantics, whose concept of nationality assumed special attention to all manifestations of national identity (history, character, life, folklore, language) and understanding of each nation as a carrier of a certain idea in the history of all mankind. The ideologists of Russian romanticism developed the nationality idea as an individual and original one proposed by J. G. Herder. At the same time, agreeing with the thesis about the transformability of aesthetic tastes under the influence of external factors, they did not support the idea put forward by them about the need to imitate certain exceptional samples (for example, antique ones) and defended the provision on the preference of turning to the national and authentic. As aptly noted by Russian researcher T. Kuznetsova, the views of Russian romantic thinkers at the nascent stage were characterized by special motives, which later developed outside of the Romantic Movement. Part of those motives is a critical attitude to the value of the foundations of European life, as a result of which a special interest has arisen in spirituality and the uniqueness of own national being [1]. Moreover, the author convincingly proves that the categories "national spirit" and "national character" expressing the national originality of culture were interpreted by Russian romantics with pronounced social concretization. For example, unlike the German romantics – for whom in the construction of their own theory, the fact of social stratification was not determinative – for the Russian thinkers of the 1820s – 1830s considered common people as the guardians of the national idea. As a result, the national idea formulated by the Russian romantics embodied by the lower, under-privileged people, found continuation in the positioning of traditional folk culture in Soviet aesthetics. In this manner, folklore as the oral folk art of peasants had become the main symbol of the national idea in the republics of the Soviet Union for many decades. The young state began to allocate financial means for studying folklore and for pro-

moting and developing professional and amateur art on its basis from the moment of its foundation. This cultural policy orientation of the USSR pursued a clear and definite goal: using the example of oral folk art, which for the first time in the world will be brought to the level of art, socialism will be positioned as a social system that has significant advantages over the capitalist [3, 172].

The holistic theory of nationality that was baswed on the russian ideas was first developed in the works of V. Belinsky, one of the most authoritative representatives of the ideological and literary movement of the 1830s and 1850s. He reflected on the fundamentals of the identity of each nation and identified essential elements (customs and language) of ethnos identification, the destruction of which inevitably entails the destruction of the people themselves. He called the nationality idea the "alpha and omega" of aesthetics of his time. Nevertheless, he considered that the nationality should not assume an orientation to the manners and customs of only the common people ("rout", "gutter"), since they are not the only bearers of the spirit of the Russian people.

Interest in folklore was also present in the Slavophil movement, which formed after the rise of national self-consciousness as a result of the victory over Napoleon. Representatives of philosophical and social ideas of the first half of the 19th century (brothers N. Aksakov and K. Aksakov and P. Kireyevsky and I. Kireyevsky A. Koshelyov, A. Khomyakov, and others) positioned themselves as supporters of the national identity of the Russian people. Under the influence of the European romanticism ideas, Slavophiles urged others to study the life of the common people (language, customs, rituals, etc.). For example, the Slavophil and the brother of one of the theorists of this trend I. Kireyevsky, P. Kireyevsky collected and published texts of Russian folk songs.

The theme of the people was central and semantic in the populistic doctrine as a socio-political movement of the last third of the 19th – early 20th century, which had a significant impact on strengthening the national identity of the Russian people. The supporters of this ideology among the intellectual class were focused on "finding their roots" – finding the lost historical and cultural identity, reviving the national culture, which stimulated the need for a so-called "bonding" with the common people. "Going to the people", the work "among the people" and "together with the people" became the basis of the creative activity of the Peredvizhniki and composers of the Balakirev's circle. It was "among the people" that they saw an inexhaustible source of inspiration for their works. V. Stasov – the ideologist and inspirer of the composers of the Mighty Handful – said that the history and culture of many civilized nations developed in such a way that over time their traditional folk art almost completely disappeared from its natural environment. As for the modern Russian art culture for V. Stasov, the folklore in it was still quite widespread. In this regard, the critic emphasized that many outstanding Russian composers were born or spent a significant part of their life in the province and were well aware of traditional folk culture, which later formed the basis of their creative method [4, 522]. As an example, he cited the names of M. Balakirev, M. Glinka, A. Dargomyzhsky, M. Mussorgsky, N. Rimsky-Korsakov and many other composers. However, in addition to borrowing the material for their works in folklore, composers such as M. Balakirev, N. Rimsky-Korsakov, and others published folk song books, which contributed to folklore preservation (even though not in authentic, but in processed form), and on the other, it was made available to a wide range of progressive public. For example, "One Hundred Russian Folk Songs" anthology by N. Rimsky-Korsakov, consisted of musical adaptations of authentic songs for voice and piano (some of which were previously published by other authors), but had become a rarity by that time, and the other part was collected by members of the Balakirev's circle and experts on traditional folk culture, and also recorded by the composer himself from the mouth of folklore carriers (detailed comments are given in the notes on this subject) [5]. It should also be noted that in this collection of the poetic lyrics of songs presented in abbreviated form. Nevertheless, it does not diminish the scientific value of this publication.

The aesthetic program of V. Stasov as an ideologist of populism was based on the fact that only the deep knowledge of the life of a people, its history, character, beliefs, imagination can make the foundation of original national art [6]. The critic called the national roots and traditions the foundation of art, its "powerful food". In addition, V. Stasov himself made a feasible contribution to the study and popularization of Russian traditional folk culture. In 1872 in St. Petersburg, the publishing house of the Society for the Encouragement of the Arts initiated a cycle of publications on Russian folk ornament, the first issue of which was devoted to sewing, fabrics and lace. It is noteworthy that V. Stasov himself, an ardent lover of folklore and propagandist of the idea of its significance for a person to understand oneself as part of a nation, wrote a rather impressive analytical volume in this publication, in which he urged people to collect and study monuments of traditional folk culture and to note their unique originality, naivety and beauty [7].

In summary, the period from the second half of the 18th century until the early 20th century played a significant role in the history of folklore interpretation as a bright and original phenomenon in the art of Russia. Public and science took interest in the study of folklore during this period, which became a steady trend. The development of the theoretical foundations of the concept of folklore within the written tradition

culture started. The expeditionary work on the creation of a collection of traditional folk art materials becomes more ac-

tive. It all this served as the foundation for the formation of the idea of nationality in Soviet art.

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THE EVOLUTION OF AUDIENCE`S PERCEPTION OF THE ARTISTIC IMAGE IN THE SCREEN ARTS

Abstract. In this article, historical data of the audience`s perception of the artistic image of the screen types of creativity are subjected to reflection and analysis. They are considered in terms of changing conditions, that shape the viewer`s consciousness. Internalizing the evolution of audio visualization are exposed to a generalizing characteristic.

Keywords: audio visualization, audio visual image, screen creativity, perception, artistic image, audience, visual evolution.

The entry of mankind into the XXI century was associated with the process of active technical progress, the development of various means of communication, the formation of all spheres of human life. The integration of classical arts with new technologies has led to the fact that audiovisual forms have taken the lead in presenting information. The past decades have changed the surrounding artistic reality beyond recognition, to which mankind has become accustomed for centuries. Various media technologies with wide range of functions and purposes invaded the daily, business and personal spheres of human life, transformed many aspects of human activity. The essence of the concept of entertainment, ways of organizing free time has changed. The life of a modern person is already inconceivable without laptops, mobile communication devices and reproduction of media products of various formats. Without smart phones, tablets and other types of gadgets, the perception of information for a person has become problematic, both in everyday life, in work and in art. In the view of the current situation and in the conditions of the 'information explosion' of the XXI century, the human appreciated and gave its preference to the audio visual mode of data. Due to the simplicity, accessibility and easy understanding of the visual component of information, audio visual culture has a dominant position in the modern society. Audio visual culture means everything that includes audio and visual elements in its structure. First of all, these are types of screen versions: cinematograph, television, the Internet. The reasons of such a vast spread expansion of audio visual culture are in the globalization of arts, high production speed and consumer media products, the primacy of visual media in all areas of life.

There are questions: what is audio visual culture? Why is it so popular in the modern world? Why the public refers visual and audio visual means getting information? What are the methods of "visual culture" and visual education of the modern viewer based on? –is the main goal and subject of many modern scientists. The term "audio visual culture" appeared at the joint of such disciplines, as history and theory of arts, theory of cinema, and others. The visual culture is a set of social, individual material and intellectual visual values, stored and functioning as symbols in a certain society and transmitted through visual media. Later the sound joined the visual form of creativity, as we know it happened in the cinema. And since then, audio visualization has begun to exist as a separate art department. And if should be noted that not only exist but shape the consciousness of the viewer. Why the arts with clearly expressed visual component, so quickly won people`s mind and found a quick access to the souls and hearts of the audience? While studying the works of art a human`s perception is built mostly to inner emotional reaction. Through the vision, the work is introduced into the system of existing values; in the process of reviewing it is multiplied by association communications.

As a result, it turns out that "the image itself is much less strong than the impression received from them". So, the aim of the visual culture is to enrich the inner world of man with visual images, to unleash the ability to create their own visible objects [1, 10–11]. When the image "spoke", the consciousness of the viewer (and to the time of the talking image recorded on the film, the audio visual art already had its audience), was very articulated and ready for the perception of a new art form. The person looking at the screen had tastes and morals. What was at the dawn of cinema, in terms of demonstration, became obsolete after a few years. And the viewer demanded all the new improvements of the beloved art. It should be pointed out, that for the person, living in the XXI century, the phenomenon twinkling from the screen and movements were already a tremendous shock. "Although the films of the Lumieres have been preserved and often shown, we are hardly able to assess the strength of their impact on the audience of the XXI century. We and they have different notions about the image and the degree of its vitality" [2, 45]. From the first violent and unrestrained reactions of the viewer to the fine

taste formed over the years, many decades passed. The driving force that changed the on-screen audio visual art was not only the technical progress, which was taking leaps and bounds, but also the very changing understanding of art. No one was able to counter the screen. Cinema, and then television – this is the real life itself. Even if speaking with "his" tongue, and looking with "his" sight. Nevertheless, a living, moving image that possesses the gift of speech is the most close to a person, rather than elite classical art. It doesn`t mean, that the screen art is worse than the classical one. It only means that there is a separation that could not have been foreseen by filmmakers, who viewed "moving pictures" as a joke and fairground fun.

From cinema the audience`s perception passed in its perception into a new television reality. And then the viewer saw and heard a new, rapid, quickly changing art that had taken possession of him for many years and does not let go so far. "There is no doubt that television transformed the prevailing nature of the functioning of audio visual "texts", breaking the monopoly of full-length feature films and returning the screen to the diversity of the early film repertoire. In the program schedule, different screen structures are found: from the "pure" information (messages, read by announcers) to a game epic, structures that intersect and complement each other in the proportion set by the communicator. The dramatic expansion of the field of non-artistic and semi-functional sound messages at the beginning led to the idea of cinema and television on the basis of "art-art", to the idea that television is (only) a means of communication, and cinema is (only) art" [3,249]. Nowadays, with unprecedented speed, various technical innovations are emerging in the field of audio visualization. The viewer`s consciousness is formed thanks to the Internet,

television and cinema. It is difficult to say what exactly has more and less influence, since in depends on the age, preferences and level of perception of different groups of viewers. One thing is for sure, the situation in the whole world, where the audio visual information offered by the screen reaches the attention of the audience quickly and easily, has become irreversible. The ability to work with material so that the artistic image is born interesting, fascinating is a whole science. Since artists used to work with clay, stone, colors, and the polyphony of sounds, medievalist artists are now working in the modern screen art. And the results of their creation are provided to the wide circle of the viewers immediately.

Between the viewer and the creator in the on-screen types of creativity there is always an important mediator- screen. This sharply changes the nature of habitual art. And the most importantly, the audience perception has changed. For centuries it was customary that in the classical forms of art, matter that was subject to the listener and the viewer had plasticity in certain limits created by the theatre stage, painter`s canvas, and others. However, the peculiarity of the on-screen types of creativity is that the optical and sound equipment now acts as brushes and paints, which create artistic images. Lifeless, at first glance, the technique actually plays the important role of artistic tools. In spite of the fact that the concept of equipment will exclude any objectivity, it is safe to say that everyone knows the names of great cinematographs and sound producers, in whose work one can see the handwriting and the subject view. And this subjective view of artists, excites the minds of the audience, forcing to delve into the essence of screen art, look for meaning in what they see, believe in the authenticity of images and admire the artistry.

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Section 4. History

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THE MAIN STAGES OF ETHNIC HISTORY OF ZARAFSHAN OASIS AND ITS ROLE IN THE FORMATION OF OASIS TOPONOMIES

Abstract. This article presents interesting facts about historical sources of ethnic history, ethnic composition, ethnology, ethnonymy and ethnic background of Zarafshan oasis. Particularly, the majority of the ethnic toponims in the region have been identified by names of places belonging to the Turkic ethnoses, among which are ethnic populations such as nayman, bahrini, kungrad, kipchoq, and so on. The article also describes the role played by various ethnic groups who participated in the ethnic formation of the Uzbek nation in ethnic and migratory processes in Zarafshan oasis (translated into English).

Keywords: etnonim, toponim, etnogenesis, archaeological research, ethnic composition, ancient ethnoses, medieval ethnic processes.

The Zarafshan oasis, like the Fergana valley, Chach, Tukhoriston, and Khorezm oasis, is one of the most densely populated regions of Central Asia. Especially Samarkand and Bukhara regions of Zarafshan valley, mainly due to its irrigated agriculture, it involves a number of pastures which were attractive for a continental and nomadic ethnos. In particular, by familiarizing with the ethnotoponyms presenting in the Zarafshan oasis, it is possible to gain some insight on the ethnic processes that took place not only in the oasis, but between the Amu Darya and Syr Darya.

Looking back at Central Asia's nearly three millennium history, it is evident that regular migratory processes are taking place in the history of the region. In other words, written sources indicate that the population of the northern and northwestern parts of the Central Asian region has been migrated to the Chach oasis, the Fergana valley, the Zarafshan oasis and the lower reaches of the Amudarya river [3; 12].

In the middle of the last millennium BC, whether in the 1st millennium or in the Middle Ages, the large-scale population movements from the Central Eurasian region (mainly Central Kazakhstan), South Siberia, Mongolia, Altay, and Yetisuv to the climate-friendly and the fertile oasis between the northern and northwestern regions of the Amu Darya and Syr Darya happened almost every century. This phenomenon is reflected not only in the written sources of the epoch, but also in the region of today, especially in the Zarafshan oasis toponymy [11, p. 144–184]. When we look at these migratory processes in the example of the Zarafshan oasis, we can

see that the region is characterized by the following major general ethnocultural processes, which include several stages [4, p. 81–91; 1, p. 73–98]:

1) From the middle of the last millennium BC to the last centuries of that millenium. At the beginning of the first millennium BC, the Scythian and Sarmatian tribes from the Eurasian steppes initially migrated to the Syr Darya River, then in the III–II centuries, the tribes of Yueji, Kang, Dung from Yettisu and its suburbs began to migrate to the places between Amu Darya and Syr Darya rivers, including the Zarafshan basins;

2) From the first centuries to the middle of the 1st millennium BC, the Himalayan, Cyrus, and Eftalian) tribes from Altai and East Turkestan settled down in the southern region of the region and upper basin of the Amudarya river [8, p. 179–192; 5, p. 19–21];

3) In the first Middle Ages, especially in the VI–VIII centuries BC, owing to regime of the Greater Turkic Khanate in the region increased the number of ethnic groups migrating from Mongolia, Altai, and Yettisu to the Amu Darya and Syr Darya rivers, including in the Zarafshan basins [13, p. 15–24]. Especially the participation of the Turks in the governance of Samarkand, Bukhara and a number of Sughd rulers have been intensified [6, p. 119–129]. As a result, significant changes have taken place in the ethnic composition of the population and the prestige of the existing Turkic peoples in the region increases;

4) In the Middle Ages, during the governance of the Karakhanids, and later Saljuqids, Karakhitas, Khorezmshah-Anushteginiys', we can see migration of a lot of Turkic tribes to

the Zarafshan and Amudarya basins from Yettisu, East Turkestan, the middle and lower basins of Syrdarya [7, p. 28–32]. Meanwhile, mainly Qarluq, Yagmo, Chighil and partly Oguz tribes of the Turks were populated in the Amu Darya and Syr Darya rivers and adjacent areas [14, p. 152–153];

5) In the XIII–XV centuries the Turkic and Turkic Mongolian tribes increased in the Syrdarya, Zarafshan and Amudarya basins during the invasion of Mongols and in the period of Chagatay's and later in the Temurids. Especially Mongolian, Southern Siberian and Far Eastern nomads (mainly Turkic-Mongolian, partly-tungus-manjur), begin to settle in the south-western region of the region, forming numerous Turkic tribes in the Altai, Eastern Turkestan, and Yettisu. In the Timurid era this process continued, and migratory processes became regular between the Volga-Ural River and the Yettisu and the Amudarya-Syrdarya River. During this period, dozens of other Turks and Turkic Mongols, such as Kungrad, Arghun, Jaloir, Uyshun, Nayman, Barlas, Arlot, are in the center of these processes [15, p. 165–176; 7, p. 36–41];

6) During the Shaibaniyes – Ashtarkhons period – in the XVI–XVIII centuries several dozens of Turkic and Turkic Mongolian tribes from the Volga-Ural region and parts of the Sariarka (Central Kazakhstan) and western Siberia are located in the Amudarya-Syrdarya interconnection and adjacent territories [2, p. 50–54]. In this period, the Turkic Kipchak tribes are intensively active and spread in the Jizzakh, Zarafshan, Kashkadarya and Surkhandarya regions [9, p. 25].

Thus, along centuries with the ancient nomadic ethnic groups of Central Asia, the percentage of the Turkic tribes – the Karluk, Oguz and Kipchak tribes, which are direct or indirect hereditary successors, increased between the Amu Darya and Syr Darya, including the Zarafshan Oasis. The composition of the 20th century ethno-populations also proves this. In particular, in several cities of the oasis and relatively old and large villages were used Karluk dialect of the Uzbek language, and in the desert and steppes of the oasis, as well as in relatively smaller villages, the Uzbek language is mostly seen in Kipchak and partly Oghuz dialects or their elements. In the period of the Shaybani, Ashtarkhon and Bukharan emirates, the share of nomadic Uzbek tribes speaking in Kipchak dialect in the Zarafshan valley has increased, and in almost every part of the area – the upper Zarafshan River (Panjikent, Urgut), Middle (Samarkand – Kattakurgan Range) and the Lower Basin (Bukhara oasis) there were originated hundreds of villages named by name of Uzbek tribes [11, p. 58–70].

Despite the fact that the Uzbek population of Zarafshan oasis speaking in the Kipchak dialect occupied lifestyle of the ancient Turkic and Tajik inhabitants of the region and the culture of this land, in the early 20th century they kept the traditions and lifestyle of nomadic Turkic tribes of Dashti Kip-

chak. Especially, they kept their speech language, tribal system (Uzbeks of 92 breed), people's names, folklore, wedding ceremonies, sports and entertaining games (wrestling, kupkari/uloq), craftsmanship (horse gear, carpet weaving), funeral ceremonies (tradition of "bone asking"), clothing, cooking (mainly meat dishes) and so on. Nomadic traditions of Turkic peoples of Central Asia dominate till the Middle Ages.

It is noteworthy that there are no significant differences between the traditions of the Turkic and Turkic-Mongolian tribes as the Kazakh, Karakalpak, Nogai, Boshkird, Karachaybulgur and Kumuk Turks, that formed a large part of the Dashti Kypchak population in the Middle Ages and traditions of the Uzbek population, which preserved their own tribal system in the oasis – languages, weddings and funerals, folklore, and so on. Especially the Kypchak Uzbeks, the Kazakh, Nogai and Karakalpak traditions are very close. For example, there are a lot of generalities in wrestling and kupkari, names of people (mainly, Eshqul, Eshpulat, Yarlakab, Edige, Cengil, Suluv, etc.), yurta and related terms (keraga, uvuk, changarok), names of tribes (Kungrad, Mangit, Kenagas, Naiman, Kypchak, Jetiuruv, Tama, Tabin, Ramadan) [15, p. 167–175], horse equipments' names (jazlik, terlik, yapugh, jalduruk), clothing (jelak, yakhtak/jiyda, cholvor, kalpok, etc.), singing and musicianship (bashikish, drum, poetry) and doston singing (eg. Alpomish). This situation was preserved not only in the Zarafshan oasis, but also in the Uzbek population of the late XIX – early 20th centuries, kept the tribal-relativeness system in Jizzakh, Kashkadarya, Surkhandarya and other regions.

It is true that Zarafshan oasis and nomadic Uzbeks of the mentioned provinces did not differ greatly from the peripheral population of the region, in particular from the stable Uzbeks, and though the difference between them disappeared over time, there are some differences in tradition and tradition. For example, among the settled Uzbeks there are more Islam-based (Arabic) names, relatively serious adherence to the Muslim traditions in wedding and funeral ceremonies (akika-ceremony for a newborn, donation), presence of Persian-Tajik names, words, terms and phrases.

In short, in the twenty-first century Zarafshan oasis, it is clear that the ethnopolitical processes that took place in the ancient and medieval centuries in the region were more prominent. For example, the place names originated from the names of the nomadic Turkic ethnoses – Karluk, Uighur tribes who had moved between the Amu Darya and Syrdarya during the Karakhanids, or Barlos, Kovchin, Arlot, Arghin, Chigatai, Kerayit, Kiyot tribes, who played dominative role in the political life of the region during the Mongolian invaders and Temuridhs periods, relatively little. However, at the predominantly mountainous areas of Surkhandarya and partly in Kashkadarya, the place names relevant to the tribal-

relativeness system before the Shaybani period such as Karlyk, Barlas, Kovchin, Kerayit, Merkit, Chigatai and Toghchi are of common occurance [10].

The Oghuz elements or ethnotoponyms belonging to the Olot and Karakul of Bukhara oasis and to the central and southern parts of the Khorezm oasis, played relatively smaller role in the 20th century ethnotopony of the upper and middle basins of the Zarafshan oasis. Its cause of the migratory processes from the northern and northwestern parts of Central Asia to the southern and south-western parts of it are primarily occurred through the Nurata and Zarafshan oasis, and these processes, which have often been carried out through the Syrdarya river basin, have also been reflected in the ethnosopoeos of our country. That is, during the last major migratory process in the region – on the Shaiban era, Uzbeks tribes speaking in the Kipchak dialect widely settled between the Amu Darya and Syr Darya, The role of the Nurota and Zarafshan oasis as a "gateway" was the basis for the relative widely popularization of ethnotoponims related ethnic Uzbeks.

Also, the lack of high mountains in the middle and lower basins of the Zarafshan oasis has prevented the formation of a chain of ethnotoponyms associated with ancient Turkic tribes. Indeed, in some districts of the oasis we can meet partially belonged to ancient Turkic ethnonyms (eg. Karluk), but ethnotoponyms related to the Temurids, such as Kataghon, Kovchin, Toghchi, Siljiut [16, p. 16–21; 11, p. 143–148], are almost lost.

However, the most ancient sorts of Uzbeks – the "Turkic group" and the ethnotoponies associated with the Timurid era (Turkic, Karluk, Barlos, Musabozori, Kaltatoy, Chigatay, Tacchi, Qovchin and others) [9, p. 72–80] were found in Zaamin, Jizzakh Province, Urgut in Samarkand Province, Gissar in Kashkadarya Province, etc.). The same situation appears in the Fergana valley, particularly in Andijan, Osh, Uzgen and Khujand. If you look at the Osh-Andijan-Mastchoh-Zomin-Urgut-Gissar-Baysun Mountains, it will be understood that the surnames of the "Turkish group" of Uzbeks (Turk, Barlos, Karluk, etc.) are quite common [7, p. 70–71; 9, p. 72–79]. It is worth mentioning that in the Shaybanid period, nomadic Uzbeks often resorted to self-restraint as a new venue – pastures, mountainous terrain, and steppe plains, as well as steep slopes and steep cliffs that are relatively difficult for livestock populations.

At the same time, however, it is known that, apart from the Kungrad Uzbeks, they chose mountainous and steppe zones, and most of them are in the later periods – in the 17th century, in the Amu Darya and Syr Darya rivers. They actually lived in the middle basin of the Syrdarya River earlier, and as a result of the raids (XVI–XVIII centuries) [7, p. 56–57] they traveled to the southern regions along the Nurata-Zarafshan highway, where the vast oasis – mountainous steppes and the steppes were mostly immigrant Uzbeks busy, so the rangers and peasants tried to settle down. In fact, the Kungrads, part of the nomadic Uzbeks, have been occupied in the XVII century, although the Shaibanids, even the Chigatay elder and the Temurids, occupy a significant place in the Amu Darya and Syr Darya rivers, in the Zarafshan, Kashkadarya and Surkhandarya rivers. Although the "jelathesh" speaks in the sheva, as well as other nomadic Uzbek breeds, the bungalows are more likely to preserve "ethnographic features" than nayman, mangit, palace, thousand, forty, hundred and dozens of "Kipchoq Uzbeks" it's because of their relative "late migrations" and the fact that they live in compact conditions, occupying the mountainous and mountainous places.

Thus, the unique feature of many places of the world is relative to ancient places, and the traces of relatively recent epochs in the oasis are more apparent in the example of our region – Zarafshan oasis.

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Section 5. Materials Science

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TECHNOLOGICAL FEATURES OFMAGNETIC ACTIVATION OF CEMENT PASTE

Abstract. The results of the study of the strength of cement stone prepared on the basis of hardening test in a constant magnetic field. The difference in the strength of cement stone depending on the technological method of activation of the cement test, consisting in a different arrangement of samples in a magnetic field relative to the poles of the magnet.

Keywords: cement dough, magnetic field, treatment modes, magnetic activation, compressive strength, liquid phase, Portland cement, mixing water.

In construction materials science, technological methods of directing external physical fields (electric, magnetic, electromagnetic, thermal, radiation, mechanical, sound, etc.) to the components of a concrete mix or the mixture as a whole are promising. The expediency of using these technological methods is explained by the simplicity of control, the possibility of reliably improving the physico-mechanical parameters of cement construction compositions and low energy consumption.

One of the important methods of management of structure formation of a cement stone, improvement of characteristics of concrete is the directed change of physical and chemical properties of water of mixing. Cement dough in its physical structure is a pasty aqueous suspension consisting of a liquid phase and solid particles in the form of clinker grains and hydrated formations. In this case, the liquid phase is a saturated aqueous solution of an alkaline composition and is the main structural unit of the test, providing its adhesion ability to wetting and adhesion to the filler [1; 2].

When conducting research, it is accepted that the cement paste (highly concentrated dispersion system) as an object of magnetic treatment reacts not only to the nature of electromagnetic effects, but also to the accepted parameters and processing conditions for a specific type of activation.Magnetic effects on pre-mixing the cement paste at steady-state conditions of the object to be processed is achievable in continuous magnetic activation, and a discrete magnetic activation of cement paste with different time modes of pre-treatment before processing.

The effect of increasing the strength of the activation object is manifested to a greater extent in the technology of discrete magnetic processing in later periods of hardening of activated samples. The increased value of the strength of cement with discrete magnetic treatment associated with rupture of the membranes of the products of hardening on the surface of the grains.

The molecules of the liquid phase of the dough, penetrating into the microcracks of cement grains, cause them to split and grind. The data of literary sources testify [1; 2] about influence of an alternating magnetic field on processes of hardening of a cement stone. It is noted that a constant magnetic field should be applied after the beginning of setting, since the magnetic field orients the dipole moments of the liquid phase, reduces diffusion, contributing to the formation of contacts of chemical nature [1].

We believe that the strength of the cement paste during magnetic treatment will also depend on the location of the cement paste samples on the poles of the magnet.

The strength of the cement stone formed from the cement paste hardening in a magnetic field is investigated. Portland

cement M500 is accepted as a binder. For the preparation of samples were taken sample cement, constituting 100 g, the amount of mixing water is 40 ml. Manufactured forms with five cells filled with cement dough was placed for processing on one of the poles of the magnet. Activation was carried out in modes in which one object was at the North pole and the 2nd object of activation was at the South pole. It was found that the dependence of the change in the strength of the cement stone from the time of holding the test to the treatment are different. The most significant time of exposure is 80 minutes.

In this interval of the test activation time when the mold is located at the North pole, the strength of the samples significantly exceeds the strength of those samples that were processed at the South pole.

A further increase in the test holding time to magnetic treatment in both cases is accompanied by an increase in the strength of the activated samples. The fact of growth of strength of cement stone at insignificant endurance – 30 min and time of the beginning of term of setting (100 min) is noted.

The data of studies on the activation processes at the location of objects at different poles indicate that the results of the strength of the cement stone, presumably has the existence of an internal field of sufficient intensity inseparable from the spontaneous residual magnetization.

We assume that the ferromagnet is constantly in a state of spontaneous magnetization, as well as its microscopic areas.

In the initial state, these regions are located so that the sum of their moments throughout the sample is on average zero, but they can be oriented in one direction. There are two important experimental facts confirming the existence of these areas.

First, if magnetization is the result of orientation of regions in one direction, then it can be expected that the magnetization process will proceed in discrete jumps. Apparently, this is due to the appearance of the so-called Barkhausen effect, which allows us to estimate the number of atomic magnets in one microscopic region. This number is close to 1016, and the corresponding volume of each region in the crystal is about 10–6 cm^3.
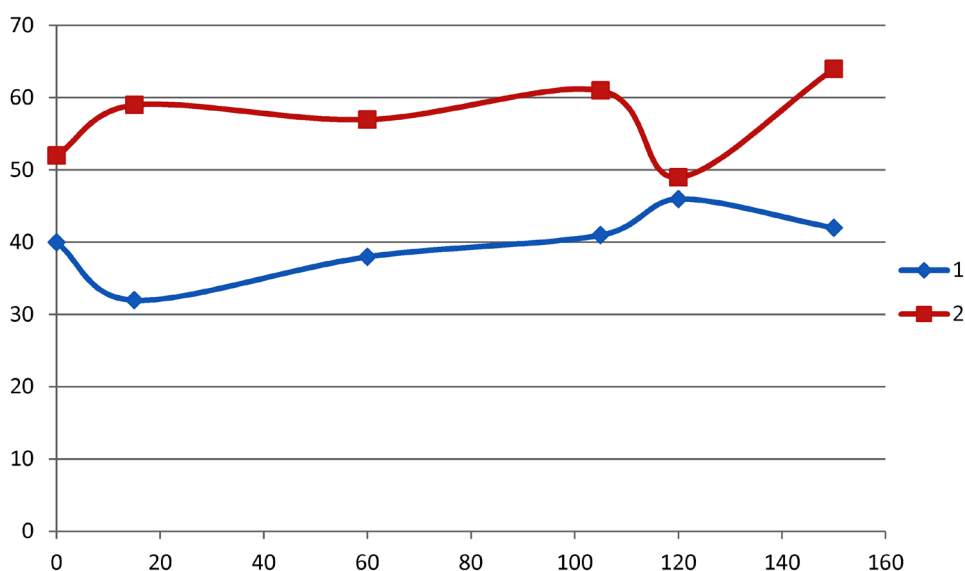

Figure 1. Strength of cement stone formed from cement paste hardening in magnetic field

The holding time of the cement test before magnetic treatment, min.

1-the dependence of the strength of the cement paste hardening between the poles M400;

2-the dependence of the strength of the cement paste hardening between the poles M500;

The second experimental confirmation gives the observation of powder figures, which are obtained by applying a colloidal solution of magnetic iron oxide on the carefully polished surface of the ferromagnet. Settling, magnetic particles accumulate where the strongest magnetic fields operate, just as iron filings are distributed along the lines of force in elementary experiments on magnetism. The strongest fields in this case are concentrated on the boundaries between the domains and, therefore, with the help of this method, the boundaries between the domains (the magnetization region of the ferromagnetic in the crystal) on the surface of the sample cutoff are "manifested". For the modes of magnetic treatment of the hardening test, studies were carried out to assess the strength of the cement stone for the conditions of different location of the processing object between the poles. Portland cement M500 and M400 were used in the studies. Activation was carried out similarly to the above modes.

The results of experimental studies of the strength of cement stone were determined in 28-day natural hardening depending on the holding time of the cement test before magnetic treatment. As before, the time of the test activation was constant and equal to 15 minutes.

It is determined that the activation of the cement test prepared on the basis of Portland cement M500 strength of activated stone is almost higher than the strength of the control series of samples and this excess reaches a value of 1.25.

Thus, the difference in the strength of cement stone depending on the geometric location of the activation object in the magnetic field is established.

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RESEARCH STRUCTURIZATION of the CEMENT STONE WITH SDzh-3 SUPERSOFTENER ADDITION

Abstract. In the scientific article results of an experimental electronic microscope with use of concrete chemical supersoftener are generalized.

Keywords: Compound chemical additive, superplasticizer SDj-3, electromagnetic microscope for concrete.

Great demands for durability which, first of all, is estimated by frost resistance and water tightness are placed on the cement compositions (concrete, solutions, etc.) which are applied in hydrotechnical and road construction. The complexity of various and technical problems in a construction complex forms new tasks of improvement of compositions of concrete and construction solutions on the basis of cement compositions. One of solutions of similar tasks is creation and use of new complex chemical additives for cement compositions – the concrete mixes, construction solutions, etc. which are rationally combining necessary technical and operational characteristics [1, 64–71].

In recent years sharply the need for concrete on the basis of the cements with complex multicomponent modifiers meeting the requirements of modern construction increased. It is caused by the accruing trend of use of high-branded concrete, creation of new technical and constructive solutions, need of increase in reliability, durability and profitability of construction. Complex modifiers are a powerful tool of regulation and management of properties of concrete, including and monolithic. Introduction to structure of cement and concrete compositions of various modifiers is the integral element of technology today. It is explained by an opportunity at rather small expenses to receive essential change of technological properties of concrete mixes and construction and technical properties of concrete [2, 111–125].

Among the main requirements imposed to high-quality monolithic concrete carry: high early durability and frost resistance, the high module of elasticity and stability of volume, low permeability in relation to water. Therefore the increasing attention is paid to researches surface-active additives of the air-involving action, actively affecting structural and rheological properties of concrete mix, structural porosity of a cement stone and also on a power condition of both the water environment, and a firm phase of cement compositions. On the other hand the large volume of scientific research is executed by domestic scientists on a research of the fine mineral substances improving and regulating structural properties of concrete mix, such as fullness, nerasslaivayemost, water separation [3, 77–81].

Now there are no doubts any more and disputes on that is costs or you should not be engaged in a research and application surface-active and the struk-turoformiruyushchikh of additives. The issue is resolved as a result of accumulation of rather long and large-scale scientific practical experience. Use of modifiers of concrete for impact in the necessary direction on the processes happening in cement systems (cement dough, solution and concrete mixes, a cement stone, solution and concrete) from the moment of a zatvoreniye and before acquisition by it of the set properties is important means of improvement of technology of concrete. However the attention of scientists is required by questions of design of structure of complex modifications, development of selection criteria and assessment of chemical and mineral substances from positions of their synergetic action, the description of stability and bifurcations of the modified cement systems [4, 41–45].

Specific feature SDzh-3 is the fact that at presence SDzh-3a there is a formation of smaller crystal structure of a cement stone of normal curing.

The carried-out RFA of samples of the stone knitting showed what SDzh-3 has no impact on structure of hydrate phases. Processing of results of RFA allowed to reveal the following: introduction SDzh-3 at further water curing of samples causes education in a stone of the calcium knitting high-basic hydroaluminates which are found after 28 days of curing. Besides, are a part of hydrate phases high-basic C-S-Hc d/n GSC = 3.09; 2.85; 2.80; 2.00 1.83; 1.56; 1.40 Å; Ca (IT) 2 with d/n = 3.11; 2.63; 1.79; Å and also d/n which did not react alitc3ss = 2.74; 2.61; 1.77 Å. At the age of 28 days

on roentgenograms of compositions from KJ – the 4th the main reflections of low main of GSC appear. After addition of KJ-4, the structure of the stone knitting at the age of 28 days is presented, generally C-S-H(II) with d/n = 2.85; 2.80; 2.00; 1.83; 1.56; 1.40 Å; C-S-H(I) with d/n = 2.80; Å; Ca (IT) 2 with d/n = 2.63; 1.79; Å, ality with d/n = 2.74; 2.61; 2.16; 1.77; 1.62 Å and also 2CaO·A12O3·8H2O with d/n = 2.68; 2.55; 1.75; 1.73; Å.
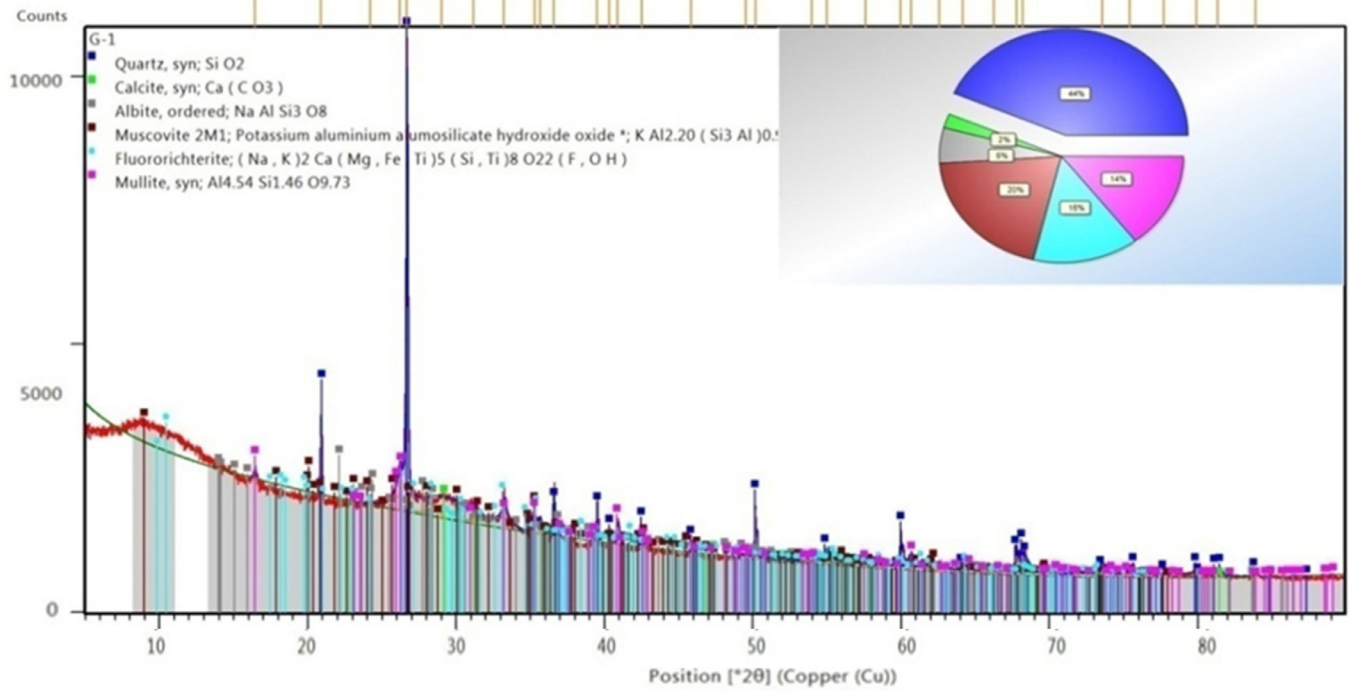
a)
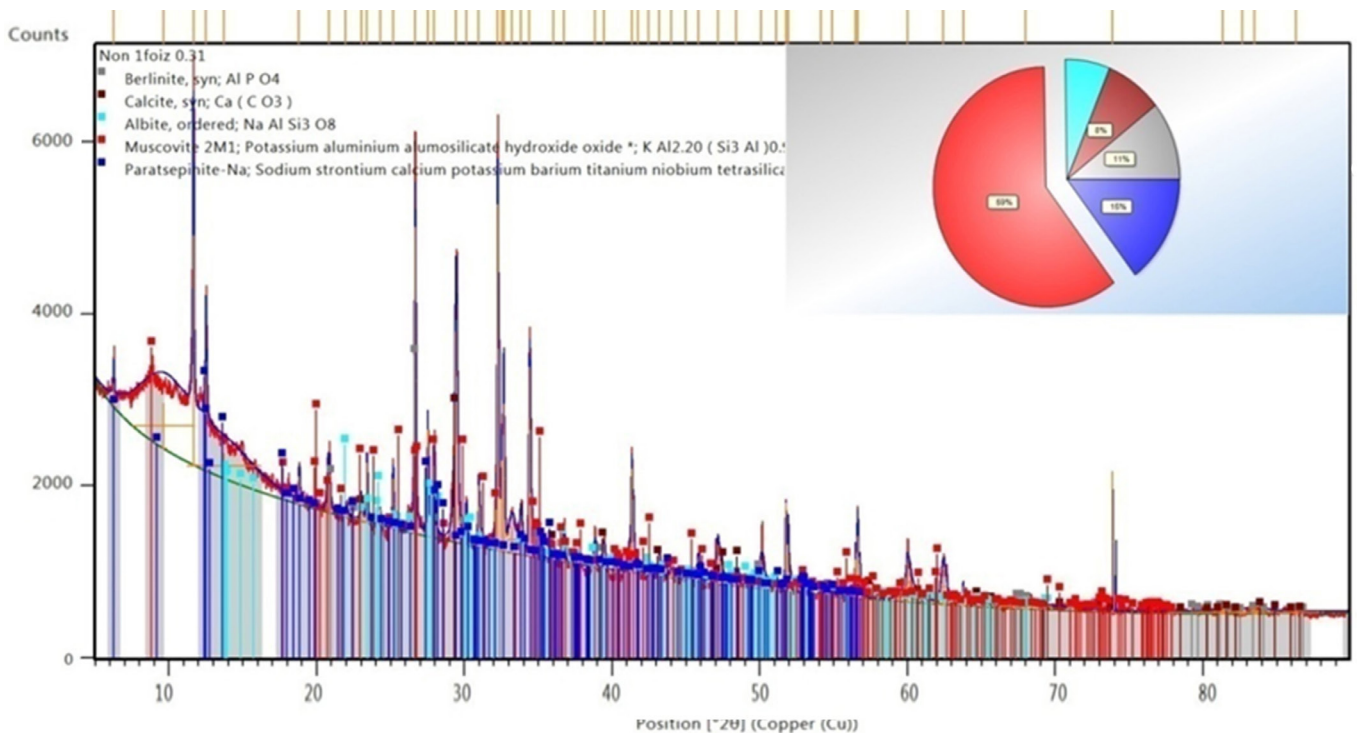
b)

a) control without additives; b) about superplastifkator SDzh-3 in number of 1%

Figure 1. – Curve RFA of samples of the cement stone hardening under natural conditions.

Thus, at introduction SDzh-3 to cement composites, will allow to make active puzzolanovy and hydraulic properties of slag, to receive considerable gain of durability when using additives in optimum quantities and also to intensify hydration processes.

In drawings the complex structure of the cementing substance is presented. In the main gel mass of new growths the needle crystals of the ettringit filling free cavities are observed. New growths of the ettringit are formed in free volumes. In electronic microphotos of samples of a cement stone with complex additive filling of a time, both plaster, and calcium hydrosulfoaluminate is observed. Increase in concentration of hydrosulfoaluminate of calcium and increase in a specific surface of hydrate phases, both in the general structure of a cement stone, and in defective areas of a spatial skeleton, leads to material hardening.

The research of chips of the stone knitting at the age of 28 days in the electronic scanning microscope showed that when curing structure slag of the containing compositions block, consisting of GSC of different basicity and degree of a zakristallizovannost with inclusions of not reacted particles of slag and evenly distributed portlandit units (fig. 2.).

The structure of a stone without additives is put from coarse-crystalline educations high-basic GSC, with well zakristallizovanny inclusions of the portlandit, a capillary time is observed.

The cement stone with SDzh-3 additive has non-uniform structure and is presented both by crystal hydrosilicates of calcium, and sites of C-S-H-of gel (fig. 2. a, b, g).
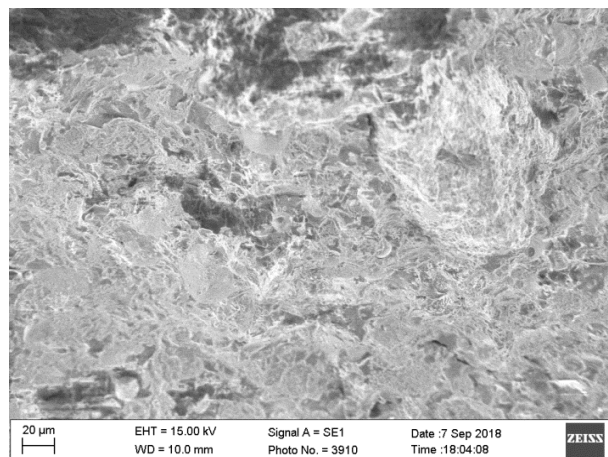
Gel areas, characteristic of stone, meet less often, are characterized by the relation of $CaO/SiO_2 = 2.5-2.8$ and have tendency to crystallization that testifies to an intensification of hydration processes with addition of SDzh-3.
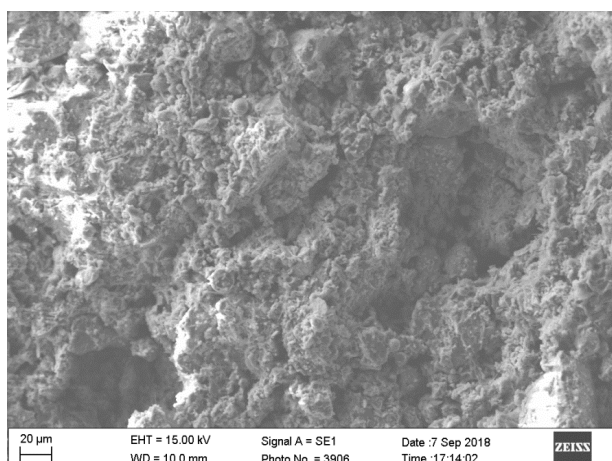
a)
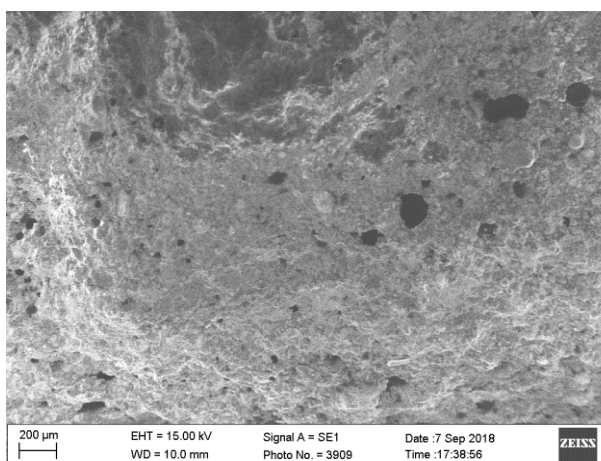
b)

c)

a) control without additives; b) about SDzh-3 supersoftener in number of 0.8%; c) about SDzh-3 supersoftener in number of 1%;
Figure 2. Electronic and microscopic pictures of samples of a cement stone

At application SDzh-3, to a dress from above the listed characteristic new growths on a stone chip surface, gel sites of "uterine solution" with the high content of ions of calcium appear. It is revealed that in this case the location of these areas has not such character, as in the previous cases: they have the smaller size and represent small exits of C-S with with CaO/

SiO_2 relation = 2.6–2.8 surrounded with crystal new growths from all directions.

Thus, at introduction SDzh-3 to cement composites, will allow to make active puzzolanovy and hydraulic properties of slag, to receive considerable gain of durability when using additives in optimum quantities and also to intensify hydration processes.

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ON THE DEVELOPMENT OF A PHYSICAL SIMULATION OF THE CAST METAL WELD CHEMICAL COMPOSITION FORMATION DURING MANUAL ARC WELDING ON THE BASIS OF THE ELECTRODE COATING MIXTURE COMPONENTS CLASSIFICATION

Abstract. The article proposes a physical simulation of the cast metal weld chemical composition formation during manual arc welding with coated electrodes that shows the structure of this process, the interaction and transfer of the electrode coating components, as well as the formation of metal and slag baths.

Keywords: electrode, physical simulation, manual arc welding, electrode coating components classification.

Global sales of welding technologies and equipment at the beginning of 2018 are approximately 52 billion USD and welding materials are 7.2 billion USD. Official data indicates Uzbekistan demand for welding electrodes is 14.5 thousand tons. Their imports exceeded 12 million USD. The main producers of electrodes in the Republic of Uzbekistan are SP OOO (joint venture limited liability company) "Tashkentsky Trubniy Zavod Imeni V. P. Galperina" (produces 2 thousand tons), AO (company limited) "Uzmetkombinat" (1.2 thousand tons), PO (production association) "Navoiysky Mekhanichesky Zavod" GP (State Enterprise) NGMK (0.5 thousand tons). However, the lack of scientific support in the manufacturing of electrodes and high-quality materials for coating not only reduces the quality of the products, but also leads to a decrease in its share in the domestic and foreign markets. The main reason for this is the scientifically unjustified approach to the development of a mixture for electrode wire coating, which makes purchasing of raw materials and technologies from abroad necessary.

The physical simulation of the cast metal weld chemical composition formation during manual arc welding with coated electrodes is necessary to describe all the processes occurring in the welding zone from the moment the arc starts to the moment welding is completed. To create a physical simulation of the cast metal weld chemical composition formation during manual arc welding with coated electrodes in the welding zone, the following physical and chemical processes are recognized:

– heating and melting of the base metal of the weld by the heat of the electric arc;

– heating and melting of the electrode rod by passing current and heat of an electric arc and the formation of a metal droplet;

– transfer to the weld pool of the electrode metal;

– mixing of the main and electrode metals in the weld pool;

– chemical reactions occurring as a result of the interaction of the components of the coating in the slag bath;

– crystallization as the heat source of the weld metal is removed [1; 2].

The physical simulation of the cast metal weld chemical composition formation during manual arc welding with coated electrodes is based on the electrode coating components classification [3]:

1) Pure Metals (iron powder, electrolytic copper powder, aluminum powder, molybdenum powder, nickel powder, titanium powder, metallic manganese, metallic tungsten);

2) Ferroalloys (ferroboron, ferrovanadium, ferromomlibden, ferrochrome, ferro-aluminum, ferrotitanium, ferrosilicon, ferromanganese);

3) Mineral Raw Materials (carbonates, titanium-containing materials, aluminosilicates, fluorine-containing materials, silicates, quartz materials, iron and manganese ores);

4) Artificially Produced Chemicals (fluorine-containing materials, chlorine-containing materials, carbonates, oxides);

5) Organic Materials (cellulose electrode, carboxymethyl cellulose, starch, dextrin, dextrinol, wood flour).

The physicochemical processes of the cast metal weld chemical composition formation during manual arc welding with coated electrodes can be represented as a diagram as shown in (Fig. 1).

The electrode is a supplier of metal droplets that form the weld metal. Droplets are formed by melting the electrode rod, the metal elements of the coating (Group No. 1. Pure Metals and No. 2 Ferroalloys of the electrode coating components classification) and the metal recovered from slag (Group No. 3. Mineral Raw Materials and No. 2 Artificially Produced Chemicals of the electrode coating components classification). All this metal goes to the weld pool, mixes with the base metal, and after solidification forms a weld.
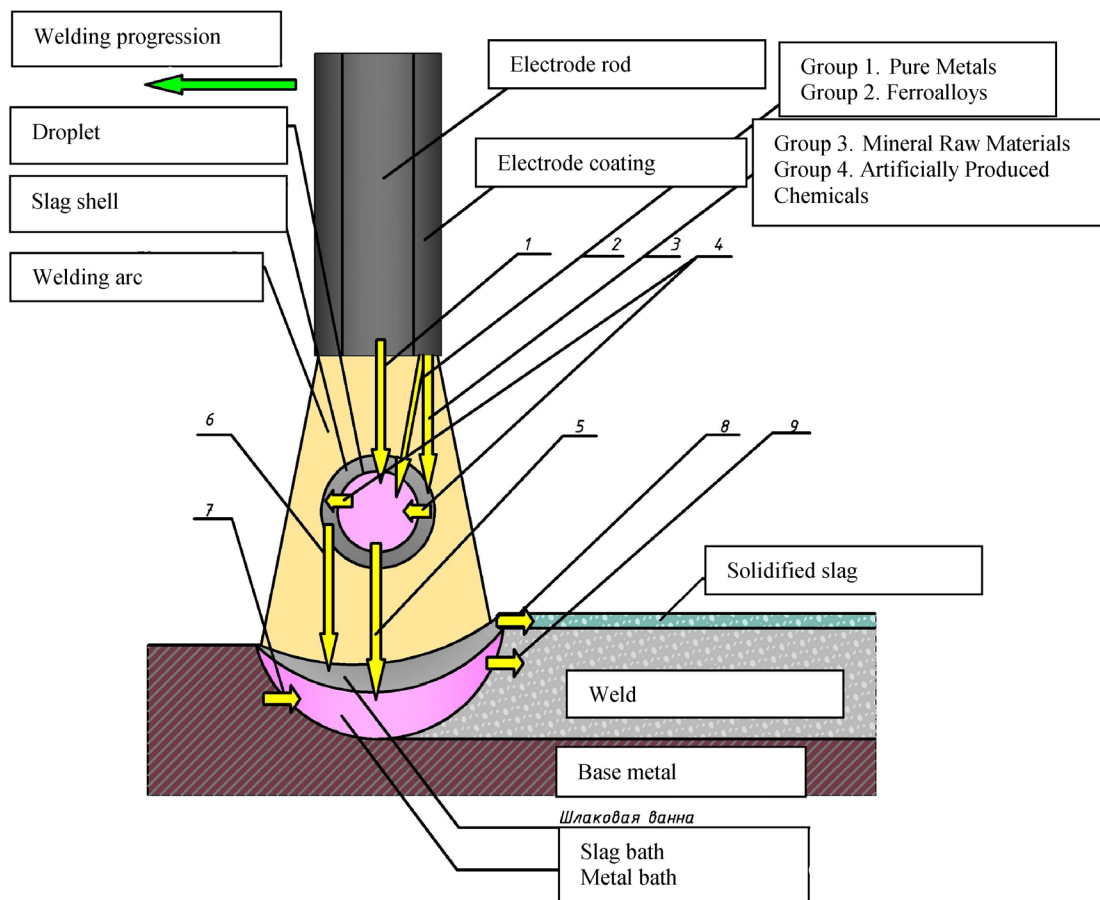

Figure 1. Physical simulation of the process of the weld metal cast structure formation during manual arc welding

1 – melting of the electrode rod and the formation of a metal droplet; 2 – melting of the metal components of the electrode coating and the formation of a metal droplet (Group No. 1. Pure Metals and No. 2 Ferroalloys of the electrode coating components classification); 3 – melting of the non-metallic components of the electrode coating and the formation of a slag film (Group No. 3. Mineral Raw Materials and No. 2 Artificially Produced Chemicals of the electrode coating components classification); 4 – transfer of elements from the slag shell into the metal droplet and from the metal droplet and the slag shell; 5 – transfer of droplets of the electrode metal in the weld pool; 6 – transfer of the slag shell of electrode metal droplets into the slag cover of the weld pool; 7 – melting of the base metal and the formation of the weld pool; 8 – solidification of the slag melt; 9 – crystallization of the metal melt.

A mathematical model of the cast metal weld chemical composition formation will be developed on the basis of the physical simulation of the process of the cast metal structure weld formation during manual arc welding.

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Section 7. Political science

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SUSTAINABLE DEVELOPMENT GOALS AND SYNERGIES OF WORLD POLITICS

Abstract. Resorting to paradigms of order and chaos allows countries to constantly adjust the national plans for the implementation of the Sustainable Development Goals (SDGs). This article attempts to analyse the number of processes using traditional synergetic potential.

Keywords: world order; sustainable development; sustainable development goals; chaos; synergy; entropy; bifurcation; attractors; non-linear development; fluctuation.

Modern era has more than once proven the narrow-mindedness of ideological limitations of the systematic approach to the analysis of international systems. The world politics globalization is accompanied by a revision of traditional paradigms and relations at all levels – alternative paradigms are analysed at a broad metatheoretical level [1].

Sustainable development is a widely known and used term; it is, as a matter of fact, economic, political, cultural and social change processes, which are coordinated with each other and establish the opportunities for satisfying human wants.

First of all, **sustainable development** is "…relative stability, consistency and predictability of positive changes in all levels of social life – in everyday life, in a business environment, in the surrounding social environment, in consciousness and in relationships of people" [2].

Sustainable development of international relations is relative, since it has irregular, discrete pattern, its development is made by passing through crisis situations – which can be described as states of unsustainability [3].

In September 2015, world leaders adopted the **2030 Agenda for Sustainable Development (the 2030 Agenda)** at an UN Summit. On January 1, 2016, the universally applicable **17 Sustainable Development Goals (SDGs)** of the 2030 Agenda officially came into force. Over the next 15 years, countries will attempt to reach those goals.

The SDGs are bold initiatives aimed at systematically closing the gaps left by previous efforts to ensure the sustainability of world development when confronted with potentially huge threats [4]. The SDGs are a combination of complex, open, highly organized, dynamic factors.

The SDGs main aims are: ending all forms of poverty in the world, fighting against inequality, solution of climate change issues. Countries committed to the SDGs implementation recognize that measures to end poverty and other world problems should be taken in combination with efforts to increase economic growth and address a range of issues in education, health, social protection and employment, as well as tackling climate change and increase environmental protection**.**

The main point of the SDGs is to ensure the **quality of life everywhere**. The SDGs emphasizes the importance of the integral consideration of a person – the importance of humanism [5]. It is believed that the SDGs promote the transition to a sustainable lifestyle and the creation of a global community based on common ethical principles, including respect for and care for the entire living community, principles of ecological integrity, universal human rights, respect for cultural diversity, economic justice, democracy and culture of peace.

Ending the major issue of poverty will require accelerating global actions aimed at eliminating the causes of poverty. The international community is now exploring new options for possible solutions, but the lessons of the past, the history of international relations and world politics may also be useful to it.

The SDGs are essentially a broad approach to the development issue, according to which problems, once considered specific to each country, are treated as challenges that the whole world must face as one.

Sustainability implies equilibrium, and **development is possible only if the system is constantly leaving the equilibrium state.**

Exposure to market economy and democratization leads – among other things – to **chaos** (the origin of all according to Hesiod).

Chaos "…can act as a force of creation, a benign evolution mechanism", which means that a new organization can grow from chaos on its own; "…in relation to social systems (including the international political one), we speak of chaos, not anarchy" [6]. The formation and establishment of a world order can be viewed as the process of the emergence of order from chaos [6]. The interchange of sustainability and unsustainability, which is distinctive trait of world politics at any given moment, in time forms dynamic cycles in the development of complex systems [7].

The unsustainability term in world politics is largely exempt from negative connotation, since it is the same element of the world and the world order as stability, sustainability and equilibrium. These opposite processes ensure a high dynamism of world processes, which stimulates the activity of the subjects of these processes [6].

Chaotic dynamics manifestations in world politics should not go beyond the sustainability frame of the evolution process, they "…should serve only as a means of finding the right solution and self-organization method within the evolutionary trend, otherwise it will lead to an end of development" [8]. This view radically changes the approach to the responsibility of the subjects of administration and governance for the development, conduct and consequences of the transformations undertaken [9].

The SDGs have always been and will obviously be subjected to strong resistance, caused by radical technological changes, geopolitical rivalry and the growth of social inequality. But populist calls for pursuing a purely nationalistic policy – and for trade protectionism in particular – significantly increase this resistance. All developed countries have faced with serious budgetary challenges, and developing countries have weakened due to low raw material prices, so the idea of paying for global public goods is becoming increasingly unattractive.

The SDGs are designed to mitigate pressure by protecting the environment and improving the lives of people inside their home countries. In order to achieve these goals, as it turns out, a much more responsible policy, and a much stronger public consensus will be necessary. And to achieve this, a fundamental shift in the thinking of the inhabitants of the planet Earth – the transition from the mentality of competition to a mentality that emphasizes cooperation – must occur.

Achieving the SDGs – from ending hunger and poverty to protecting the environment – will require the dynamic participation of multinational companies, a private sector capable and willing to provide technology solutions and key funding.

The political sciences today priority is the early diagnosis and preventive activities to stop emergence of social and political crises and conflicts [10].

It is regrettable that the **global assessments of the human dimension, human development indices, sustainable economic welfare** are rarely considered in post-Soviet countries [11] and many international legal documents are left untranslated into national languages.

This is the reason why synergetic approaches serve as a theoretical and ideological basis for creating order from chaos. They construct conditions for coherent communication that minimizes the isolation of the power vertical and its efforts to preserve its privileged position [12]. Synergetics is what offers today a modern model of sustainable development, which has the broadest heuristic and praxeological future directions [13]. The science of complexity – or synergetics – analyses the future way of development of the international community [14].

One of the key achievements of synergetics in study of world politics was the recognition of unsustainability and instability as the fundamental traits of various self-organization forms of human communities, both at the country and at the world levels [6].

The synergetic approach analyses the diversity and ambiguity of the factors of non-linear development and studies such feature of social reality as a set of uncontrollable and unpredictable uncertainties that can act as random factors of destabilization of the social order [15].

Uzbekistan has developed national indicators for the implementation of the UN Sustainable Development Goals. The Action Strategy adopted by the President of Uzbekistan in five priority areas of the development of Uzbekistan in 2017–2021 is a "road map" for the implementation of the UN Sustainable Development Goals.

At the end of 2018 in Uzbekistan, the government of the country approved the National Goals and Objectives for Sustainable Development for the period up to 2030. The corresponding Coordination Council was formed. "Road map" was approved. At the same time, the main goals of the Coordination Council are: the organization of effective work of the responsible ministries and departments, ensuring intersectoral coordination and an integrated approach to achieving the SDGs; ensuring the inclusion of National Goals and Objectives for the development of sectoral, regional and dedicated development programs, strategies and concepts; analysis of ministries, departments and working groups reports on the implementation and achievement of the results of the National Goals and Objectives.

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Section 8. Agricultural sciences

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THE EFFECT OF ELEVATED TEMPERATURES ON THE CHLOROPHYLL CONTENT (A) IN THE LEAVES OF SOME MEDIUM AND FINE FIBER VARIETIES OF COTTON

Abstract. This article presents the results of studies on the effect of medium and high temperatures on the content of chlorophyll "a" in leaves of various varieties and cotton lines and on a comparative study of them with control variants. It was revealed that the high (hot) air temperature on the content of chlorophyll "a" in the leaves of the varieties Surkhan-14 (G.barbadense L.), Istiklol-14 (G.hirsutum L.) and the cotton line L-02, obtained on the basis of a hybrid G.hirsutum L. x G.sturtianum Müll. did not act significantly.

Keywords: chlorophyll a, medium and high temperature, deviation from control, homogenization, spectrophotometer, air humidity, pigment concentration.

1. Introduction

It is known that for the development of cotton the main environmental factors are their geographical origin, air temperature, light exposure, water regime and mineral nutrition. Among them, the air temperature plays an especially important role on the growth and development of plants and the biochemical and physiological processes occurring in them.

According to the World Meteorological Organization, last year there was an increase in the average temperature on the surface of the earth by + 1.1 °C, also 2015, 2016 and 2017 were recognized as the hottest, and the twentieth century – the hottest period in a millennium. Especially in the last decade of the twentieth century, there was a significant increase in the average temperature on earth (by 0.3–0.6 °C) [1].

Such climatic changes in recent years have caused tremendous damage to crops, in particular cotton. Thus, an increase in the temperature of air and soil, as well as a decrease in relative humidity, depending on the biological, morpho-physiological characteristics of species, varieties and cotton lines, have a negative effect on their qualitative and quantitative characteristics. In scientific studies on the resistance of plants to unfavorable environmental factors, much attention is paid to the determination of chlorophyll a content, since The overall productivity of plants depends on the content of chlorophyll and its related forms.

It has been established that the content of chlorophyll "a" in cotton leaves varies depending on the characteristics of the species and varieties, as well as the environmental conditions. Cotton plant belongs to plants with a high content of chlorophyll in the leaves. Thus, in the varieties of cotton cultivated under conditions of high agrotechnics, the content of chlorophyll in the leaves is 300–400 mg per 100 g of weight [2].

According to A. K. Tewari and B. C. Tripathy [3], the content of chlorophyll in cotton leaves depends on the characteristics of the variety and its physiological state. Under the action of elevated temperature, a change in the content of chlorophyll is observed.

In some plants, under conditions of elevated temperature, there is a shortage of moisture, as a result of which the diffusion of CO_2 is somewhat activated. A prolonged lack of moisture in the next stages of development leads to a decrease in photosynthetic activity [4].

Slowing down the process of photosynthesis, most often, is associated with the closure of the stomata of leaves. In addition, it is advisable to study the effect of temperature on photosynthesis activity [5].

MD Kushnirenko believes that changes in temperature affect differently the activity of photosynthesis [6]. For example, low and short-term temperatures can partially activate this process. Under the action of elevated and prolonged temperatures, a sharp slowdown in photosynthesis was noted.

In the studies of A. Ergashov [7] on the effect of various high temperatures (+30, 40, 50, 60, 65 °C) on the cotton variety 108-F, a decrease in the chlorophyll content was observed as the air temperature increased. During the development of cotton plants, the highest content of chlorophyll in the leaves is noted in the budding phase. This indicates that an active assimilation process occurs in young plants. With the further development of cotton plants, the chlorophyll content gradually decreases. As is known, the ratio of chlorophyll to carotinoid in cotton does not exceed 3: 1. Cotton with a high content of chlorophyll yields a high yield [8].

As a response to the lack of water, wheat plants increase the content of strongly bound chlorophyll. In seedlings hardened to elevated temperatures, the content of chlorophyll "a", "b" and carotinoids is much higher than that of unhardened ones. In many wheat varieties, an increase in temperature is the cause of a decrease in the chlorophyll content [8].

From the above literature data it can be seen that, mainly, studies were carried out on old cotton varieties, and conclusions on their resistance to elevated temperatures were made on the content of total and bound chlorophyll. In our studies, cotton lines were used, obtained with the participation of some wild species, and varieties currently cultivated on large areas, the study of their resistance to elevated temperatures, based on the change in chlorophyll a content.

2. Materials and methods. The objects of research were the varieties of medium-fiber cotton G. hirsutum L. Sultan, Istiklol-14, Bukhara-102, fine-fiber cotton G. barbadense L. Surkhan-14, as well as lines L-01 and L-02 obtained using wild species G.klotzschianum Anderss., G.sturtianum Müll. respectively.

The experiments were carried out in the greenhouse complex Phytotron and at the vegetation site in an open area of the Research Institute of Breeding, Seed Production and Agricultural Technology of Cotton Cultivation, in Wagner's vessels in three versions: at the vegetation site at air temperature + 25–30 °C (I variant – control), in special boxes at a temperature of + 40–45 °C (II variant), and ultrahigh temperatures + 45–52 °C (III variant). In these boxes, the necessary conditions (elevated temperatures) were created in the flowering phase and the collection of fruit elements of the material under study.

To determine the content of chlorophyll "a" from 70-day plants (mass flowering phase), at the same time, from each variety and line, samples from 3–4 leaves from the growing point down were taken from all the experimental variants. Each sheet was thoroughly washed with running water, crushed, and 50 ml were placed in test tubes with 80% acetone solution (5 ml). These samples were homogenized for 10 minutes. in a centrifuge at 5000 rpm. The content of chlorophyll "a" in the resulting extract was determined on an Agilent Cary 60 UV–Vis spectrophotometer at a wavelength of 663.2.

Chlorophyll was determined by the formula (Lichtenthaler, Sumanta, 2014):

$$\text{Chl "a" } [mg/l] = 12.25 \cdot A_{663,2} - 2.79 \cdot A_{646,8}$$
$$\text{Chl "b" } [mg/l] = 21.5 \cdot A_{646,8} - 5.1 \cdot A_{663,2}$$

The stability index of chlorophyll was determined by the formula R. K. Sairam (1997):

$$\text{Car } [mg/l] = ((1000 \cdot A470) - (1.82 \cdot \text{Chl a}) - (85.02 \cdot \text{Chl b}))/198$$

The primary analysis of the obtained results was carried out using the Olingan EXCEL2010 program, dispersion analysis – (ANOVA, Fisher PLCD, alfa – 0.05) Stat View on a Pentium-4 computer.

3. Research results. In all studied varieties and cotton lines in different (3-variant) conditions of temperature and air, different content of chlorophyll "a" was noted. With an increase in temperature, all the studied varieties with minor deviations showed a decrease in the content of chlorophyll "a". Indicators of chlorophyll "a" in the leaves of the studied varieties and cotton lines in the first (control) variant at a temperature of + 30.9 °C and humidity 62.8% were located within 1.66 + 0.1–2.01 + 0.02 mg/l. At the same time, the highest content of chlorophyll "a" among the varieties was observed in Surkhan-14 (1.92 + 0.06 mg/l), among the lines – in L-02 with the participation of *G.hirsutum* L. x *G.sturtianum* Müll. (2.01 + 0.02 mg/l) (Table 1).

In the second experimental variant (at a temperature of 42.9 °C and humidity of 46.5%) the content of chlorophyll "a" was from 1.42 + 0.007 to 1.87 + 00.4 mg/l, the deviation from the control was downwards – 0.01; –0.02 mg/l, respectively. At the same time, positive indicators were observed in the Sur-

khan-14, Istiklol-14 and Sultan varieties, the difference with the control variants in which was –0.05, –0.01 and –0.03 mg/l, respectively (Table 1).

When determining the content of chlorophyll "a" in the third variant (temperature + 48.2o C, humidity 41.2%), it de-creased to 1.00 + 0.05–1.84 + 0.11 mg/l and the difference with the control amounted to –0.02 and 0.66. Here the highest content of chlorophyll "a" is observed in the line L-02. As can be seen from table 1, it is equal to 1.84+ 0.11 mg/l and exhibits a slight (–0.02 mg/l) deviation from the control.

Table 1. – Chlorophyll content "a"

Varieties and lines	Contents chlorophyll "a" in the flowering phase, mg/g			
	$\overline{x} \pm S\overline{x}$	limit	V%	difference
I Option-experience on the growing area (air temperature and humidity + 30.0 °C. 62.8%)				
Surkhan-14	1.92 ± 0.06	1.84–2.0	0.11	–
Istiklol-14	1.75 ± 0.11	1.65–1.86	0.14	–
Sultan	1.70 ± 0.09	1.69–1.71	0.01	–
Bukhara-102	1.73 ± 0.03	1.69–1.76	0.05	–
L-01 (*G.hirsutum* L. x *G.klotzshianum Anderss*)	1.66 ± 0.10	1.55–1.76	0.14	–
L-02 (*G.hirsutum* L. x *G. Stursianum Muii*)	2.01 ± 0.02	1.97–2.04	0.03	–
II Option – in conditions of elevated temperatures (air temperature and humidity + 42.9 °C. 46.5%)				
Surkhan-14	1.87 ± 0.04	1.78–1.94	0.084	–0.05
Istiklol-14	1.74 ± 0.06	1.61–1.81	0.11	–0.01
Sultan	1.67 ± 0.02	1.65–1.69	0.02	–0.03
Bukhara-102	1.61 ± 0.08	1.51–1.78	0.14	–0.12
L-01 (*G.hirsutum* L. x *G.klotzshianum Anderss*)	1.42 ± 0.007	1.41–1.44	0.01	–0.24
L-02(*G.hirsutum* L. x *G. Stursianum Muii*)	1.86 ± 0.01	1.85–1.87	0.018	–0.15
III Option – in conditions of high temperatures (air temperature and humidity + 48.2 °C. 41.2%)				
Surkhan-14	1.73 ± 0.03	1.69–1.77	0.056	–0.19
Istiklol-14	1.49 ± 0.01	1.47–1.50	0.22	–0.26
Sultan	1.59 ± 0.08	1.50–1.68	0.12	–0.11
Bukhara-102	1.45 ± 0.07	1.37–1.52	0.10	–0.28
L-01 (*G.hirsutum* L. x *G.klotzshianum Anderss*)	1.00 ± 0.05	0.96–1.07	0.07	–0.66
L-02 (*G.hirsutum* L. x *G. Stursianum Muii*)	1.84 ± 0.11	1.73–1.96	0.16	–0.02

4. Conclusion. From the obtained results it follows that the content of chlorophyll "a" in the cotton varieties of Sur-khan-14, Istiklol-14 and the line L-02 (obtained on the basis of G. hirsutum L. x G.sturtianum Müll.) Was insignificant. In this regard, these varieties can be recommended as a starting material for genetic selection studies on resistance to elevated temperatures (heat resistance) and to create varieties with high photosynthetic activity.

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WINTER CHICKPEA CULTIVATION USING NO-TILL METHODS UNDER RAINFED CONDITIONS IN TAJIKISTAN AND UZBEKISTAN

Abstract. In Tajikistan and Uzbekistan, chickpea is one of the most important cash crops and source of protein for farmers in rainfed areas. The experiment was established in 2014 and continued in 2015. Results on grain yield revealed that no-till treatment in both locations gave highest grain yield 1687 and 2255 kg/ha in Gissar and Qamashi districts respectively. Grain yield was lowest for minimum tillage 1222 and 1230 kg/ha in both sites. No-till winter chickpea can be an entry point for adoption of conservation agriculture in Tajikistan and Uzbekistan. It could be concluded from the present study that winter chickpea tillage methods should be studied according to the areas of their adaptability for increased productivity per unit area in different soil and climatic condi[tions of rainfed agriculture in the region.

Keywords: chickpea, rainfed, no-till, conservation agriculture, yield and soil.

Introduction

Conservation Agriculture as a term had not been extensively used in Central Asia until the last decade. However, conservation tillage in the rainfed areas and raised bed planting in irrigated areas, formerly researched and applied, could be attributed to be a development towards CA. The development of conservation tillage in rainfed areas of Central Asia was caused by the massive soil erosion occurring at the time when the reclamation of virgin and fallow lands in Kazakhstan became of enormous importance in ensuring food security. In 1954, special surveys by agronomists, soil scientists and land developers examined vast tracts of the land stocks of Kazakhstan. Those expeditions identified more than 21 Mha of arable virgin and fallow lands of which more than 13 Mha are lands of good to medium quality that could be used for agricultural crops, and primarily for planting of cereal crops without significant costs (Dvurechenskiy [2]).

There is a need for crop diversification with legumes to improve sustainability as well as to provide protein-rich grains. Introducing legumes into CA rotations is an essential component of successful CA systems. Food legumes enrich the soil with nitrogen and are very important for sustainable production intensification. In addition to providing nitrogen, legume crops also improve soil quality, thus positively affecting the performance of the ensuing crop. Nitrogen fertilizer requirement for the succeeding crop is reduced in a cropping system that includes legumes, which results in lower cost of production. In Tajikistan and Uzbekistan, chickpea is one of the most important cash crops and source of protein for farmers in rainfed areas. Chickpea is also highly preferred by farmers because of its good marketing crop that enables farmers to get immediate cash income compared other agricultural crops in the region.

So far, no research have been conducted on determination of optimum tillage methods for production of winter chickpea in Tajikistan and Uzbekistan. In rainfed agriculture no-till technology facilitates sowing of chickpea at proper time. Due to winter sowing chickpea productivity can be increased by 1.5 time which is very important to achieve food security in Tajikistan where there is a need to increase agricultural production to cope with growing demand for food. Cox (1986) studied the effect of different methods of soil preparation and two different types of wheat varieties on wheat grain yield. No significant difference was observed between treatments. Touchton and Jonson (1982) conducted an experiment on the effect of three different methods of tillage (chisel, moldboard plow and no tillage) on the yield of wheat and soybean. Yield of soybean under chisel and no tillage were similar, but wheat yield under chisel plow was less than moldboard plow. The development of tillage practices for dryland crop production has been and will be a dynamic process. Winter sowing is not common in Central Asia including Tajikistan and Uzbekistan. Therefore, there is a need to acquire of information on influences of tillage methods in growth, dry matter yield and yield component of winter chickpea in study area. Thus, this study was initiated with the following objectives:

- to evaluate the effect of different tillage methods on growth, dry matter yield and yield components of winter chickpea;
- to study the effect of different tillage methods, impact of location and climate variability on the productivity

of winter chickpea under the rainfed conditions of Tajikistan and Uzbekistan in two different locations.

Material and methods

The experiment conducted Tajikistan and Uzbekistan to better understand the impact of location and climate variability on winter chickpea growth and yield under different tillage methods. The study sites were located at the altitude of 850 m and 980 m above sea level in Gissar district and in Qamashi district in Tajikistan and Uzbekistan respectively. The experiment was established in 2014 and continued in 2015. The experiment was carried out in randomized complete block design with four replicates. All statistical analyses done using Genstat 18th edition (Genstat [3]). There were three different tillage options; conventional till (CT), minimum till with disking (MTD) and no-till (NT). Monitoring over the crop growth and development was conducted from the time of the starting (10%) and full completion (75%) of the different stages during crop season. Field observations on germination, number of grains per spike, number of grains per m^2, thousand kernel weight, plant height, days to heading, days to flowering, days to maturity, dry matter and grain yield (SVTCAC [6]). Amorphous 30 kg/ha was applied before planting.

Ammonium nitrate was used as a nitrogen fertilizer (34%) depending on weather conditions.

Results

Tanaka's findings (1989) on the comparison of the yield of pea while using different tillage treatments including no tillage, reduced tillage and conventional tillage (Moldboard Plow) support the obtained results in the present study as it was indicated in their study that the yield difference for the mentioned tillage treatments was not significant and even no tillage showed a better yield trend.

Days to maturity differed between tillage methods, locations and years and ranged from 180 to 199 days. Maximum days to maturity (199) were recorded in Gissar district in 2014 with conventional tillage technology while minimum days to maturity was observed for Qamashi district in 2015. In general, days to maturity in 2014 was higher compared to 2015 year, as it is depending climate conditions of the region (Figure 1).

ANOVA showed that there were significant differences in winter chickpea within different locations (Table 1). This indicates that tillage methods does not significantly affect chickpea grain yield under rainfed conditions of Tajikistan and Uzbekistan.
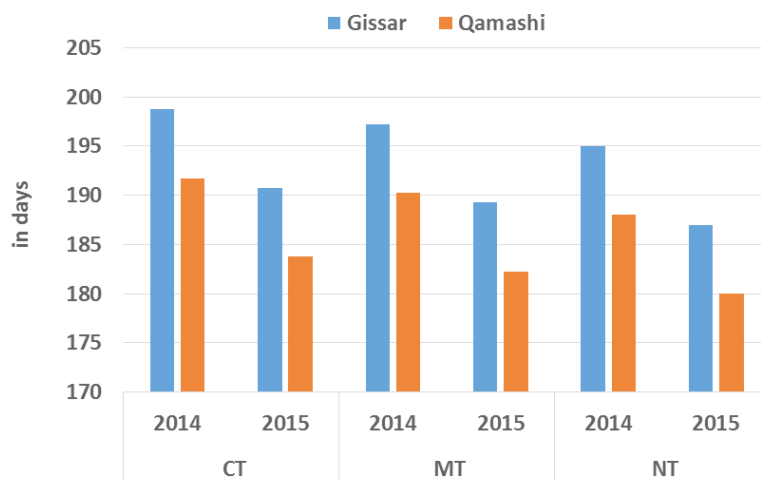

Figure 1. Effect of tillage on days to maturity of winter chickpea in Tajikistan and Uzbekistan

Table 1. – Analysis of variance grain yield

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
1	*2*	*3*	*4*	*5*	*6*
Location	1	2245973	2245973	14.28	<.001
Treatment	2	2175181	1087590	6.91	0.003
Year	1	543789	543789	3.46	0.071
Location.Treatment	2	265928	132964	0.85	0.438
Location.Year	1	543789	543789	3.46	0.071
Treatment.Year	2	28865	14432	0.09	0.913
Location.Treatment.Year	2	28865	14432	0.09	0.913

1	2	3	4	5	6
Residual	36	5663110	157309		
Total	47	11495499			

Results on grain yield (Figure 2) revealed that no-till treatment in both locations gave highest grain yield 1687 and 2255 kg/ha in Gissar and Qamashi districts respectively. Grain yield was lowest for minimum tillage 1222 and 1230 kg/ha in both sites. Yield reduction was associated with tillage methods. Lower grain yield was observed in Gissar district. It can be concluded, that climatic conditions of Gissar and Qamashi districts are favorable to grow winter chickpea under no-till method.
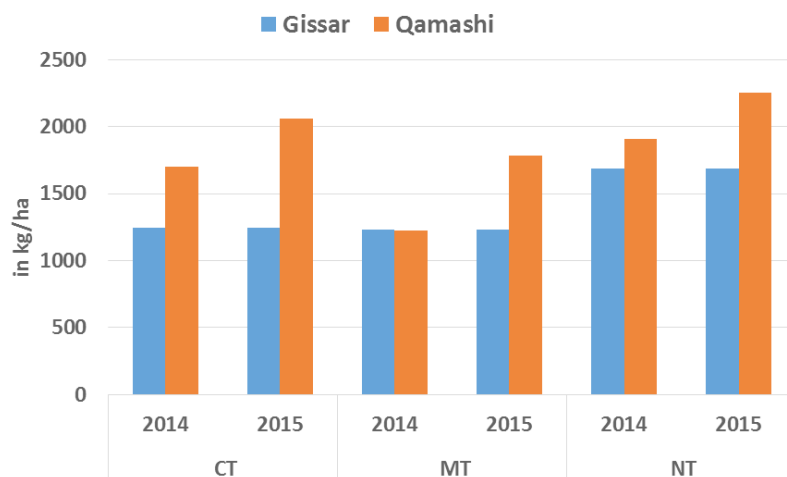
Figure 2. Effect of tillage on productivity of winter chickpea

Discussion

The results of this experiment proves that tillage methods have not significant effects on dry mass and grain yield in winter chickpea while days to maturity had significant effect. No-till winter chickpea can be an entry point for adoption of conservation agriculture in Tajikistan and Uzbekistan.

It could be concluded from the present study that winter chickpea tillage methods should be studied according to the areas of their adaptability for increased productivity per unit area in different soil and climatic conditions of rainfed agriculture in the region.

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TECHNIQUE – ECONOMIC ANALYSIS OF THE USE OF SOLAR AIR COLLECTOR IN THE CONDITIONS OF THE FERGANA REGION OF THE REPUBLIC OF UZBEKISTAN

Abstract. In recent years, the demand for energy by geometric progression increases with an increase in production capacity, population, and with an increase in the standard of living of the population. This development has led to the depletion of natural resources and environmental degradation throughout the world. To this end, the use of environmentally friendly renewable energy sources is an urgent task and the main strategy of all countries. In this article, the optimal place to use a solar air heater is chosen in the natural climatic conditions of the Fergana region of the Republic of Uzbekistan. A technical and economic comparison of the solar air heater with a traditional heat source was also made.

Keywords: Renewable energy sources, Solar energy, solar heating, solar collectors, solar air heater, efficiency.

One of the promising areas of renewable energy is the direct production of environmentally friendly heat for the air conditioning system, the drying of agricultural products with the conversion of solar radiation [1]. The easiest way to convert solar radiation into heat energy is to use solar air heaters. Among the various types of solar thermal installations, solar air heaters are widely used due to their lower cost and simplicity of design [2]. In the air heating system, the solar collector is the main component, which, receives solar radiation, then it, converts and collects direct and scattered sunlight in the form of heat and transfers thermal energy to the coolant [3]. The elements of the simplest solar air heater are (Fig. 1.): a case for collecting heat 4, a transparent coating 2 that transmits solar radiation inside the collector and protects the radar absorbing surface (absorber) from the external environment and reduces heat losses from the front side of the collector. Absorber 3 absorbs solar radiation, converts it into heat and transfers it to the coolant. Thermal insulation 1 reduces heat loss from the rear and side surfaces of the collector [4; 5; 6].
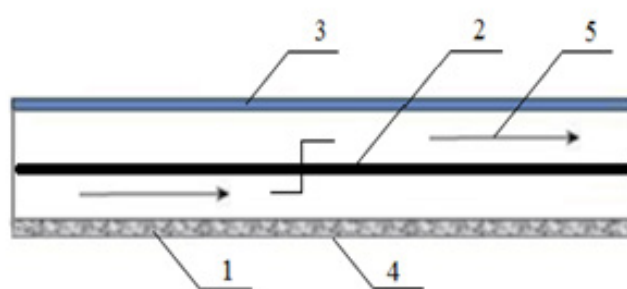

Figure 1. 1 – Thermal insulation, 2 – Absorber, 3 – transparent coating, 4 – Case, 5 – air flow

The principle of operation of the solar air collector is as follows: most of the solar radiation incident on the collector is absorbed by the absorber, which has a black surface in relation to solar radiation. A part of the absorbed energy is transferred by the air flow circulating in the collector, the rest is lost in the process of heat exchange with the environment. The heat carried away by the coolant which is the useful heat that is accumulated or used to cover the heat demand [7; 8; 9; 10; 11; 12].

For the reliability of the economic feasibility of the use of a solar air heater in a particular area and taking into account all the positive aspects of a solar air heater are demanded to perform a feasibility study. For the accuracy of the technical and economic analysis, the geographical location and climatic conditions of the area, where the ICS is applied, are taken into account. In this area, the Fergana region of the Republic of Uzbekistan is considered as an area for calculation.

The Fergana region is located in the eastern part of the Republic of Uzbekistan in the southern part of the Fergana Valley at an altitude of 580 meters above sea level at a latitude of 40.38 °C and 71.78 °B. The main part of the annual dura-tion of sunshine is the volume within 2900–3100 hours. The climate of the Fergana region is continental.

From a technical and economic point of view, the factors affecting the operation of the ICS, the Fergana region, can be divided into three territories: Kokand, Fergana, Shakhimardan, according to the totality of climatic and solar resources, such as air temperature, solar radiation density, wind speed, etc.

Below are shown the climatic conditions of the above factors in the indicated territories of the Fergana region during the year: in table 3.5 – ambient temperature t, °C; in table 3.6 – the average total solar radiation Q, W/m²; in (table 3) – the average duration of sunshine τ, h for region.

Table 1. [13]

territory	Month											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Kokand	−1.8	1.6	8.4	16.4	21.6	25.6	27.4	25.5	20.1	13.1	5.5	0.4
Fergana	−1.7	1.5	7.9	15.6	20.8	25.0	26.9	25.0	19.7	13.1	5.7	0.7
Shakhimardan	−1.6	−1.7	3.2	10.4	14.4	18.7	22.2	21.3	16.4	10.3	3.9	−1.1

Table 2 [13]

Territory	Month											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Kokand	195	267	389	518	707	792	810	740	579	383	225	150
Fergana	193	266	387	517	706	792	808	739	578	383	228	151
Shakhimardan	191	264	384	515	704	789	800	735	571	378	219	145

Table 3. [14]

Month											
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
110.4	121	149.4	213.7	279.4	328.2	354.9	347.8	293.6	228.6	139.4	102.2

It can be seen from the above tables that the territories of the Fergana region do not differ much from each other. Less favorable climatic conditions for the operation of ICS, despite the relatively high rates may occur in the western part of the region where the territory of Kokand is located. The territory of Kokand is located in the neck of the Fergana Valley because of this, a strong wind often occurs in this area, which reduces the efficiency of the ICS. Taking into account the above factors, the territory with the most favorable conditions, namely the territory of Fergana, was considered for further calculations. Here, the average monthly intensity of solar radiation on a horizontal surface varies from 0.151 kW/m² in December to 0.808 kW/m² in June.

It is also necessary to take into account the daily varia-tion of the duration of sunshine $\overline{\tau}$ according to which dur-ing the winter months the longest sunshine is observed (13.6–15.5 h), which falls on the interval from 10 to 14 h. In spring, it increases and the highest values (17.2–24.2 h) fall on 11–12 h. In summer, the longest sunshine duration is observed from 9–10 to 13–14 h and amounts to 29.4–29.8 h on average per hour interval. In the autumn season, the duration of sunshine is reduced compared with summer, but its influence is slightly higher than in spring. These differences are due to increased cloudiness in the spring months compared with autumn. The longest sunshine (25 hours) in October is observed from 10–11 to 12–13 hours [14; 15].

Taking into account the above-mentioned climatic conditions and the results of the experimental research conducted on efficiency and the optimum consumption found from them at various levels of solar radiation of ICS, given in this chapter, it is possible to calculate the effective-ness of using ICS for a year. To calculate the generalized climatic conditions of the territory of Fergana is given in (table 4).

Table 4.

Month	Q, W/m²	τ, h	Work time of ICS accounting, $\bar{\tau}$, h	Average CF ICS	t, ºC
I	193	110.4	73.5	0.3	-1.7
II	266	121	73.5	0.33	1.5
III	387	149.4	111.8	0.4	7.9
IV	517	213.7	173.3	0.45	15.6
V	706	279.7	262.7	0.5	20.8
VI	792	228.2	297.5	0.6	25.0
VII	808	354.9	327.6	0.6	26.9
VIII	739	347.8	337.2	0.5	25
IX	578	293.6	274.8	0.4	19.7
X	383	228.6	195.6	0.4	13.1
XI	228	139.4	117.3	0.33	5.7
XII	151	102.2	82.2	0.3	0.7

The calculation results were processed using the Exel program and are shown below in (Fig. 2) graphically.
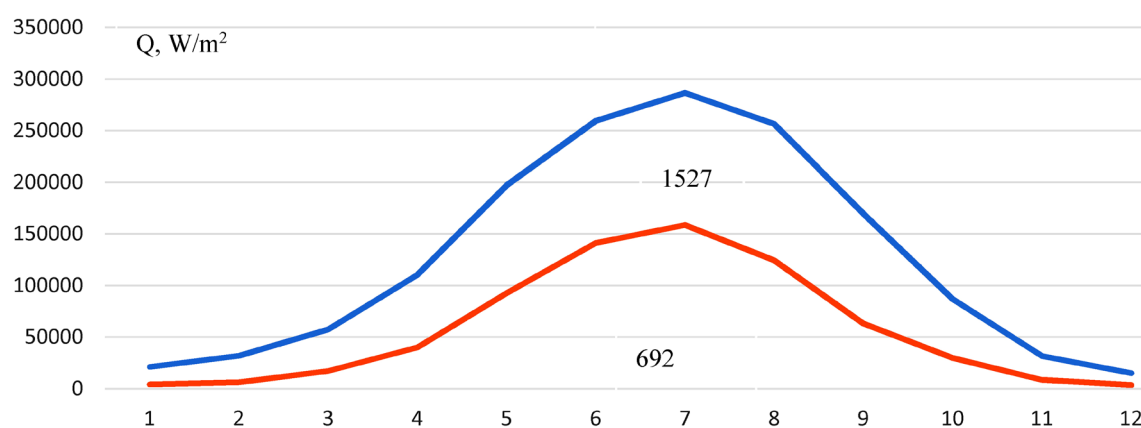
– generation of powering the air conditioning system for the year, kW · h;
– total solar power, falling horizontal surface per year, kW · h.
Figure 2. Optimum generation of useful thermal energy of VCS per m², depending on solar radiation per year

From the calculations it can be seen that for the year the generated heat from the solar air heater with an area of 1 m² is 692 kW · h, the highest heat generation is observed in the summer season, the total time of 424 kW · h is the maximum in July 159 kW · h of heat per month low heat generation in winter – 14.4 kW · h, the minimum figure in December is 4.2 kW · h, while the level of total solar radiation per year is 1527 kW · h. Analysis of the efficiency of operation of 1 m² of the internal airways makes up 45% per year. According to the tariff of the Republic of Uzbekistan from April 1, 2018, the cost of electricity used for heating, hot water and air conditioning is 241.5 soums. The calculation of the solar air heater is given in (table 5).

Table 5.

п/п	Materials name	Material size	Price of one item thousand soums	Expense thousand soums
1	2	3	4	5
1.	Glass	1 м²	26	42
2.	Aluminium shape	15 м	6	90
3.	sheet metal plate	1 м²	36	36

1	2	3	4	5
4.	Cutting machine		2	2
5.	Pipe 32	1	3	3
6.	Fan	20 W	50	50
7.	Shaving	3 kg	0.5	1.5
8.	Cost price			224.5
9.	Service manufacturing			50
	Market price			274.5

Comparison of the results with the electric air heater is given in (Table 6).

Table 6.

п/п	Materials name	Consuming electricity for heating 692 kW /h	Set price Thousand soums	Price of 1 kW energy	Expense of electricity thousand soums	Total expense thousand soums
1.	Calorifer	865	250	241.5	208.897	458.897
2.	ICS	50	274.5	228.6	11.430	285.93
Economy of using ICS in 1 year thousand soums.						
3.	155.043					
cover of expenditure ICS. years						
4.	1.8					

Conclusions: Considering the sharp increase in energy demand caused by the increase in population, the development of science and technology, which led to a decrease in mineral resources and environmental degradation throughout the world, the reduced cost method is distorted by the use of plants using renewable energy, it should be considered as a way out of the current situation [16].

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ABOUT THERMAL EFFICIENCY OF FLAT SOLAR AIR HEATERS

Abstrct. The article discusses issues of thermal efficiency of flat solar air heaters and its enhancement through the intensification of thermal processes occurring on the surface of the absorber. On the basis of the heat balance equation compiled for the air heater, an analytical formula for the thermal efficiency and heat loss of the heater is obtained. The article also obtained the dependence of the thermal efficiency of the heater on the heat transfer parameter. A universal dependence on the calculation of the efficiency of flat solar air heaters is presented.

Keywords: flat solar air heater, temperature, heat transfer, thermal efficiency, heat loss, absorber, thermal energy, coolant flow.

The current state of the power system is characterized by rising fuel prices and, as a consequence, high cost of thermal energy. In connection with the exhaustibility of traditional hydrocarbon energy sources, the release into the atmosphere of greenhouse gases at an alarming scale and noticeable climate change, the prospects for the use of solar energy are becoming increasingly urgent. Consequently, an intensive search for alternative energy sources, in particular, the conversion of solar energy into heat energy is a very important scientific and technical task at this stage of the development of energy. Considering that in the air heating and air conditioning systems, as well as in the drying equipment, low potential heat is used (up to –70%), the use of solar air heaters is promising and allows to increase the efficiency of the existing heat supply systems and heat and power plants.

Solar air heaters being one of the varieties of solar devices in recent years are becoming increasingly popular because of their obvious advantages: no corrosion of heater elements, ease of maintenance, low heat pumping costs, direct heating of room air bypassing the heating system, availability in manufacturing etc. Figure 1 shows the main types of flat solar air collectors [1–4].

a)   b)
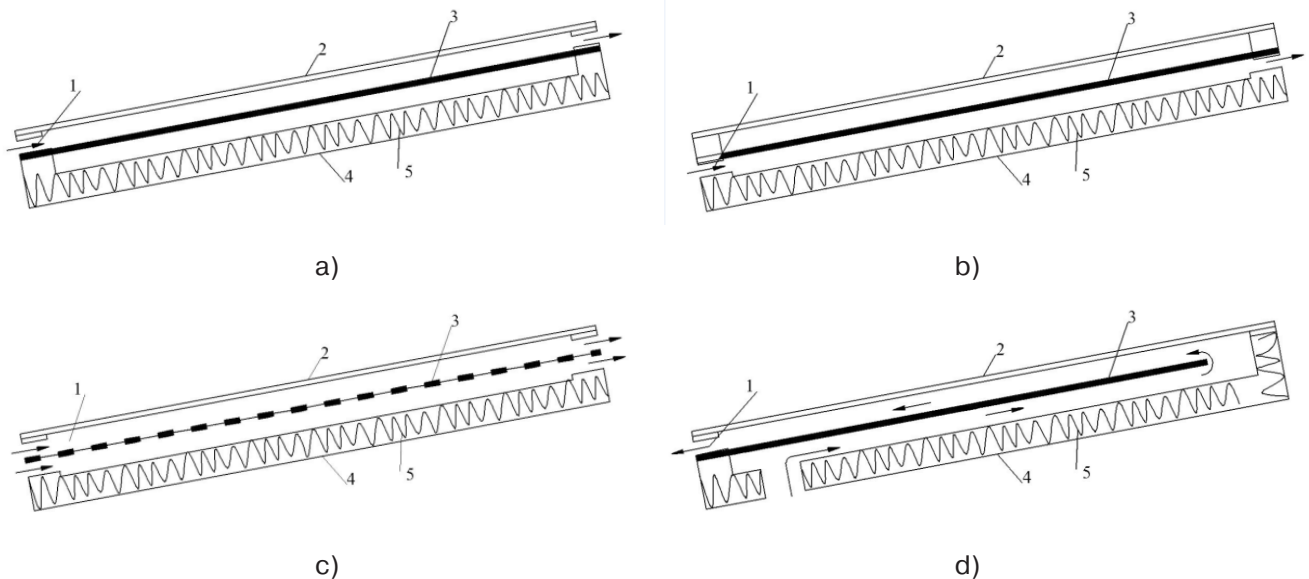
c)   d)

Figure 1. Basic types of flat solar air collectors: a) with air movement above the solar collector, b) –with air movement under the solar collector, c) – with a solar collector made of a perforated sheet and air movement above and below the sheet, d) – with multiple air movement in the collector

Analysis of the works on the development of flat solar air heaters (FSAH) designs show that the main subject of research in this area is to increase the heat transfer from the absorber to the air and, accordingly, the thermal efficiency of the heater. A review of the literature indicates that to date there have been very few published papers devoted to the study of the thermal efficiency of FSAH with free convection and convective heat exchange at low and medium Reynolds numbers, i.e. in the modes in which these devices are most often used.

This problem of increasing the thermal efficiency of a solar air heater can be solved by intensifying the processes of convective heat exchange from the heated surface of the absorber to the air flowing in the channel of the solar receiver. An analysis of the literature indicates [5–16] that an increase in heat transfer through the use of surface heat transfer intensifiers allows an increase in heat removal from the absorber from 1.3 to 2.5 times compared with a smooth surface. Surface intensifiers are a large class, including spherical, cylindrical cone-shaped or other forms of protrusions and grooves, diffuser-confused profiles, as well as spiral and transverse wire inserts and micro-ribs. Moreover, an easily feasible method of wall flow turbulization is a discrete well-streamlined roughness in the form of metal chips, which is a waste of mechanical production and, therefore, widely available for use.

The task of wall flow turbulization is the periodic destruction of the boundary layer in order to reduce the thermal resistance of heat transfer from the wall of the absorber to the air flow. Such an impact on the near-wall boundary layer does not cause a significant increase in the hydraulic resistance, which has a particularly positive effect on the increase in the efficiency of heat exchange in the solar heat exchanger. The well-known method of evaluating the effectiveness of a solar air heater, based on the use of EF. heater is insufficient especially for a heater with heat transfer intensification, since the traditional formula (1)

$$\eta = \frac{Q}{JF} = GC_p \Delta t / JF \qquad (1)$$

does not reflect, firstly, the heat transfer efficiency of the heater i.e. efficiency of the processes of convective heat transfer between an absorber with heat transfer intensifiers and air flow. Secondly, the formula (1) does not take into account the hydraulic losses of the device at elevated Re numbers.

As a FSAH scheme selected for the analysis of its thermal efficiency, we choose a flat solar air heater, in which a metal sheet with surface heat transfer intensifiers is used as an absorber of solar radiation (Fig. 2). Provided that the air moves at low speed (which corresponds to the practical operation of the collector), i.e. with small Reynolds numbers, the collector efficiency will be determined only by its thermal efficiency (without taking into account hydraulic losses).
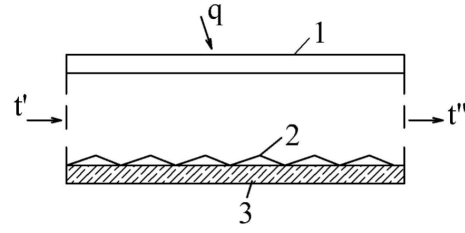

Figure 2. Flat solar air heater: 1 – transparent coating, 2 – absorber, 3 – insulation

The diagram shows $t^{'}, t^{''}, t_{cm}$ – respectively, the temperature of the incoming, outgoing air from the heater and absorber, q-density of falling sun radiation

From the heat balance equation compiled for FSAH in stationary conditions we get

$$Q_1 = Q_2 + Q_3 \qquad (2)$$

$Q_1 = GC_P(t_{cm} - t')$ – maximal using of heat FSAH W

$Q_1 = GC_P(t_{cm} - t')$ – beneficial use of heat of FSAH W

$Q_3 = GC_P(t_{cm} - t'')$ – underutilized heat in FSAH due to incomplete heat exchange between the absorber and the air flow of watts.

G, C_P – respectively consumption kg/s b heat capacity K kg/s °C in the air

Substitution of the above expressions in formula (2) gives

$$t_{CT} - t' \approx (t'' - t') + (t_{cm} - t'') \qquad (3)$$

Consumption and heat capacity of air is considered constant.

$$1 = \frac{t'' - t'}{t_{cm} - t'} + \frac{t_{cm} - t'}{t_{cm} - t'} \qquad (4)$$

Denoting by

$$\varepsilon = \frac{t'' - t'}{t_{cm} - t'} \text{ and } \varepsilon_{nom} = \frac{t_{cm} - t''}{t_{cm} - t'}$$

Get $1 = \varepsilon + \varepsilon_{nom}$ $\qquad (5)$

Or $\varepsilon = 1 - \varepsilon_{nom}$ $\qquad (6)$

We assume ε – heat efficiency FSAH

ε_{nom} – heat loss in FSAH

Thus, Eq. (6) is the formula for the thermal efficiency of FSAH.

IF $\varepsilon_{nom} \to 0$ то $\varepsilon \to 1$ Consequently, at low heat losses, that is, when heat transfer is perfect, the thermal efficiency of PWS tends to its maximum. We show that an increase in heat transfer from the surface of the absorber to the air flow increases the thermal efficiency of the SSWH. The initial equation can be the heat transfer equation.

$$GC_P(t'' - t') + GC_P(t_{cm} - t'') = \alpha F \Delta t, \qquad (7)$$

Where Δt – average logarithmic temperature pressure in FSAH. If we assume that the temperature of the air flow varies slightly along the length of the heater, then the pressure can be calculated by the following formula:

$$\Delta t = \left[(t_{cm} - t') + (t_{cm} - t'') \right] / 2 \qquad (8)$$

We transform equation (11) to the following form:

$$\frac{(t'' - t')}{(t_{cm} - t')} + \frac{t_{cm} - t''}{(t_{cm} - t')} = \left(\frac{\alpha F}{GC_p}\right)\left[1 + \frac{\varepsilon_{nom}}{2}\right] \quad (9)$$

Because $\varepsilon_{nom} = 1 - \varepsilon$ получим $\varepsilon = 2\left(1 - \frac{GC_p}{\alpha F}\right)$, (10)

Where $\frac{GC_p}{\alpha F}$ –is a heat transfer parameter of P.

Thus, on the basis of the obtained formula (10), we can draw up the following graph to determine the thermal efficiency of the HRSS depending on the heat transfer parameter chosen $\frac{GC_p}{\alpha F}$.

Preliminary analysis of formulas shows that with increase of efficiency in heat exchange processes (rate coefficient heat exchange α) heat efficiency FSAH ε should rise up.

Table 1 shows the results of the calculation of the thermal efficiency of the heating device ε depending on the values of the heat transfer parameter $\frac{GC_p}{\alpha F}$.

Table 1.

№	$\frac{GC_p}{\alpha F}$	ε	ε_{nom}
1.	0.5	1	0
2.	0.55	0.9	0.1
3.	0.6	0.8	0.2
4.	0.65	0.7	0.3
5.	0.7	0.6	0.4
6.	0.75	0.5	0.5
7.	0.8	0.4	0.6
8.	0.85	0.3	0.7
9.	0.9	0.2	0.8

In accordance with the table number 1 in (Fig. 2) built dependencies ε = f(GC$_p$/αF).

It should be noted that this relationship is universal for all types of air heaters.
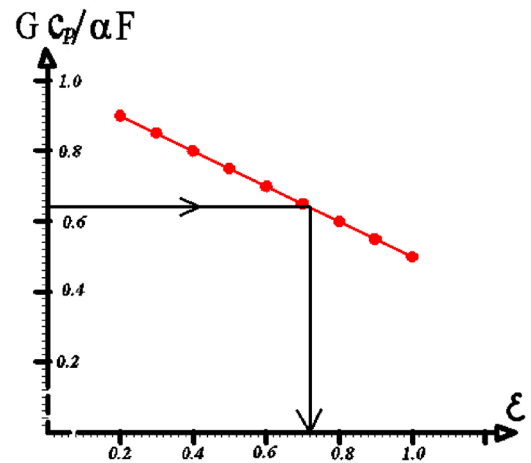
Figure 2. The dependence of the thermal efficiency of ε on the heat transfer parameter GC$_p$/αF

The dependence shown in (Fig. 2) was used to compare the thermal efficiency of two FSAHs. The first FSAH had a smooth absorber, the second FSAH consisted of a flat absorber with heat transfer intensification. Experiments on heat transfer were carried out in August 2018 in Fergana separately in FSAH having an absorber in the form of a flat sheet, the width of the flat channel of the absorber was a = 0.5 m, the length of the absorber was L = 1 m. And in FSAH having heat transfer intensifiers.

Metal chips, 1 cm in diameter, spaced 12 cm apart and glued to the walls of a smooth blackened metal sheet across the main direction of the moving air, were used as heat transfer intensifiers. Tables 2 and 3 show the results of experiments on heat transfer from a smooth absorber and from an absorber with heat transfer intensifiers.

Table 2.

№	G kg/s	t' C⁰	t'' °C	t_{cm} °C	α w/m² °C	ε_1	$GC_p/\alpha F$	ε_1
1.	0.0015	27	41	45	3.8	290	0.8	0.4
2.	0.00275	27	41	49	6.5	506	0.85	0.3
3.	0.0055	27	43	49	12.5	938	0.88	0.24
4.	0.00825	27	43	49	18.3	1440	0.9	0.2
5.	0.0116	27	42	49	24.7	2020	0.94	0.12

Table 3.

№	G kg/s	t' °C	t'' °C	t_{cm} °C	α w/m² °C	ε_2	$GC_p/\alpha F$	ε_2
1.	0.0015	30	65	72	4.7	290	0.64	0.72
2.	0.00275	30	63	70	7.7	506	0.71	0.57
3.	0.0055	30	61	69	14.5	938	0.76	0.48
4.	0.00825	30	60	68	21.6	1440	0.79	0.42
5.	0.0116	30	59	67	30	2020	0.77	0.41

The analysis of (tables 2 and 3) shows that the thermal efficiency of FSAH with a smooth absorber is significantly inferior to the thermal efficiency of FSAH with heat transfer enhancers. In (fig. 3) also shows dependences graphically $\varepsilon = f(Re)$ for two types of FSAH.
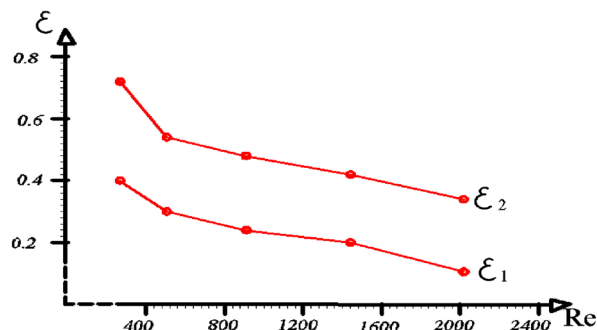
Conculotion

1. A formula is proposed for calculating the thermal efficiency of flat solar air heaters and the dependence of the thermal efficiency of heaters ε on the heat transfer parameter $GCp/\alpha F$ is constructed.

2. It has been established that the thermal efficiency of SSWN with a smooth absorber is significantly inferior to the thermal efficiency of FSAH with heat transfer intensifiers.

3. The developed method for calculating the thermal efficiency of air heaters can be applied to various designs of absorbers with heat transfer intensification.

Figure 3. The dependence of the thermal efficiency of on the numbers *Re*

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THE PROBLEMS OF ALGORITHMIZATION OF THE AUTOMATED SYSTEM OF ACCOUNTING AND CONTROL DEVICES OF RAILWAY AUTOMATICS AND TELEMECHANICS DURING HIGH-SPEED MOVEMENT

Abstract. The article describes the stages of development of high-speed rail on the Railways of Uzbekistan, peculiarities of electronic document management of technical documentation of railway automatics and telemechanics. The considered problem of synthesis of mathematical descriptions of electronic document management of technical documentation of railway automatics and telemechanics.

Keywords: high-speed traffic, railway automatics and telemechanics, electronic document management.

Introduction

In the Republic of Uzbekistan embarked on the modernization of its Railways, where the priority is to increase speeds of passenger trains. In this direction have already been put into operation high-speed line at the site Tashkent-Samarkand with a train speed of 150–250 km/h. Was carried out a number of measures to ensure traffic safety of high-speed trains such as the strengthening of railway lines, renewal of the dimensions of the structures, reconfiguration of switches [1].

Statement of the problem. In modern conditions, expanding the functionality of the latest systems of automation and telemechanics, grow the amount and quality of information provided by the railway automatics and telemechanics systems for traffic management, monitoring of train location and state of infrastructure. With further development of these systems, their design, process Troubleshooting of failures becomes more difficult; increase the number of subcontractors participating in the design, construction and supply of equipment, constructs and components; lengthened periods of verification systems in commissioning.

Unfortunately, with the establishment of railway automatics and telemechanics systems do not always use modern design techniques, the organization of interaction of involved organizations, quality control of work execution, automation, input and retrieve information. The result increases the duration of design, construction and commissioning of the systems, waste of time, more difficult scheduling of deadlines, it is impossible to take timely corrective management decisions and, consequently, significantly raise the price of supplies work. Today in world practice in the field of automation occupies a leading position in developing highly efficient systems of control of technological processes with the involvement of intelligent technologies. Further development of intelligent control technology in rail transport allows you to implement advanced technical systems with high performance and enhanced functionality.

Intelligent technologies are allocated by the developed systems of monitoring and diagnostics. In modern conditions in the railway automatics and telemechanics systems of the ability of a monitoring system organised on the basis of document workflow technical and other regulatory documents.

In this regard, the establishment of an integrated monitoring and control the design, construction, commissioning works, supply of devices, materials, and equipment, as well as analysis

of the quality of work performed on the basis of document workflow technical documentation (DWTD) is relevant.

Formal method. The use of electronic document management [2] due to the increasing complexity of systems and, as a consequence, huge amounts of transmitted and processed information. For example, a test project of electric centralization of station visual method without the use of technical means at the time can be comparable with the time of system design. Thus, without the use of means of complex automation of processes of obtaining information and information exchange impossible to reduce time and increase efficiency of production work.

Formally, the process DWTD is submitted in the form of three finite sets and relations of the elements of these sets among themselves [3]. Mathematical notation of this process is presented in the form

$$D_T = \{ U, P, F \}$$

where D_T – is a formal model of electronic document management of technical documentation; U – a plurality of participants; P – the set of processes; F – the set of states of the technical documentation (TD), which valid fields values.

A set U is defined as a finite set of actual participants in the workflow, P – as a finite set of processes, the implementation of which is within the system of workflow participants from many U. F – is a nite set of states, which can take a TD after executing processes of the plurality of P members from the set U.

Graph model. Logical level formal model document TD is implemented using the theory of graphs. When building a graph model of the circulation of TD are encouraged to use the following method to display workflow graphs of TD [4]. To set the vertex set of a graph we use the number of possible states of edges of F. Edges of the graph define a through many processes P. Install this according so as to fulfill the following rules:

– one node of the graph corresponds to one and only one element of a set F;

– one edge of the graph corresponds to one and only one element of a set P;

– one element of the set F corresponds to one and only one node of the graph;

– one element of the set P corresponds to one and only one graph edge.

As a basis consider the overall technological process of doing custom specs railway automation and telemechanics (Fig. 1), presented in [5].

The process consists of the following steps:

1) project organization is to customer specifications on the basis of the project under construction or renovation projects.

2) drafted specifications according to the service automation and remote control.

3) then, the specification should apply to the head of capital construction. Based on these data, determines which equipment must be ordered manufacturers. As in the specification of several hundreds of items of equipment and devices, the likelihood that their releases only one plant is very small. The capital construction Department shares the equipment specified in the specifications between suppliers.

4) Suppliers, in turn, give the order to the factory to fulfill the order.

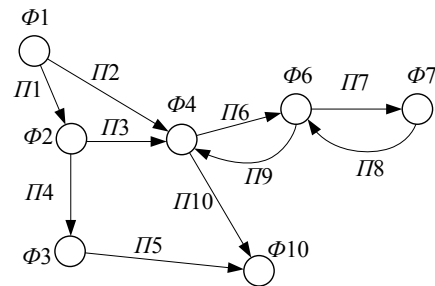5) Upon completion of the work, the plant sends equipment to the warehouse signalling.

Figure 1. The count of technological process of doing custom-made specifications of railway automatics and telemechanics

To denote model parameters used legend:

– documents denoted with a multitude of forms used in the simulated process – $F1 \ldots F10$;

– the processes performed on the documents for the state transitions – $P1 \ldots P10$;

– executor processes – $U1 \ldots U10$.

Consider the logical scheme of algorithms of process management custom spec algorithm A11:

$$A11 = b_{111} \downarrow^{111} b_{112} \alpha_{111} \uparrow^{111} \downarrow^{117} d_{111} \alpha_{112} \uparrow^{112} \alpha_{113} \uparrow^{113} \upsilon_{119} b_{113} \omega \uparrow^{116} \downarrow^{113} \upsilon_{111} \downarrow^{116} \upsilon_{112} \upsilon_{113} \times$$

$$\times \upsilon_{114} \upsilon_{115} \upsilon_{116} \upsilon_{117} \upsilon_{118} \alpha_{114} \uparrow^{114} \downarrow^{114} b_{115} b_{116} b_{117} \upsilon_{1111} \upsilon_{1112} \downarrow^{112} \upsilon_{1110} b_{114} \alpha_{115} \uparrow^{115} \upsilon_{+} \omega \uparrow^{117} \downarrow^{115} \upsilon_{J}$$

To display the transition process, the algorithmic description by using the graph theory [6; 7], construct the transition graph (Fig. 2).

In the graph model following symbols have been used:

– changed as the documents used in simulated process – $F1, \ldots, F12$.

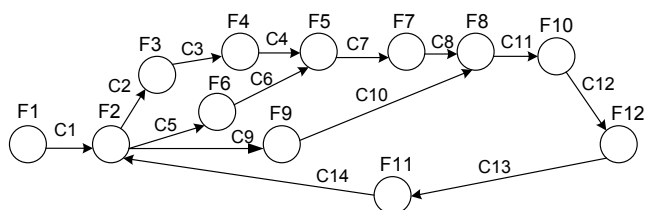– algorithms performed on the documents to change the conditions – $C1, \ldots, C14$.

Figure 2. The graph model of algorithmic descriptions A11

Possible chains (Ц) passing algorithm A11 in graph model:

$$Ц1=F1C1–F2C2–F3C3–F4C4–F5C7–$$
$$–F7C8–F8C11–F10C12–F12$$

$$Ц2=F1C1–F2C5–F6C6–F5C7–F7C8–$$
$$–F8C11–F10C12–F12$$
$$Ц3=F1C1–F2C9–F9C10–F8C11–F10C12–F12$$
$$Ц4=Ц1–Ц2–Ц3–C13F11C14–Ц1–Ц2–Ц3$$

Conclusion. Needs high-speed rail transport increase, which reveals the need to update and upgrade systems and devices of Railways, to develop modern information technologies in electronic document processing.

Based on the methodology of constructing a conceptual model of document management systems technical documentation [3] and models of composite workflow [4] this paper presents a graph model of electronic document management of technical documentation, and implementation of the model in the software module.

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SIMILARITY CRITERIA DEVELOPMENT FOR PHYSICAL MODELING OF THE PROCESS OF SOLID DOMESTIC WASTE CRUSHING ON LANDFILLS

Abstract. Similarity criteria for modeling the process of leveling solid domestic waste are determined in the paper by a physical model of a bulldozer blade. The method of functional dependencies analysis is used for determining the similarity criteria.

Keywords: solid domestic waste, modeling, leveling, resistance, power, similarity criterion.

Environmental protection and rational use of natural resources in conditions of rapid development of industry, transport, agriculture and construction, and the involvement of huge amounts of natural resources into operation are the most important economic and social problems.

An important part of these problems is sanitary purification of the territories of cities and settlements and sanitary earth fill of solid domestic waste (SDW) at landfills, which provides a favorable living environment and protects public health [1, 7–8].

In the process of SDW disposal at landfills, various types of transport and technological facilities are used, but the main machine is a compactor. In many ways, the quality of SDW disposal operations depends on the correctly grounded definition and selection of design and technological parameters of the compactor.

The basis for creating efficient and cost-effective transport-technological machines is to solve the problem of reducing the specific energy consumption of the process of solid waste leveling. In this case, of particular interest are the issues of improving the working equipment, the choice of rational parameters of working blade units, in particular, such geometrical parameters at which the least specific power consumption of the process is reached at the greatest volume of dragging prism.

The issues of determining and substantiating the main design and technological parameters should be carried out using the methods of physical and physical-mathematical modeling, which allow conducting experiments on small-scale engineering objects.

Conducting experiments on physical models significantly reduces the costs of tests conducting and experimental data processing. Besides, these methods are irreplaceable when initial information is required to state a mathematical model of the process [2, 11–12].

Initial information for the development of similarity criteria is obtained on the basis of the analysis of stressed state equations of the medium and the laws of mechanics.

SDW is represented as an elastic-plastic medium with account of inertia forces of the waste components.

Rheological equivalent of the process of bulldozer blade interaction with the medium is shown in the (figure 1).

The equation for determining the shear stress of SDW components has the form [3, 42–43]:

$$\tau = \gamma \ell \, tg\rho + C + m_{y\partial}\frac{d\vartheta}{dt}, \qquad (1)$$

where $\tau, \gamma, \ell, tg\rho, C, m_{y\partial}, \vartheta, t$ — are the tangential stress, H/m²; the volumetric weight, H/m³; the generalized linear dimension, m; the friction coefficient of adhesion between

SDW components, H/m²; the specific weight of the shifted section of SDW components (the ratio of the mass of the shifted material to the shear surface), kg; the speed of the base car motion, m/s; the time of unsteady motion, s, respectively.
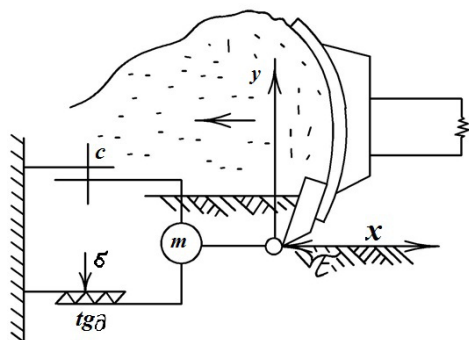

Figure 1. Scheme of the process of leveling of solid domestic waste components and rheological equivalent of the process

Normal stress in the medium is

$$\sigma = \frac{\gamma \ell^3}{\ell^2} = \gamma \ell \qquad (2)$$

Specific mass of waste components is:

$$m_{y\partial} = \frac{\gamma \ell^3}{g\ell^2} = \frac{\gamma \ell}{g}, \qquad (3)$$

Therefore, $\tau = \gamma \ell tg\rho + C + \dfrac{\gamma \ell}{g} \cdot \dfrac{d\vartheta}{dt}$, (4)

Resistance force to the cutting of SDW components is:

$$P = \tau \ell^2, \qquad (5)$$

The power of the base machine necessary for leveling SDW components is:

$$N = P\vartheta, \qquad (6)$$

In conditions of unsteady motion, we have the following equations of motion

$$P_{UH} = T - W, \qquad (7)$$

where $P \approx m(\vartheta / t)$; $m = G / g$, $T = G\phi_{CU}$

Using the method of integral analogues for the stress state equations and the laws of mechanics, the similarity criteria are determined [4, 121–122].

At the first stage, on the basis of equation (4), we have the equation of integral analogues:

$$\tau \sim \gamma \ell tg\rho \ \sim C \sim \frac{\gamma \ell}{g}\frac{d\vartheta}{dt}$$

The dimensionless function $tg\rho$ is a similarity criterion Π_2

$$\Pi_2 = tg\rho$$

The remaining terms are divided by C

$$\frac{\tau}{C} \sim \frac{\gamma \ell}{C} \sim \frac{\gamma \ell^2}{gC};$$

hence, we have three dimensionless complexes:

$$\Pi_3 = \frac{\tau}{C}, \ \Pi_4 = \frac{\gamma \ell}{C}, \ \Pi_1 = \frac{\gamma \vartheta^2}{gC}$$

Thus, from equation (4) we have three determinant criteria:

$$\Pi_1 = \frac{\gamma \vartheta^2}{gc}; \ \Pi_2 = tg\rho; \ \Pi_4 = \frac{\gamma \ell}{C} \text{ and one determinate}$$

criterion $\Pi_3 = \dfrac{\tau}{C}$

From equations (5) – (7) we get four more criteria:

$$\Pi_5 = \frac{\tau \ell^2}{P}; \ \Pi_6 = \frac{P\upsilon}{N}, \ \Pi_7 = \frac{P_4}{W}, \ \Pi_8 = \frac{T}{W}, .$$

All the criteria systems in the first approximation, describing the process of SDW leveling, are as follows:

$$\Pi_1 = \frac{\gamma \vartheta^2}{gC}; \ \Pi_2 = tg\rho; \ \Pi_3 = \frac{\tau}{C}, \ \Pi_4 = \frac{\gamma \ell}{C}, \ \Pi_5 = \frac{\tau \ell^2}{P};$$

$$\Pi_6 = \frac{P\vartheta}{N}, \ \Pi_7 = \frac{P_4}{W}, \ \Pi_8 = \frac{T}{W}, \qquad (8)$$

In addition, for transportation mode the system can be supplemented with the following criteria:

$$\Pi_9 = \frac{T}{G}; \ \Pi_{10} = \frac{G}{G_M}; \ \Pi_{10} = \frac{G_M}{G_{rp}}; \ \Pi_{11} = \frac{G_{gp}}{g \cdot \gamma}; \ \Pi_{12} = \frac{\vartheta^2}{gl}, \quad (9)$$

where G, G_M, G_{gp}, q, l – are the weight of the base machine with a load, kN (t), the weight of the base machine, kN (t), the weight of the load kN (t); the dragging prism volume, m³; the generalized linear dimension, m, respectively.

At the second stage the scale equations are built.

From criterion Π_1, we get the scale equation

$$K_\gamma \cdot K_\upsilon^2 = K_g \cdot K_c \qquad (10)$$

From the limitations Kγ = 1, K_g = 1, we get $K_\upsilon^2 = K_c$ or

$$K_v = K_c^{1/2} \qquad (11)$$

From criterion Π_2 it follows

$$K_{tgp} = 1 \qquad (12)$$

From criterion Π_3 the scale of the stresses is found:

$$K_\tau = K_c \qquad (13)$$

From criterion Π_4 we find

$K_\gamma \cdot K_l = K_c$ at $K_\gamma = 1$, and get

$$K_c = K_l \qquad (14)$$

So, $K_v = K_{l^{1/2}}$ and $K_\tau = K_c$ (15)

From criterion Π_5 the scale of forces is found: $K_\tau \cdot K_l^2 = K_p$, at $K_\tau = K_l$.

Consequently, the scale of resistance forces is defined as:

$$K_p = K_w = K_T = K_l^3 \qquad (16)$$

Power scale is

$$K_N = K_l^{3,5} \qquad (17)$$

At the third stage, the parameters of the model are determined. To characterize the model of the medium, relationships (12) – (14) are used.

Based on Π_2 the friction coefficients of the medium in the model and in the original unit should be equal

$$tgp_M = tgp_H \qquad (18)$$

From the limitation $K_\gamma = 1$ it follows that the volume weight of the model medium γ_H is:

$$\gamma_{\text{м}} = \gamma_{H}, \qquad (19)$$

From the limitation $K_g = 1$ it follows that

$$g_{\text{м}} = g_{H}, \qquad (20)$$

The adhesion between the components of the model medium is determined by the data of this value in the original unit $C_{\text{н}}$ by (14, 15)

$$C_{\text{м}} = \frac{C_{\text{н}}}{K_l} \qquad (21)$$

Therefore, in modeling it is necessary to use an equivalent material with parameters

$$C_{\text{м}} = \frac{C_{\text{н}}}{K_l}; \ tg p_{\text{м}} = tg p_{H}; \ \gamma_{\text{м}} = \gamma_{H}, \qquad (22)$$

The mode of model operation is determined by the speed $v_{\text{м}}$

$$\vartheta_{\text{м}} = \frac{\vartheta_{\text{н}}}{K_l^{1/2}}, \qquad (23)$$

The stress in the medium before the instrument is defined as it is done in the base.

$$\tau_{\text{м}} = \frac{\tau_H}{K_l} \qquad (24)$$

Resistance of the medium (SDW components) P, W and dynamic loads $P_{\text{ин}}$ T are determined from:

$$P_M = \frac{P_{\text{н}}}{K_{e^3}}, \ W_M = \frac{W_{\text{н}}}{K_{e^3}}, \ P_{\text{ин,м}} = \frac{P_{\text{ин}}}{K_{l^3}}, \ T_M = \frac{T_{\text{н}}}{K_{l^3}}$$

The power of the model drive is determined from:

$$N_M = \frac{N_{\text{н}}}{K_{l^{3,5}}}$$

At the fourth stage, the formulas for the model-to-original transition are determined (on the basis of inverse relationships discussed in the third stage).

The stress in material before the blade of the original unit is found from (24) in the form:

$$\tau_H = \tau_M \cdot K_l \qquad (25)$$

The resistance to SDW destruction from (25) is:

$$P_{\text{н}} = P_{\text{м}} \cdot K_l^3, \ W_{\text{н}} = W_{\text{м}} \cdot K_l^3,$$

Dynamic loads are

$$P_{\text{ин, н}} = P_{\text{ин, м}} \cdot K_l^3,$$
$$T_{\text{н}} = T_{\text{м}} \cdot K_e^3$$

The drive power of the original unit is determined from (26)

$$N_{\text{н}} = N_{\text{м}} \cdot K_l^{3,5} \qquad (26)$$

The following conclusion can be made from the obtained relationships:

– the model of the bulldozer blade (a compactor) can be built on the basis of the relationships obtained in the fourth stage;

– to refine the model-original unit agreement it is necessary to conduct the experiments with two models of different scales.

– on the basis of the obtained relationships of the fourth stage, the transition from the model to the original unit is carried out along all parameters and indices.

– an assessment of the effectiveness of the solution obtained is done on the basis of the accepted technical and economic indices.

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MODELING OF SENSORS OF THE HALL IN SOFTWARE PACKAGES SIMSCAPE AND SIMULINK

Abstract. Modeling of sensors of the Hall in the environment of Simscape programs MATCAD is considered. The mathematical substantiation and the scheme of model created with application of components Simscape and Simulink are offered.

Keywords: The Hall sensor, model, longitudinal contacts, cross-section contacts, a magnetic induction, a current measuring instrument, solver.

In program MATCAD, in package Foundation Library there is program complex Simscape where software package Magnetic enters. A variety of models of components entering into a package allows to model magnetic chains practically any complexity and a configuration. Often enough at research of magnetic chains the Hall sensor is applied, allowing making measurements magnetic induction in cores, voltage and currents in windings. For possibility of use of sensor of the Hall in programs it is necessary to create their adequate computer models. Many proceedings [1; 2; 3; 4 and others] are devoted modeling of sensor of the Hall. However, the described in these works of model of sensor are developed for programs EDA, SPICE and some other programs. Absence among components Simscape of computer models of sensor of the Hall does not allow to make high-grade research of magnetic chains, therefore creation of such models is an actual scientific problem.

Let's consider model creation on an example of the linear analogue sensor of the rectangular form, as Hall having the greatest voltage and most widely used at research of magnetic chains. The scheme of this gauge is shown on (fig. 1), where:
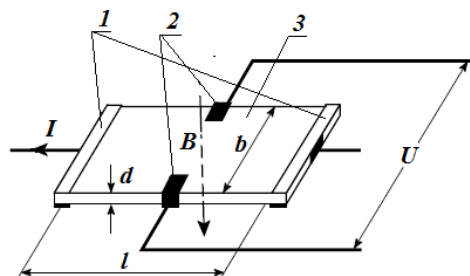
Figure 1.

1 – longitudinal contacts on which the longitudinal current I is passed, 2 cross-section contacts from which stress of Hall U is removed, 3 – a plate from a semi-conductor material, b, d, l – accordingly width, a thickness and length of a plate, In a-induction and a direction of the magnetic field directed to perpendicularly semi-conductor plate. The size of voltage of the Hall induced in cross-section contacts is defined by expression

$$U = \frac{R_H}{d} \star I \star B \star G + U_O,$$

where R_H – the constant of the Hall depending on properties of a material of a semi-conductor plate, d – a thickness of a plate, I, B – accordingly a longitudinal current and a perpendicular component of a magnetic induction, G – the geometrical factor accepting values in limits from 0 to 1 and sizes depending on a parity b, d, l, the sizes and a place of placing of contacts, and also geometry of a semi-conductor plate, U_O – voltage between cross-section plates at $B = 0$, caused by technological admissions on reproduction of the geometrical sizes of the chip, and also heterogeneity of a material of a plate.

Let's designate $\frac{R_H}{d} \star G = const = K$. Taking into account a designation expression for voltage of the Hall will be copied in the form of $U = K \star I \star B + U_O$. From here follows, that creation of two kinds of models is possible: at $B = const$ voltage on an exit will be proportional to a current I and the model will measure this current, and at $I = const$ voltage will be proportionally magnetic induction In and accordingly the model will measure size of this induction. As at research of magnetic chains it is necessary to deal with measurement magnetic induction is more often and

creation of condition $I = const$ to provide easier, we will create model of the sensor of the Hall for measurement of a magnetic induction.

The scheme of model created in the environment of Simscape with application of components Simulink [6] is shown on (fig. 2).
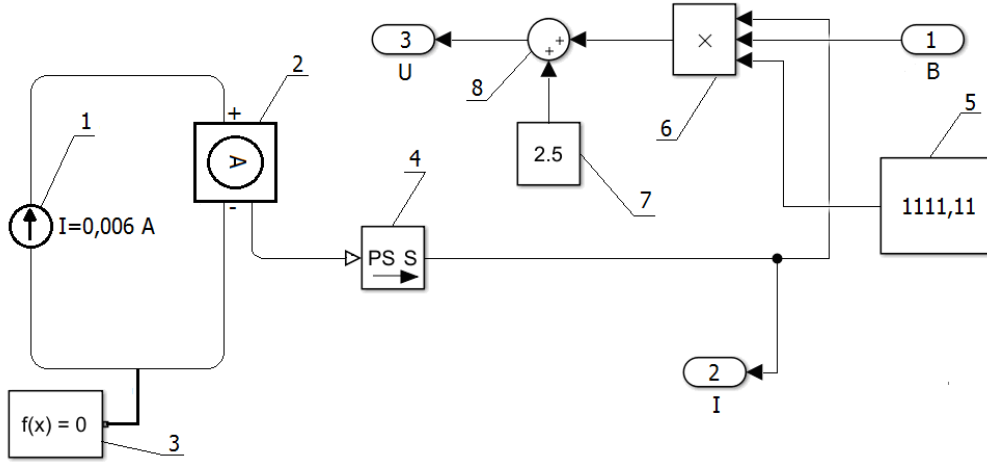

Figure 2.

The blocks presented to models carry out following functions: 1 – the block of the task of the stabilized current $(I = const)$; 2 – a current measuring instrument; 3 – solver for the task of initial parameters of modeling of a chain; 4 – the converter of signal Simulink in signal Simscape; 5 – block of the task of constant $\dfrac{R_H}{d} \star G = const = K$; 6 – the multiplier, multiplies among themselves a current I, constant $\dfrac{R_H}{d} \star G = const = K$ and an induction In, received from port 1; 7 – a constant setting voltage U_O at induction $B = 0$; port

3 – port from which total voltage of Hall U is taken away; port 2 – port for tap of a current I.

On (fig. 3) schedules of voltage U on an exit of the sensor of the Hall depending on size of magnetic induction B are shown at various values of a longitudinal current I. Curves are received for model of the sensor of the Hall of type SS49E of firm Honeywell at voltage of 5V and currents from 6 to 10 mA, and continuous lines show settlement parameters of model, and dashed lines – experimental parameters at $U = 5V$ and the currents equal 6, 8, 9 and 10 mA.
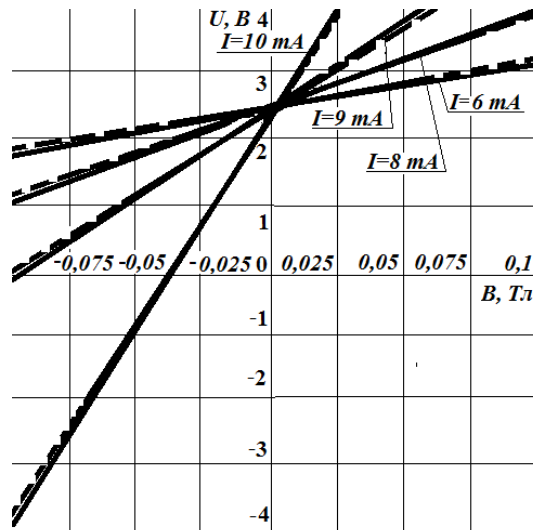
Figure 3.

From schedules it is visible, that the model adequately reflects a real condition of the sensor (the modeling error makes less than 1% in all range of measurements) and it can use at modeling of magnetic chains with sensor of the Hall in the environment of Simscape. A lack of the given model Hall sensor is the impossibility of reflexion of some attendant effects (secondary effect of the Hall, nonlinear dependences of voltage of the Hall on temperature, influence of loading on effect of the Hall, etc.), however these displays for real devices have insignificant character and they can be neglected.

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IMPROVEMENT OF CLASSIFICATION OF FACTORS AFFECTING THE QUALITY OF SILICON CONNECTIONS IN SEWING PRODUCTS

Abstract. this article is devoted to the analysis of technological factors affecting the strength properties of threaded joints in the details of garments. At the same time, special attention is paid to the properties, structure and geometry of the interlacing of the used fabrics, as well as the technological sewing regimes and the parameters of the seams. As a result of the studies, a classification of the factors influencing the strength properties of the threaded joints of the garment details was developed.

Keywords: technological operations, grinding of parts, thread joints, sewing threads, seam, factors, interlacing and structure.

From the implementation of the technological operation to grind the parts of garments, the strength properties of the threaded joints largely depend, in turn, which determine the quality of the product as a whole. This problem was devoted to the majority of scientific research, which were aimed at improving the quality of technological operations in the manufacture of garments [1–3].

If we analyze by assortment of garments, then depending on the purpose of the product, close attention was paid to such indicators of thread joints as the expansion of the seams in the fabric for products of light assortment [4–6]. Also, ensuring the tightness of the seams for special clothing [7; 8], the unresponsiveness of the seams for the range of products from multi-layered fabric with increased hairiness [9].

During the formation of stitches, the quality of the threaded joints is influenced by various factors caused by the kind of weaving and the structure of the stitches, the type and properties of the materials and threads, the parameters of the seams, the technological sewing regimes, etc.

Factors affecting the quality of the threaded joints of clothing items are divided into 6 groups (figure).

Group 1 – these are factors that depend on the type of weaving and stitch structure. The structure, appearance, dimensional characteristics and properties of stitches are significantly influenced by the number of threads participating in their formation. At any weaving, the stitches can be visible and hidden. Threads of visible and secret stitches are arranged on the material in different ways:

– along the line (longitudinal); across the line (zigzag); around the edge of the material; inside the cross-linking materials.

– Simple stitches consist of 1–2 threads, complex – from 3–4 or more. Stitches can be combined.

Group 2 – factors, depending on the type and properties of the materials used for cross linking. The type and properties of the material affect the wear of sewing needles and threads, the tightness of the stitching, the appearance of the stitch. This is due to the fact that when a material is punctured with a needle, a friction occurs between the material, and the sewing thread, the value of which depends:

– from the kind of material (fabric, knitted fabric, nonwoven fabric), its structure, density, thickness, etc.; from fibrous composition; from the area and duration of contact of the material with the needle and thread; from the presence of treatment of the tissue with chemically reactive reagents (eg, polymer compositions called for the cross-linking of textile threads), and the like.

Group 3 – these are factors that depend on the type and properties of the threads that form the stitches.

The quality of the thread joints, both in the transverse and longitudinal directions, as well as at some angle is largely de-

termined by the fibrous composition, linear density, structure, twist of the sewing thread, the type of finish of their surface, the degree of weakening of the thread during stitch formation.

Based on the analysis of this group, the strength and elongation of the yarn links, and hence the yarn, as a whole depends on the strength and elongation of the sewing threads.
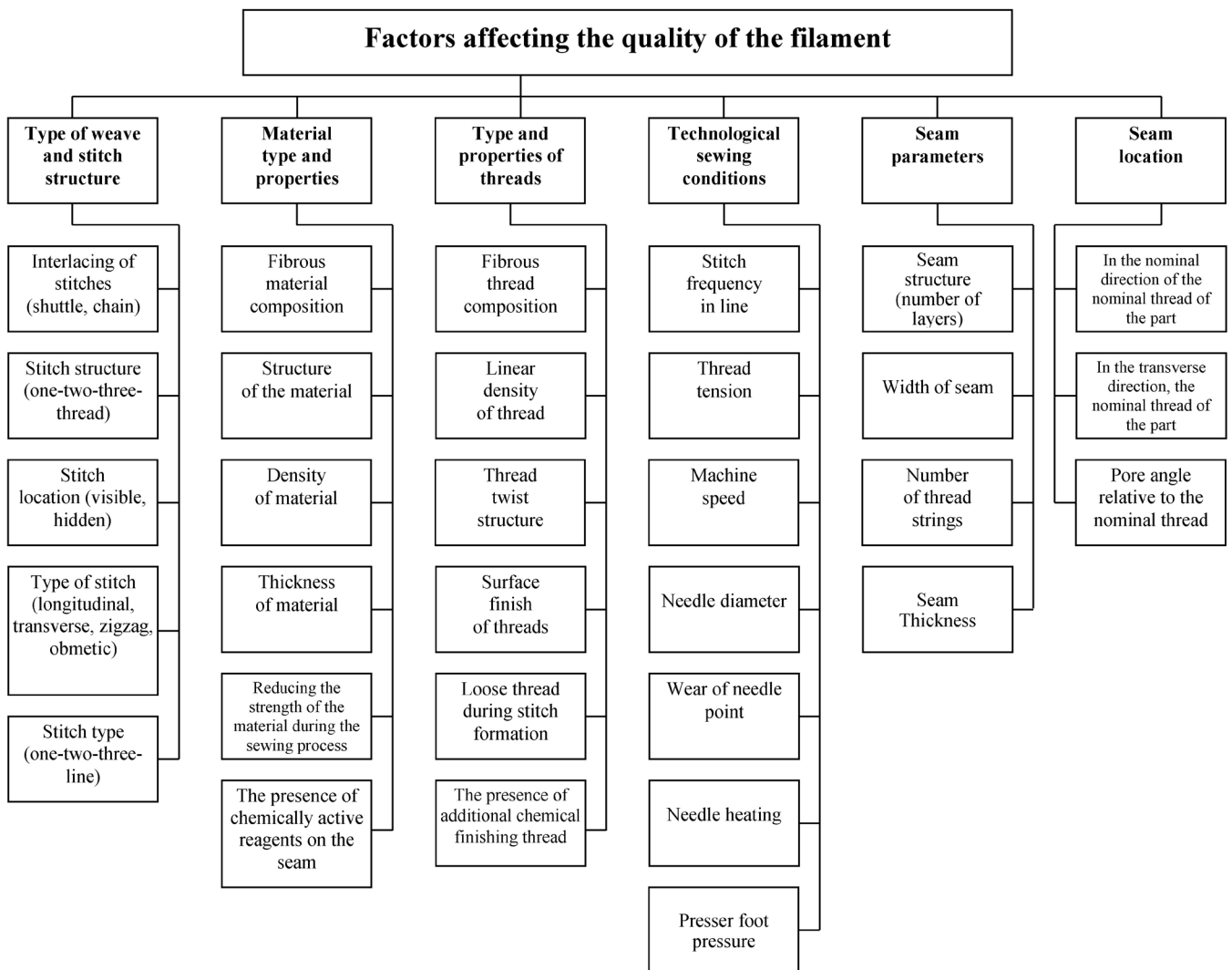

Figure 1. Improved classification of factors affecting the quality of the filamentary compounds

Group 4 – the factors depending on technological modes of tailoring, which include:

– frequency of stitches in the line; thread tension; speed of grinding; the degree (temperature) of heating the needle during the grinding process; diameter of the sewing needle, sharpening form and wear of its point; pressure of the presser foot on the materials to be sewn, etc.

The choice, installation and maintenance of rational technological modes of grinding are a complex multifactor task.

Group 5- factors that depend on the parameters of the joints:

– number of material layers to be ground; number of thread strings; thickness of the cross-linking materials; width of seam, etc.

Group 6 included those factors that determine the location of the seams, relative to the direction of the nominal thread:

– longitudinal stitching; transverse seam; seam, padded at some angle.

It is the structure of the seam, determined by the method of location and width of the cuts of the material in the seam, the number of stitches and their arrangement, which greatly affects the strength and reliability (endurance) of the threaded joints in the garments.

Thus, the conducted studies made it possible to improve the classification of the factors affecting the strength properties of the filamentous compounds and to determine that the quality of the filamentous compounds depends on many

factors. Therefore, the optimization of the properties of the filamentous compounds is a complex multifactor problem, to which our subsequent complex studies will be devoted, by providing interdisciplinary connections such as thread mechanics, polymer chemistry, sewing technology, physics, materials science, heat transfer mass, thermodynamics, e.

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STUDY OF THE IMPACT OF THE METHOD OF STRAWING ON THE QUALITY OF TWIST TWISTED YEARS FOR GARMENTS

Abstract. torsion of threads for sewing threads is one of the main technological processes in the production of textile materials. Twisted household yarn is widespread. The need for it is growing every year. Twisted yarn is a thread consisting of two or more yarns. Twisted yarn has higher qualities than single yarn. The main advantages of twisted yarn are: stable structure, increased breaking load, uniformity of elongation, resistance to abrasion, elasticity, uniformity, gloss and smoothness. The expansion of the range of high-quality fabrics, knitwear, curtains and tulle products necessitates a further increase in the production of twisted yarn.

Keywords: torsion, textile materials, yarn, quality, stable structure, breaking load, elongation, abrasion resistance, elasticity, uniformity, shine.

Torsion is one of the main technological processes in the production of textile materials. Twisted household yarn is widespread. The need for it is growing every year. Twisted yarn is a thread consisting of two or more yarns. Twisted yarn has higher qualities than single yarn. The main advantages of twisted yarn are: stable structure, increased breaking load, uniformity of elongation, resistance to abrasion, elasticity, uniformity, gloss and smoothness [1]. The expansion of the range of high-quality fabrics, knitwear, curtains and tulle products necessitates a further increase in the production of twisted yarn.

Based on the above, an experimental study was conducted of the influence of the spinning method, the linear density of the yarn, the magnitude of the final twist on the quality of the twisted yarn.

Experimental studies are carried out in the production conditions of the spinning mill and the twisting production of TashKaya Textil JV.

A single cotton yarn with a linear density of 29 tex was produced on both AUTOCORO –240 pneumatic spinning machines (Germany, Schlafhorst) and P-76–5M6 ring spinning machines of type 5 and 1–2 sorts of cotton.

Semi-finished and single yarn is produced according to factory spinning plans.

Yarn rewind from cobs from ring spinning machines is carried out on AUTOCONER winding machines.

The yarn stitching of both spinning methods in 2 additions is carried out on the AES-12 walking machine (from Savio), and the twisted yarn is twisted on the Savio TDS double-twisting twisting machine. Twisted yarn in 2 additions of linear densities of 29 tex x 2 was produced from a single yarn of both spinning methods using double twisting machines from Savio (Italy) with varying values of the final twist.

The subject of research was to determine the coefficient of hardening of yarn of different methods of spinning in torsion, the definition of twisting, lengthening, unevenness by properties.

Indicators of the basic physicomechanical properties of twisted yarn of linear densities 29 tex x 2 obtained from single yarn of ring and pneumomechanical spinning methods, and for convenience of comparative analysis, the main indicators of the quality of twisted yarn of all variants are given in the (Table 1).

From the data in the table it can be seen that in the process of twisting single yarns of any spinning method, the twisted yarn is hardened; with a decrease in the linear density of the twisted yarn of any spinning method, the harden-

ing coefficient of the yarn increases; with an increase in the final twist, the coefficient of hardening of all types of yarn increases, since the pressure of the fibers and filaments on each other increases in the process of torsion; hardening in a twisted yarn of a pneumomechanical method of spinning (any linear density) is noticeably lower than hardening of a yarn of a ring method of spinning with the same twists and one thickness.

Table 1. Twisted Yarn Indicators

Kind of yarn	Twist ratio		Twist $Y_{1\%}$	The resulting linear density, tex $R_н$	Hardening coefficient $K_{уп}$	Fiber strength factor $K_{ип}$
	$α_0$	$α_1$				
Ring spinning						
29/2 tex	40.2	32.2	0.998	58.7	1.105	0.58
29/2 tex	40.2	40.1	1.012	59.5	1.12	0.59
29/2 tex	40.2	47.9	1.015	59.7	1.17	0.61
Pneumatic spinning method						
29/2 tex	45.7	32.2	0.98	57.2	1.03	0.44
29/2 tex	45.7	40.1	0.99	57.8	1.08	0.46
29/2 tex	45.7	47.9	1.0	58.4	1.11	0.476

This is due to the presence in the rotor yarn of a loose outer layer of obviochny fibers, which play a significant role in the process of imposing twists. Surface fibers subjected to bending due to torsion, have less tear resistance than core, less curved fibers [2].

It has been established that during torsion of a rotor yarn, there is a slow unwinding of the strands at low and medium secondary twists due to the presence of loose outer layers and obvivochnye fibers in the yarn, which, forming a large contact surface when twisting, prevent the twisting of the constituent threads. This affects the twisting of the yarn, which for PSMP yarn is close to 1 at a ratio of $α_1/α_0 = 1.03$ and even has a nega-tive twisting (i.e., is lengthened when twisting) with a small final twist $α_1 (α_0 = 0.73 – 0.9)$.

Hardening of the yarn in the process of torsion leads to an increase in the coefficient of the use of fiber strength to 0.61 for the ring spinning yarn and to 0.476 for the primary health care yarn.

The addition of single yarns leads to an increase in the uniformity of the properties of the twisted yarn. The reduction ratio of unevenness in linear density and breaking load from 0.7 to 0.9, depending on the magnitude of the final twist. The elongation at break of twisted yarn is greater than that of a single yarn and increases with increasing twist.

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ANALYSIS OF WORLD EXPERIENCE IN APPLICATION OF MICROBIOLOGICAL TECHNOLOGIES IN OIL FIELDS

Abstract. This article presents the results of the analysis of the world experience in the use of microbiological technologies to increase oil production.

Keywords: microbiological technologies, oil fields, petroleum refinery.

The world reserves of high-viscosity oil are about 5 times higher than the volume of recoverable reserves of low and medium viscosity oil. Geological reserves of high-viscosity oil are 500–1000 billion tons. By 2035, oil Sands production is projected to increase to 5.2 million barrels per day [2–3].

Scientific research on the development of this type of raw material is developing all over the world. Effective but expensive methods of extraction of heavy hydrocarbon raw materials are being developed, which is associated with unique physical and chemical properties and conditions of occurrence. Thus, economically viable development is possible only through the development of resource-saving production technologies with the transformation of hydrocarbon resources in the reservoir in order to reduce the viscosity of the extracted oil.

The laboratory study of microbiological methods was carried out for the first time by K. Zobell, he isolated cultures of sulfate-reducing bacteria from the waters of the oil field and showed that the treatment of oil-saturated samples by bacteria causes the displacement of oil, that is, microbial metabolites can be used to increase oil recovery [4, 5, 33, 34].

The residual oil is distributed in the formation in macro-traps, as well as in micropores, where it is held by capillary forces. The most effective way to extract oil from macro-traps is drilling additional wells or drilling secondary wells.

Microbiological methods of impact on oil reservoirs are divided into two main groups, the first group includes biotechnologies in which the natural microflora of the reservoir is activated by supplying nutrients from the surface (Insitu), and the second group – the introduction of a culture of microorganisms with nutrients (Extrasitu) [6].

The technology of activation of reservoir microflora consists in cyclic injection of inorganic culture medium and culture of microorganisms in oil reservoirs, which stimulates an increase in the number of certain types of microbes in the reservoir, mainly oil-oxidizing bacteria.

As an example, we can consider the Gloria Energy project on AERO technology in Canada [7]. In March 2013, AERO microbiological impact technology was injected into a field in southern Alberta in Canada.

The productive zone lies at a depth of 232–246 meters below sea level. The average thickness of the reservoir is 3.88 meters. Porosity averages 23%.

The deposits were discovered by three operating injection wells and six producing wells. At the beginning of the project, oil production decreased by 34% per year. After 31 weeks, despite the fact that one of the producing wells was closed for technological reasons, the oil production rate began to increase.

The effect lasted for a year. As of September 2014, oil production increased to 63 barrels / day, which is higher than the design value of 15 bar./day. Due to the use of the technology, an additional 13.5 thousand barrels were produced. oil or 256% of initial production.

There are more than 175 species of bacteria that use hydrocarbons in their metabolism as the only source of energy [8].

Due to high adaptability, bacteria play an important role in the process of biotransformation of hydrocarbons, however, there are no separate strains that can completely degrade any complex classes of hydrocarbons [9].

The microbiological processes that cause the decomposition of petroleum hydrocarbons, occur in two reactions: aerobic and anaerobic. Aerobic processes in the conditions of free access of oxygen proceed with high speed. In this case, oil undergoes deep oxidative conversion with the destruction of saturated and aromatic hydrocarbons and the formation of non-hydrocarbon compounds and asphaltenes and resins [10].

The main intermediate product in the process of aerobic degradation of alkanes are fatty acids, which are formed as a result of the interaction of alcohols and aldehydes [11].

Depending on environmental conditions, the final stages of anaerobic biodegradation are carried out by denitrifying, sulfate-reducing or methane-forming bacteria [12].

For the same period of time microorganisms consume hydrocarbons in the following order: paraffins-90%), asphaltenes – 8%, resins – 2% [13].

Condensed polycyclic aromatic hydrocarbons decompose by one ring, by a similar mechanism, but the ability to biodegradation, as a rule, decreases with increasing number of rings and increasing the degree of condensation [14, 15].

Asphaltenes in oil tend to increase their relative and sometimes absolute number. It can be assumed that they are not only resistant to biodegradation, but can also be formed as a result of condensation reactions [16].

In crude oil, hydrocarbons exist as a complex mixture, each component of which affects the biodegradation of the other component. This effect can have a positive and negative effect. In the simultaneous presence of phenanthrene, acenaphthene, anthracene, pyrene and benzapyrene, the rate of biodegradation for phenanthrene and acenaphthene decreases, and for anthracene and pyrene increases [17].

The main purpose of the study of microbiological methods of influence on the oil field is to reduce the viscosity of oil with the help of bacterial waste products, less attention is paid to the study of the process of direct biodegradation of undesirable components of oil. In addition, the influence of various isolates on the biodegradation of petroleum hydrocarbons was studied [8].

As a result of their vital activity microorganisms form various compounds (fatty acids, alcohols, carbonic acids, molecular hydrogen, surfactants), affecting fluids and reservoir rock, oil displacement processes [18].

Absorption and transformation of insoluble substrates such as alkanes requires special physiological adaptation of microorganisms. To increase the absorption of hydrocarbons through the hydrophilic outer membrane, microorganisms form cell membrane-bound or extracellular surfactants [19].

Biopolymers change the mobility of reservoir fluid by increasing the viscosity of aqueous solutions with biopolymers, reduce the phase permeability for thickened water, selective and non-selective clogging [20].

The results of the study of the influence of Enterobactercloacae and Bacillus Stearothermophilus on the efficiency of tertiary methods of oil extraction in carbonate rocks, their results showed that different variants of injection into the reservoir together with the use of the necessary composition of bacteria critically affect the final performance of microbiological methods [21–23].

Different types of nutrients, primarily nitrogen and phosphorus, are used to improve the degradation of petroleum hydrocarbons. Bioavailability is one of the important factors affecting the degree of biodegradation of hydrocarbons [24, 25].

It is known that the criterion for the applicability of microbiological methods to increase production is the ability of microorganisms to exist in a Deposit containing hydrocarbons and salt water. Autochthonous microorganisms used in this technology have high adaptability to extreme conditions typical for oil fields [26, 27].

Kinetic analysis has shown that both consortia actively and continuously convert carbon resources in the process of metabolism, even in the stationary phase of growth. There was also a slight increase in CO_2 formation at this stage. The fermentation process also produces solvents, whereby consortia of microorganisms convert cheap substrates into reagents for oil production, such as gases, acids, solvents and cellular biomass [28].

Chemical compounds formed by microorganisms change the surface properties of the medium. Bio emulsifiers not only increase the biological availability of petroleum hydrocarbons, but also improves the contact between cells and oil [29].

It is known that selective degradation of heavy oil components reduces viscosity and consequently improves flow characteristics. Some strains can effectively degrade heavy oil [30].

Temperature can affect the rate of microbiological reactions, increasing or slowing them down. As a rule, oil biodegradation occurs at temperatures below 80 °C, at a higher temperature, most organisms in the process of biodegradation in the reservoir cannot exist [31; 32].

Microbiological methods of extraction are used as an alternative technology, since this method does not require a large amount of energy consumption.

Bacteria grow at an exponential rate, which contributes to the rapid production of a large number of potential products using inexpensive and renewable resources.

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ANALYSE OF WATER PERMEABILITY OF SOILS USED FOR DAMB CONSTRUCTION

Abstract. In this article discusses the results of analysis of permeability of soils. In the practice of hydro technical construction, widespread impervious devices made of clay soils. When constructing them, it is very important to correctly assess the permeability of the soil. Based on experimental studies, the filtration coefficient of bentonit was determined and recommendations and practical use were developed.

Keywords: permeability, bentonite, filtration coefficient, pressure, flow rate, soil, sand, water, suffusion.

In the practice of hydro technical construction, anti-filtration devices which made of clay soils (ponures, screens, cores, etc.) are widespread. When constructing them, it is very important to correctly assess the permeability of the soil. The overestimation of this value leads to excesses in the construction and unproductive expenditures of material resources, and an understatement leads to higher filtration losses [1; 2].

Bentonite clay – is one of the valuable fossil materials that has found it's widely application in various fields of human activity. Its other name is cloth clay, which is used for degreasing cloth. In modern industry, bentonite clay is used mainly in metallurgy to form iron ore pellets and to make molding sands. Equally important is the use of bentonite clay in the preparation of drilling and mortar, cleaning products for petroleum products, and also as a raw material for the production of heat and waterproofing materials.

Conducting these analysis is necessary, since there is still no clear indication in the literature about the most appropriate method for determining the filtration coefficient of low-permeable bentonite. Moreover, some authors even doubt about the possibility of determining it directly, in connection with which they recommend to study this important soil characteristic indirectly according to other analyze methods [3].

Fractional analysis of bentonite is refers to clay rocks, since the content of particles with diameter d < 0.005 mm is more than 30%.

The article deals with the analyse of the permeability of bentonite of a broken structure, taking into account some additives that are recommended for reducing the permeability of the soil used as an impervious material. In modern literature and regulatory documents, a significant number of various devices have been proposed to determine the filtration coefficient [3; 4]. However, their application in the study of clay soils in the field requires some features. To this end,

we have developed a device design for analysing bentonite. The instrument for determining the filtration coefficient of bentonite includes the following elements: Compression filtration device, which allows conducting analysis close to natural conditions. The composition of the compression-filtration device should include: mesh with filter, providing free flow of water to the sample and its withdrawal; roof on the device; choke connector; Libra; stopwatch; thermometer; scales and others.

In the implementation of field studies, based on the design of the available instruments, new installations were created to determine the filtration coefficient of bentonite. According to GOST 25584–90, the preasure on the stamp should be no more than 0.0025 MPa or 2.5 kPa in order to prevent soil swelling. Taking this factor into account, a soil from local sand was installed in a cylindrical chamber ($d = 150$ mm). The density of the soil was $\beta = 1.42$ g/cm^3

According to preliminary calculations, it was established that the flow of water through bentonite is $Q < 10^{-3}$ cm^3/s.

To assess the permeability of bentonite, it is necessary to determine the filtration coefficient of the sand which the dam body of the reservoir is built. To determine the filtration coefficient of sands, we use the Kamensky device in field conditions [5].

The filtration coefficient is determined by the formula:

$$K = \frac{l}{T}\phi\left(\frac{S}{h_0}\right) \qquad (1)$$

where: h_0 – initial pressure;

S – level drop;

l – the length of the filtration path (the height of the column of sand in the tube).

T – filtration time;

Temperature correction to the value of the filtration coefficient:

$$\tau = 0.7 + 0.03 \cdot t \qquad (2)$$

The results of the experiment are summarized in (Table 1).

Table 1.– Sand filtration coefficient

№	Soil	h_0, sm	S, sm	T, c	$\phi(\dfrac{S}{h_0})$	l, sm	$K, sm/s$	t	τ	$K_{10} = \dfrac{K}{\tau}$
1	Sand	86	35.3	540	0.41	15	0.014	18	1.24	0.011
2	Sand	39	11.5	300	0.346	15	0.017	18	1.24	0.0137
3	Sand	28.5	9	300	0.315	15	0.015	18	1.24	0.0121
4	Sand	50.5	13.8	300	0.273	15	0.0136	18	1.24	0.011

Based on the results of research about permeability of sand, the body of the dam and bentonite made the following conclusions:

- When testing bentonite clays in order to reduce the time to determine the filtration coefficient, it is necessary to create a large head;
- When determining the filtration coefficient of bentonite, the time factor is essential, i.e. the duration of the experiment;
- Determination of the filtration coefficient of bentonite samples with a broken structure should be carried out at high pressure gradients, which makes it possible to drastically reduce the duration of experiments, reduce the spread of experimental values and improve the accuracy of determination;
- According to research results, the value of the filtration coefficient is on average 0.4 * 10–7 cm/s;
- It should be noted that the tests were carried out without taking into account chemical phenomena

in the filtration process, nature of bentonite has not yet been fully studied;
- The tests did not take into account the phenomenon of suffusion, which occur during insufficient compaction of soils.

According to the results of studies of the water permeability of bentonite in the form of a powder, it was established that without creating a shell around bentonite, the phenomenon of mechanical suffusion is possible, which creates the risk of compromising the safety of a pressure hydraulic structure. Analysis of the results of laboratory studies showed that with an increase in the pressure of water from the pressure tank, the filtration of water through bentonite increases and the time of the experiment decreases, depending on the pressure. The tests did not take into account the phenomenon of mechanical suffusion, which occur during insufficient compaction of soils. As well as resistance to effects on bentonite, the presence of salts contained in water.

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DAMPING PROPERTIES OF SEISMIC PROTECTIVE SYSTEMS

Abstract. The article describes the results of testing new fire retardant compositions on the damping properties of seismic protection systems. Tests have shown that the strength of the proposed material remains higher than the "initial position" of the composition with neoprene (25.6% vs. 23.6%). Thermal impact on the samples leads to the fact that the building structure with a neoprene composition in comparison with a composition based on ebonite reinforced by wollastite and basalt fiber loses its strength almost 4 times, whereas the strength of the ebonite base is lost by 21.2%.

Keywords: Seismic risk, dynamic effects, explosion, fire, arson, neoprien, seismic protection, ebonite, wollastonite.

Seismic risk, i.e. the probability and scale of seismic disaster is determined not only by danger, but also by another equally important factor, namely: the seismic vulnerability of various objects of urban development, engineering and transport infrastructure of cities and other settlements. The probability of providing contains the security of complex systems, contains a multifactor analysis. Research and design developments in recent years are characterized by the adoption of various seismic protection systems, including damping systems and devices that ensure the reliability of objects during intensive earthquakes, dynamic effects, explosions, fires, and arson. This circumstance is especially relevant for shockproof, anti–dumping damping devices [1; 2].

When they are introduced into the practice of design and construction, there is a decrease in seismic and impulsive loads on bearing and enclosing structures, technological equipment and, as a result, a reduction in the estimated cost of construction, material and labor intensity of construction and installation works, and an increase in the industrialization of the entire construction process.

The achievement of increasing the sustainability of the operation of technological equipment and structural elements of industrial facilities in industries requiring seismic protection occurs through the use of damping systems and anti-dump, anti-shock devices, which significantly reduce the effect of external influence at a relatively low cost compared to other systems and devices used in earthquake–resistant construction. Construction of foundations with supporting elements in the form of swinging pillars (kinematic supports), suspended type supports, seismic insulating belts and on neoprene supports, according to the works, without metal layers, besides reducing the cost of seismic isolation, also reduced the frequency of vertical oscillations of the building to 2.03 Hz, and horizontal – up to 0.64 Hz. When deciding on the use of seismic protection, it must be borne in mind that the effectiveness of the use of certain seismic isolating devices depends on many factors, and requires serious theoretical and experimental research. In this regard, the properties of materials used for damping and shockproof devices are investigated.

For testing the damping qualities of materials of seismic isolation systems, cubes with a rib size of 10 cm were prepared. To increase fire protection, ebonite with wollastonite additives. The cube was struck with a steel ball weighing 5 grams. from a distance of 1 meter (by the experience of Soldatova).

For testing the damping qualities of materials of seismic isolation systems, cubes with a rib size of 10 cm were prepared. To increase fire protection, ebonite with wollastonite additives. The cube was struck with a steel ball weighing 5 grams. from a distance of 1 meter (by the experience of Soldatova). The distance of the ball rebound, the resistance of the samples to compression after they received the Nth number of impacts, and the resistance of the samples to compression were measured. After a single heat treatment in an oven at $500\,°C$ for 15 minutes. Samples were installed in the installation. From the diagram in fig. 4.9 that ebony + wollastonite initially had a "springing effect" is understated.

However, after 60 strokes of ebonite with the addition of wollastonite, especially with the addition of wollastonite, it continues to maintain damping qualities, but already greater than that of neoprene.
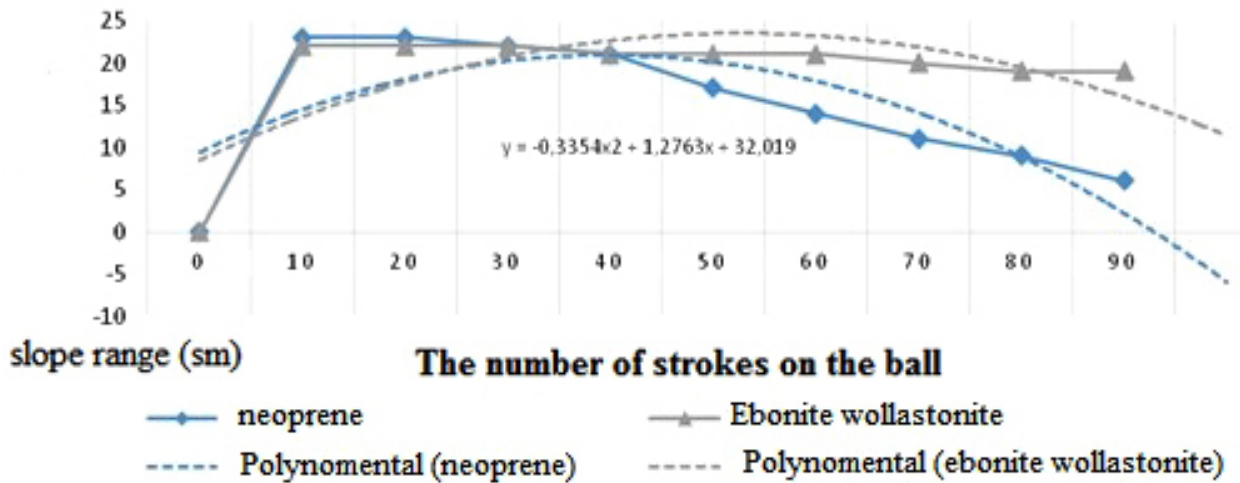

Figure 1. Curves of the range of the ball rebound after heat treatment

A sharp jump down on the graph for neoprene after 70 strokes is apparently related to the onset of material fatigue. Something similar happens with the material of ebonite-based building construction, but later (and not, quite explicitly), i.e. after drawing 80 hits. This fact suggests that the proposed material has a certain margin of safety, which will be necessary when operating in real conditions, as this can increase the life of the damping device. The results show that the composition based on neoprene quickly loses the damping advantages, compared with ebonite + wollastonite, after 100 beats, the indicator for all three materials is equalized [3]. From the graph in (fig. 2) it can be seen that when using neoprene for a building structure, the strength begins to decrease already after the application of 30 blows, and when performing a building structure based on ebonite with wollastonite additives, the strength decreases only after 40 blows.

The number of strokes on the ball
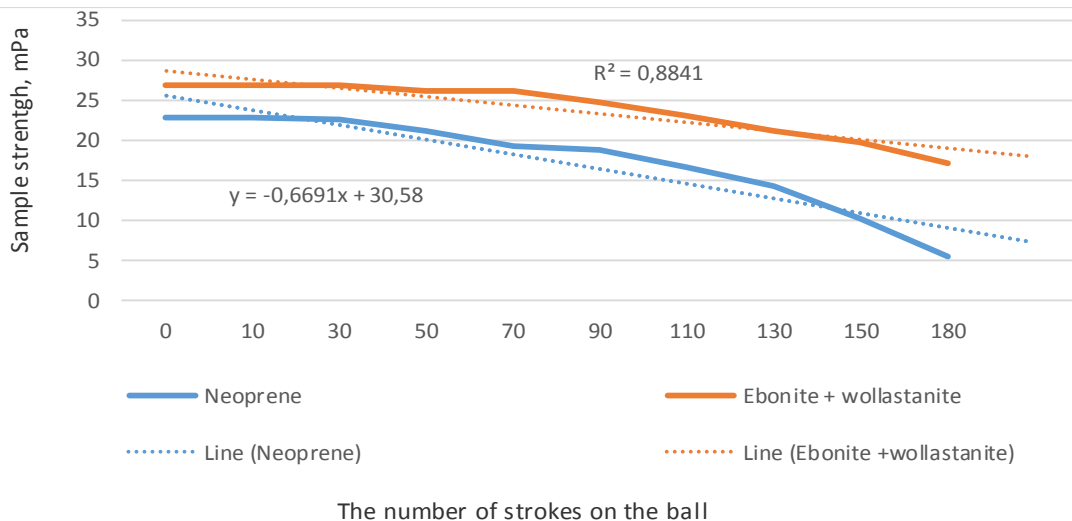
Figure 2. Curves of resistance of samples to thermal effects

This graph also shows that after applying 50 strokes for neoprene, the strength begins to decrease faster, whereas with the proposed composition of the material with liquid glass with wollastonite additives this occurs only after 80 strokes are applied.

Analysis of the results shown in the graphs of (fig. 1_ and 2 shows that a neoprene-based building structure loses its strength more quickly. After 180 blows, it decreases by a factor of 2–2.3 times, whereas a building structure based on ebonite with the addition of liquid glass loses its strength by 11.3%.

Thus, at the same time, the strength of the proposed material remains higher than the "initial position" of the composition with neoprene (25.6% vs. 23.6%). Thermal

impact on the samples leads to the fact that the building structure with the neoprene composition loses its strength almost 4 times, whereas the strength of the ebonite base is lost by 21.2%.

To check the degree of impact of shocks on the mass of samples of building structures, the same cube was checked (after applying the designated number of blows, the sample was weighed). It should be noted that this graph also confirms that neoprene begins to lose its strength characteristics faster. Tests have shown that if neoprene loses more than 10% of its mass after 180 strokes, then the proposed material based on ebonite + wollastonite loses a little more than 7%. This circumstance also speaks of the greater strength of the proposed material [4–5]. It is well known that the use of seismic protection de-vices reduces the risk of vulnerability in the whole building and structure. The test results showed that the most optimal in terms of reducing the risk for building structures, and therefore for structures (in which seismic protective devices are installed), developed ebonite–based damping devices.

Thus, in the theoretical aspect, the practical use of elastic plastic properties of the tested building structures and materials to identify the degree of destruction of buildings and structures can be considered as another mechanism to ensure the safety of industrial and civil construction, for the process of development of protectology. Fatigue tests also revealed that the endurance limit of prototypes of building structures of the proposed option, a damping device, is higher than the initial position when using a neoprene material.

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CALCULATION OF SEISMIC PROTECTIVE QUALITIES OF DAMPEFER AND ABSORTER

Abstract. In article the technique of comparative calculation for determination of quality of seismoprotection devices is given. The example of calculation for a damper and quencher is carried out. Calculations show that use of seismoprotection devices reduces K3 coefficient more, than twice. This circumstance allows to draw a conclusion that the offered damping device reduces seismic loading almost with the same efficiency as quenchers (difference by 0,3 times), falling on the protected construction on 1–2 points.

Keywords: Seismoprotection devices, damper, seismoquencher, dissipation coefficient, fluctuation decrement, seismoinfluence.

When calculating the degree of impact of seismic effects, taking into account active seismic protection on the object of study, follow the normative data laid down in KMK 2.01.03–96 "Construction in seismic areas". Table 2.7 of clause 2.13 KMC normalizes the coefficient α depending on the seismicity of the construction site (in points). In order to determine the correction value of the coefficient, the coefficient of acceleration reduction K_3 is introduced, which is necessary to take into account the cumulative effect of active seismic protection devices on the protected building.
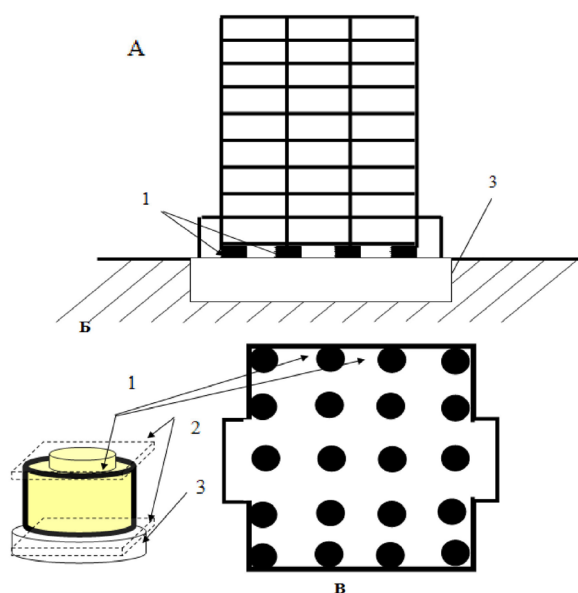
A) view of the facade of the building; B) axonometry of the damper device; C) the location of the 23 –damper devices under the building. 1 – paronite damping device; 2 – metal fastening plates; 3 – reinforced concrete cushion (basement production compartment)
Figure 1. Layout of damping devices under the building

The estimated value of K_3 – as shown in the work of L. L. Soldatova. This determined from the condition of not exceeding the total shear force above the level of the sliding belt, according to the formula:

$$K_3 = f_{tp} \sum_{k=1}^{n} Q_k \bigg/ \sum_{k=1}^{n} S_{ik} \qquad (1)$$

where: $f_{\text{тр}}$ – coefficient of sliding friction in the supports when using seismic protective devices;

$f_{\text{тр}}$ – allowed to specify on the basis of model or field tests.

For the case of calculation without seismic protection device for concrete, $f_{\text{тр}} = 0.445$

For the damping device, $f_{\text{тр}} = 0.2775$; For dampers $f_{\text{тр}} = 0.1304$;

ΣQ_{kd} – the sum of vertical loads when using a damper;

$\Sigma S_{\partial k}$ – total shear seismic force when using a damper.

ΣQ_{kg} – the sum of vertical loads when using a damper;

ΣS_k – is the total shear seismic force in use.

A number of refinements are also taken from the KVM, the coefficient α was determined according to table 2.7, depending on the seismicity of the construction site, laid down for the determination of Sik.

$$Sik = K_0 K_n K_{\text{зм}} K_p S_{oik} \qquad (2)$$

where, K_0 coefficient of responsibility taken according to table 2.3, depending on the limit state adopted for the building, for structures according to the degree of importance of such power plants is assumed to be 1.5;
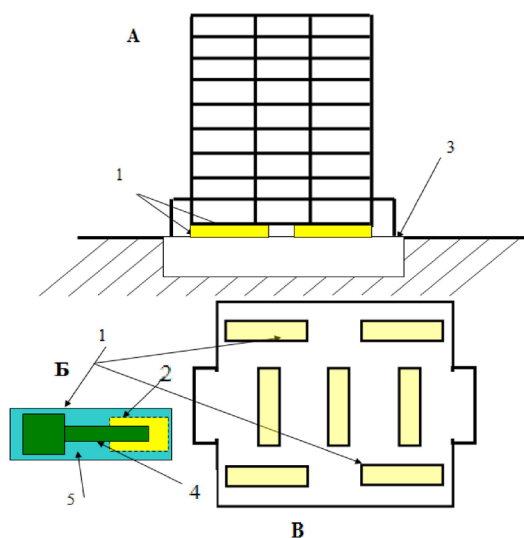
A) view of the facade of the building; B) damper circuit; B) the location of the 7 – absorbers under the building. 1 – Extinguisher; 2 – Pneumosupercharger; 3 – reinforced concrete cushion (basement production compartment) 4 – rod with a piston; 5 – Fluid damping

Figure 2. Layout of dampers under the building

K_n – factor of taking into account the frequency of earthquakes, taken according to table 2.4 is equal to 1.2;

$K_{\text{зм}}$ – the coefficient depending on the number of floors of the building, taken in paragraph 2.17 equal to 1.

K_p – coefficient of regularity, determined according to item 2.25 is taken equal to 1.

S_{oik} – the average value of seismic load corresponding to the i-th tone of natural oscillations, determined under the assumption of elastic deformation of the structure using the formula.

$$S_{oik} = aQ_k W_i K_\delta \eta_{jk} \qquad (3)$$

where, Q_k – loads (permanent and temporary), causing inertial force at the point k and are determined by clause 1.3 KMK 2.01.07–96 "Building codes and rules for the load and impact."

η_{jk} – coefficient depending on the shape of the building deformation during its free vibrations, is taken according to the KMK p. 2.18 and 2.19. calculated by the following formula.

The design scheme with a dynamic oscillation damper – m (x) is the linear mass of building structures. $X(x)$ is the ordinate of the normalized form of the natural oscillations of the building, according to the basic tone (the ordinate at the point of suspension of the damper is taken

to be unity). mk is the mass of structures for loads, concentrated at the point with coordinate x_k. h is the total height of the building. n – total number of concentrated masses. F_{mp} – dry friction force in the C_r extinguisher – viscous friction coefficient in the U_k extinguisher acceleration of the base during an earthquake.

$$\eta_{ik} = X_k \sum_{j=1}^{n} Q_j X_j \bigg/ \sum_{j=1}^{n} Q_j X_j^2 \qquad (4)$$

For the parameters of the building shown in Fig. 1. A, the calculated value of η_{jk} without seismic protection is 1.049, for the case of using a damper device, $\eta_{jk\partial} = 1.213$, for the case of using a damper, $\eta_{jk\partial} = 1.104$. Kδ – coefficient taking into account the dissipative properties of the structure, is taken in accordance with paragraph 2.16. KMK 2.01.03–96 according to the formula: α is the coefficient determined according to table 2.7 depending on the seismicity of the construction site; W_i is the spectral coefficient determined by item 2.14 depending on the period of natural oscillations of the building, in our case it is assumed to be equal to 0.83 [10]. At the same time, the period of free oscillations found experimentally was used as a period, i.e. $T = 0.5$ sec.; Estimated value

A   B   Q
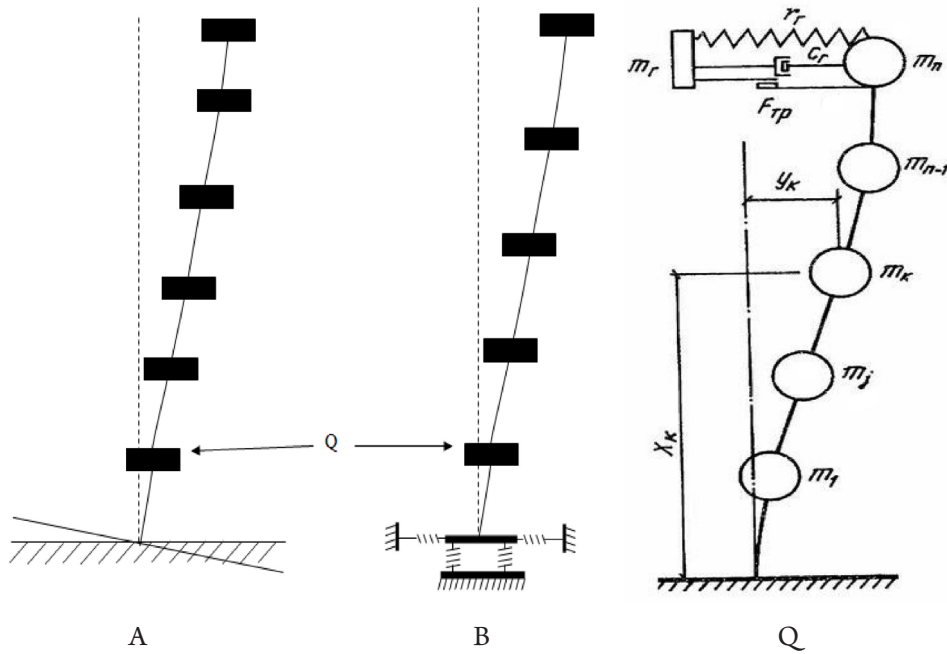
Q – load per floor. Comparative schemes of the building: A – without damping device; Bx– with damping device

Figure 3. Design schemes for the damper and damper
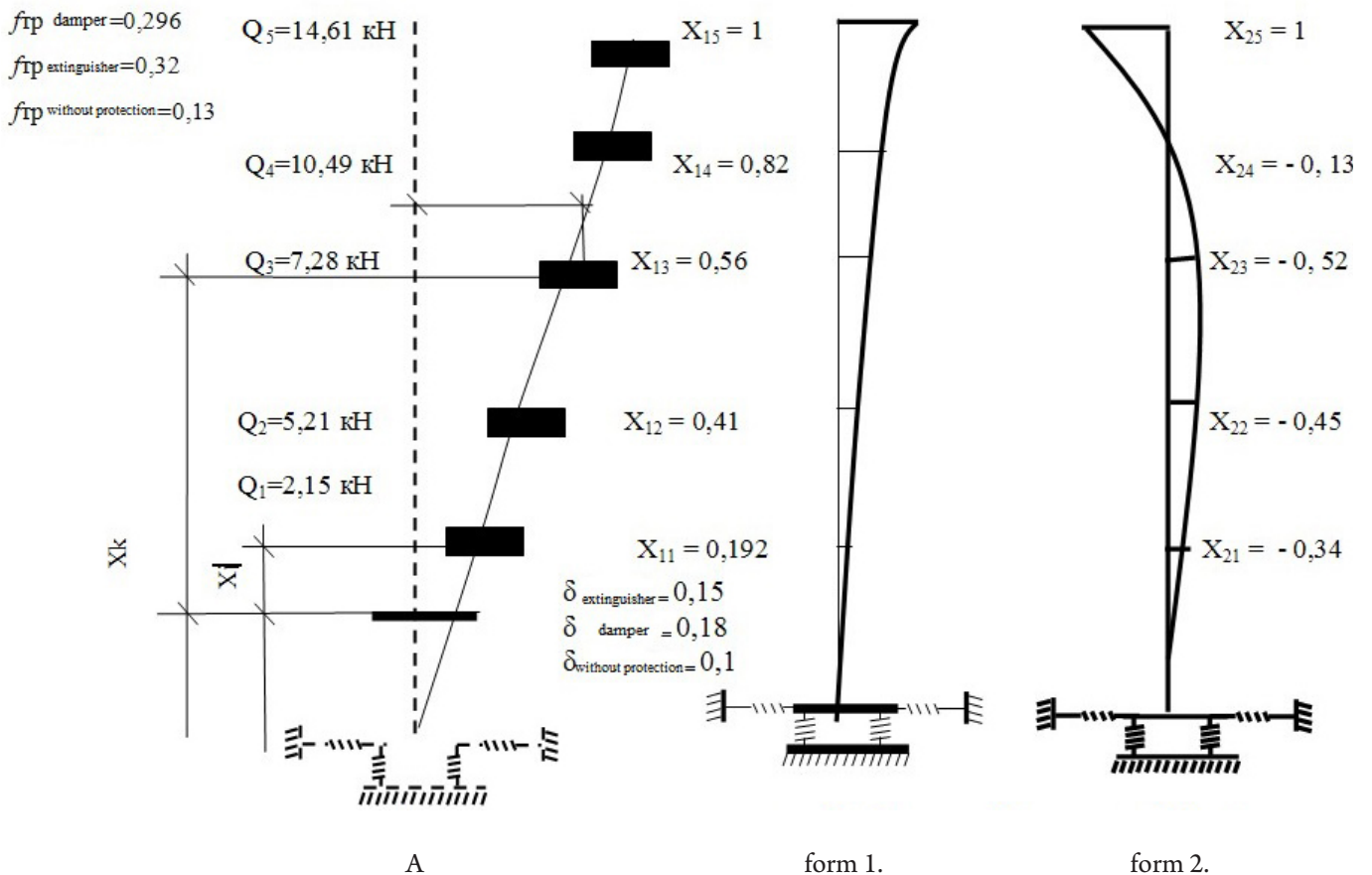

A   form 1.   form 2.

Figure 4. Design scheme (A) 1st and 2nd forms (B) of free vibrations of a building when using active seismic protection: where: δ is the decrement of active seismic protection oscillation; f_{rp} – coefficient of sliding friction when using active seismic protection

$k = 13.59$ кPa. $\left(0.548 - \sqrt{\delta}\right)\left(0.1 + 0.7/\sqrt{T_1}\right)K_\delta = e$ (5)

where, δ is the decrement of oscillation, taken from the results of full-scale tests in the elastic stage of buildings (structures) similar to the designed one. According to the results of experimental data for a building without a damper, $\delta = 0.10$. For the case of the use of the damping device, $\delta = 0.15$; For the case of damper $\delta = 0.18$;

T_1 – the period of natural oscillations of the building, taking into account the use of active seismic protective systems, is assumed to be 0.5 seconds, for a building without damping systems 0.3 seconds Consequently,

$$K\delta_{(extinguisher)} = e^{\left(0.548 - \sqrt{0.18}\right)\left(0.1 + 0.7\right)/\sqrt{0.5}} = 1.23,$$

$$K\delta_{(damper)} = e^{\left(0.548 - \sqrt{0.15}\right)\left(0.1 + 0.7\right)/\sqrt{0.5}} = 1.28,$$

$$K\delta_{(without\ damper)} = e^{\left(0.548 - \sqrt{0.1}\right)\left(0.1 + 0.7\right)/\sqrt{0.3}} = 1.73$$

Substituting the obtained values in (3), we determine that Soik with 8 points without a damping device is 5.68 kN, when using a damping device 6.01 kN, based on a damper 6.2 kN. Calculation Sik.

$$S_{ik(extinguisher)} = 1 \times 0.9 \times 1.23 = 1.107 \text{ кН}$$

$$S_{ik(damper)} = 1 \times 0.9 \times 1.28 = 1.15 \text{ кН}$$

$$S_{ik(without\ protection)} = 1 \times 0.9 \times 1.73 = 1.557 \text{ кН}$$

The data obtained make it possible to calculate the coefficient K_3:

$$K_{3(extinguisher)} = 0.296 \times 14.61/1.107 = 3.906$$
$$K_{3\ (damper)} = 0.32 \times 14.61/1.15 = 4.065$$
$$K_{3\ (without\ protection)} = 0.13 \times 14.61/1.557 = 1.219$$

After determining K_3, the values of horizontal seismic loads Sik reduced by the use of a damping system, taking into account which it is necessary to calculate the above-ground structures of the building, are found using formulas (1) and (3) with the replacement of a values by aK_3 values.

$$S_{ik(extinguisher)}{}^* = S_{ik(extinguisher)} \times K_{3(extinguisher)} = 1.107 \times 3.906 = 4.32$$
$$S_{ik(damper)}{}^* = S_{ik(damper)} \times K_{3(damper)} = 1.15 \times 4.065 = 4.67$$
$$S_{ik(without\ protection)}{}^* = S_{ik(without\ protection)} \times K_{3(without\ protection)} = 1.557 \times 1.219$$
$$= 1.899$$

The reduction of S_{ik} for the case of using a damping device as compared to the variant without using a seismic protection device a seismic device is $4.67/1.899 = 2.46$ times. Comparing with the quencher for the variant, the $4.32/1.899 = 2.276$ times.

Thus, the calculations show that the use of seismic protection devices reduces the coefficient K_3 more than twice. This circumstance allows us to conclude that the proposed damping device reduces the seismic load with almost the same efficiency as absorbers (difference by 8%) falling on the protected structure by 1–2 points. However, it must be borne in mind that the cost of damping devices much cheaper compared to dampers. In addition, damping devices have a high degree of interchangeability.

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ANALYSIS OF THE MODERN CONDITION OF THE METHODS OF CONTROL OF HUMIDITY OF AGRICULTURAL MATERIALS

Abstract. The article discusses the main stages of controlling the humidity of raw cotton while ensuring product quality. Analyzed the role of moisture control in the reception and processing of raw cotton. Defined trends in the development of methods for measuring humidity.

Keywords: raw cotton, moisture, moisture measurement methods, the main stages of control.

In modern measuring processes in the cotton industry, monitoring and measuring devices that control humidity with high accuracy are required. One of the important tasks of technical progress in the cotton-growing and cotton-ginning industry is the creation and implementation of moisture control devices for raw cotton and other cotton materials, primarily because the moisture index affects the physical, mechanical and chemical properties of the material. The moisture content of cotton is necessary to maintain quality from the moment cotton is in the field, until the bale is processed into yarn and fabric. Moisture in cotton affects color, length and strength.

During the sowing of cotton, the quality and similarity of the seed depends on the moisture content of the seeds. During the period of harvesting and harvesting, it is necessary to determine the moisture content of raw cotton for mutual settlements with suppliers, as well as for proper storage, storage and, if necessary, pretreatment. Optimum cleaning efficiency is achieved only when the moisture content in the seeds of cotton is about 6%. In the early season of cotton, the moisture content in seed cotton is about 10–15%, which makes it difficult to clean the cotton, and also affects the efficiency of the process. Effective cotton gin can only be achieved when the moisture content of the cotton seed is about 8%.

Humidity control during the storage of raw cotton is of great importance for the cotton industry. In technological processes of cotton preprocessing, its increased humidity causes an increase in energy consumption, a decrease in the efficiency of cleaning and ginning, and an increase in the yield of lower quality fibers. In the production of cottonseed oil, the effectiveness of the use of raw materials, the quality and yield of the final product depend on the moisture content of cotton seeds.

The main stages of moisture control in the production and processing of raw cotton are shown in (Figure 1).

The moisture indicators of cotton and its products are of great importance when:

a) in cotton-growing, during sowing and harvesting, in the processes of storage and delivery;

b) in the procurement system in the processes of acceptance, storage and transportation;

c) in the industry, technological processes of the cotton-cleaning industry and in the production of cotton oil;

d) in the industry processing cotton as a raw material for the production of cotton yarn and cellulose.

The conductometric method is based on the dependence of the electrical conductivity of the sample material on its humidity. With increasing humidity, the conductivity of the material increases, which is provided by a growing number of charge-ion carriers. A large number of various moisture meters (for example, the following models, like WALCOM TK-100C, GMH 38-LW1/LW2, GMH2710, GMH 3810) of agricultural materials are based on this method. Advantages of the conductometric method – its implementation, as well as high sensitivity in the range of low moisture content. The disadvantages of this method when using it to determine the moisture content of cotton and its products include the effect on the result of measuring the density of the material, which determines its bulk resistance; temperature, which depends on the ionic conductivity inherent in moisture-containing dielectrics and semiconductors; chemical composition of the material and the humidifier, which determines the resistance; surface conductivity of the material affected by cotton seed drooping.

The problem is that, despite the development of elements and devices of measuring equipment, the thermogravimetric method for controlling humidity with a sufficient number of flaws remains as an exemplary (reference) method for measuring this parameter. The essence of the

thermogravimetric method is that the masses of the sample are measured before and after air-heat drying. The standard method is characterized with significant losses of energy and labor resources. The thermogravimetric method has several drawbacks: a significantly large number of certified technical means is required; it takes more time to complete the experiment; laboratory conditions are required, it is impossible to measure in the mobile mode, and the method is not suitable for continuous control of the material in the stream. As is known, the essence of the method for measuring the moisture of products consists in extracting water from the material being analyzed by evaporation by heating a sample. Thermogravimetric method (TGM) is absolute and is used as an initial tool in measuring humidity.

Cotton moisture control

Cotton seed moisture control
Raw cotton moisture control during harvest
Moisture control of raw cotton during its processing
Cotton moisture control before packing in bales
Humidity control of raw cotton at cotton points
Control of raw cotton moisture before compaction in riots
Control of moisture of cotton seeds upon delivery to the oil and fat factory

Figure 1. Stages of moisture control in the production and processing of raw cotton

One of the non-destructive indirect and most common is the capacitive method of moisture control of cotton materials, which provides efficiency, significantly reduces energy and labor resources to perform humidity control, and also significantly expands the range of controlled materials.

The infrared method of moisture control for agricultural and fibrous materials and products of its processing takes a considerably widespread introduction. The physical basis for controlling the humidity of the infrared method is characterized by significantly high accuracy ($\pm 0.5\%$). The infrared method of moisture control can be applied to a wide range of materials, besides it has the functionality in a wide range of moisture control%. In addition, the infrared method of moisture control is characterized by a long duration of moisture control (up to several hours) and it is not applicable to moisture control in a stream.

The analysis of published works and foreign practice shows that the thermogravimetric method has the most ac-curate moisture control – up to%. The analysis of the methods for controlling the humidity of cotton materials shows that the thermogravimetric method has the best actual metrological properties. Among the methods for controlling the humidity of cotton materials (raw cotton, fiber, seeds and products of its processing), the thermogravimetric method has become popular. It is characterized by high accuracy, but requires a lot of time, and therefore not suitable for continuous monitoring of the material in the stream.

The microwave method is based on the interaction of electromagnetic waves with a frequency from 50 MHz to 30 GHz with the material under study. The principle underlying it is simple and consists in measuring the parameters of a transmitted or reflected wave, previously collected in narrow beams with the help of a transmitting and receiving antenna, after interacting with the material. The most common is the method of measuring moisture by absorbing microwave energy. It is

simple in terms of technical implementation, has a high sensitivity, a wide dynamic range, low measurement error, low cost equipment in the most common three-centimeter wavelength range. However, moisture meters based on this method have so far not found wide industrial use.

Studies have shown that the result of moisture measurement by the amplitude microwave method is mainly influenced by the temperature of the material, the degree of heterogeneity in the sample volume and the uneven distribution of moisture between the components. Depending on external influences (humidity and air temperature, intensity of sunlight) and time elapsed between the specified natural effects and the moment of measurements, the moisture content of cotton changes, and the moisture is redistributed between the fiber and the seeds and differs from the equilibrium. At the same time, the electrophysical parameters of the raw cotton sample change, which also leads to an error in measuring its humidity at the microwave.

The undoubted advantage of capacitive measuring transducers is the ability to control the investigated volume of the material over a wide range by changing the geometric parameters of a capacitive transducer and the intensity of its field. Due to the rapidity of measurements, ease of use, low cost and acceptable accuracy, the capacitive method of control has been widely used in moisture measurement of cotton materials. Currently, the capacitive method means are used in agricultural production technologies, mainly to control the moisture content of cotton materials.

After analyzing the methods, it can be said that it is advisable to use them not as separate methods to increase the accuracy and reliability of the control, but in combination with other methods, as a necessary condition. The dielectric constant of a substance is measured at different temperatures, for example, positive and negative. The theoretical possibility of compensating for the influence of a variety of substances is present, but in practice, even with deep freezing, some of the water remains in a liquid state and the amount of unfrozen water can be determined only approximately. The process of freezing a substance, for example, moving in a continuous flow, is also difficult and not always possible. The problem is that the dielectric constant of the controlled material – the objects of control is not normalized and varies significantly even for one type of object under study. Take into account the full range of such changes is almost impossible.

The analysis revealed that the group of methods using capacitive transducers is the most promising. It is the capacitive method and transducers that should be taken as the basis for developing raw cotton transducers for moisture control.

The capacitive method of moisture control involves exposing the material under control to an electromagnetic field and an appropriate analysis of the behavior of the material in this field. Such measuring devices are widely used due to a number of incontestable advantages, the main ones of which are:

– the ability to use them to control the humidity of a wide class of materials of the agro-industrial complex

– the use of such systems is relatively simple, inexpensive, easy to use and highly reliable in the work of electronic equipment;

– lack of potential danger to attendants;

– ease of obtaining a unified output signal.

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NORMALIZATION OF CHARACTERISTICS OF MEASUREMENT MEANS AND CLASSES OF ACCURACY OF MEASUREMENT MEANS

Abstract. The article discusses the valuation of the metrological characteristics of measuring instruments. The features of the definition and confirmation of the actual metrological characteristics of measuring instruments.

Keywords. measuring instruments, metrological characteristics of measuring instruments, error, normative document, methodology.

Obtain quantitative information about the objects and phenomena of the world around us is possible only by measurement.

During measurements, the value of a quantity is obtained (its quantitative estimate) in the form of a certain number of units taken for this quantity – a numerical value.

Quantities that can be quantified, i.e. can be measured, called measurable quantities.

The correctness of the value of a quantity obtained by measurement is characterized by the degree of its approximation to the true value of this quantity.

The true value of a quantity belongs to the category of absolute truth, therefore in practice it is replaced with a real value.

Each practical dimension is subject to a specific goal, the error in the measurement is its error.

The accuracy of each measurement in technical and economic terms must be consistent with the purpose of the measurement itself.

Types, methods and methods of measurement are objects of consideration of theoretical and applied metrology and are selected in accordance with a specific measurement task.

The measurement error, and hence its instrumental component, must correspond to the purpose of the measurement. For this, a prerequisite is a preliminary calculation of the determination of the possible measurement error of a given value, by this measuring instrument under the specified conditions. The solution of this task is possible only if there is information on the limits of permissible values of all metrological characteristics of the measuring instrument. Therefore, the metrological characteristics of measuring instruments are subject to standardization – the establishment in regulatory documents of measuring instruments of nominal values and the limits of permissible deviations of the real metrological characteristics of measuring instruments from their nominal values.

Along with the characteristics of the errors of measuring instruments, the following are subject to rationing: characteristics intended to determine the results of measurements;

sensitivity characteristics of measuring instruments to changes in operating conditions;

characteristics that determine the response of measuring instruments to a change in the measured value in the measurement process (dynamic characteristics);

characteristics that determine the interaction of measuring instruments with the object of measurement and the connection to the output of the measuring instrument of any components.

In addition to the normal conditions for measuring instruments, the operating conditions of application are normalized – the intervals of values of the influencing quantities, within which the errors of the measuring instrument are normalized.

The use of measuring instruments in conditions other than operating conditions is unacceptable.

General requirements for standardized metrological characteristics of measuring instruments are set forth in GOST 8.009.

Technical means used in measurements and not having standardized metrological characteristics do not belong to measuring instruments.

When calculating the estimated error of measuring instruments under actual operating conditions, according to their normalized metrological characteristics, it is necessary to take into account all the relevant errors for these measuring tasks that constitute the errors of these tools.

In order to rationalize the choice of measuring instruments for solving specific measuring tasks, the form for expressing limits of permissible basic and additional errors of measuring instruments when standardizing them is selected taking into account the design features, principle of operation, conditions of use and purpose of measuring instruments and depending on the nature of the variation of errors within the measuring range.

For a qualitative comparison among themselves of measuring instruments of the same type, that is, the same accuracy class for measuring the same value and having different limits of permissible errors, the concept of accuracy class is used.

The accuracy class of measuring instruments is a generalized characteristic of this type of measuring instrument, reflecting their level of accuracy, determined by the limits of permissible basic and additional errors, as well as other characteristics affecting accuracy.

It should be noted that the accuracy class of measuring instruments, representing an indicator of their level of accuracy, is not a direct characteristic of the accuracy of measurements performed using these means. As mentioned above, the measurement error depends on a number of factors, including the measurement instrument error. The error of measuring instruments, in turn, depends on the influencing quantities, which in actual operating conditions can be combined in various ways.

Therefore, the accuracy class should be considered only as a symbol characterizing the error of measuring instruments, and not absolutize this concept. For example, the use of a measuring instrument of accuracy class 1.5 does not mean that the measurement error of this device will not exceed 1.5%.

Accuracy classes of measuring instruments are established in standards or technical conditions containing technical requirements for measuring instruments, divided by accuracy.

The designations of accuracy classes are applied directly to the measuring instruments and are indicated in the technical documentation on the measuring instruments.

To facilitate the selection of measuring instruments, the designation of accuracy classes is determined by the form of expressing the limits of the permissible basic and additional errors of measuring instruments.

The basic requirements for the forms of expression of the limits of permissible errors of measuring instruments and the designations of their accuracy classes are given in GOST 8.401.

Depending on the nature of the manifestation, systematic and random components of the error of the measuring instrument are distinguished; each of these components, depending on the form of the numerical expression, can be represented as an absolute or relative error.

The errors of measuring instruments depend on the conditions of their operation, so they are usually divided into the main and additional ones.

The metrological characteristics of measuring instruments are subject to standardization – the establishment in regulatory documents of measuring instruments of nominal values and the limits of permissible deviations of the real metrological characteristics of measuring instruments from their nominal values.

For each tool normalized and (or) working conditions of operation.

The use of measuring instruments in conditions other than operating conditions is unacceptable.

Technical means used in measurements and not having standardized metrological characteristics do not belong to measuring instruments.

When calculating the estimated error of measuring instruments under actual operating conditions, according to their normalized metrological characteristics, it is necessary to take into account all the relevant errors for these measuring tasks that constitute the errors of these tools.

The accuracy class of measuring instruments is a generalized characteristic of this type of measuring instrument, reflecting the level of their accuracy.

Accuracy class should be considered only as a symbol characterizing the error of measuring instruments.

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SODIUM TRIPOLYPHOSPHATE FROM EXTRACTION PHOSPHORIC ACID ON THE BASIS OF PHOSPHORITE OF CENTRAL KYZYLKUM

Abstract. The article presents the results of obtaining sodium tripolyphosphate from the extraction phosphoric acid based on phosphorites of Central Kyzylkum.

Research processes of clearing extraction phosphoric acid and obtaining pure solutions of a mixture mono- and disodiumphosphates, their deep clearing from magnesium salts by gaseous ammonia and influence of duration of process dehydration and calcination temperature on a chemical compound sodium tripolyphosphate.

The optimal technological parameters of the dehydration process were established – temperatures of 450–500 °C and a process duration of 2 hours. Thus sodium tripolyphosphate on a basis extraction phosphoric acid from phosphorites Central Kyzylkum contains not less than 57,00% P_2O_5.

Keywords: extraction phosphoric acid, desulfurination, defluorination, barium carbonates, sodium, ammonia, evaporation, filtration, drying, calcining

Introduction

The condensed phosphates of alkali metals are widely used in various industries, such as food, cosmetic, pharmaceutical, chemical, construction and etc. [1].

Depending on the application conditions and requirements for the properties, separate polyphosphates and mixtures of variable composition are used. Among alkali metal polyphosphates are the most commonly used sodium polyphosphates, which have significant restructuring properties and rather high solubility in water [2; 3].

Sodium polyphosphates are actively used for preliminary water treating and anticorrosive protection of pipelines of turnaround water supply. Sodium tripolyphosphate is one of the basic making synthetic washing-up liquids. For manufacture of sodium polyphosphate it is necessary phosphoric acid. The republic Uzbekistan has no high-quality phosphatic raw materials, suitable for reception of thermal phosphoric acid. Obtained of phosphorites Central Kyzylkum extraction phosphoric acid (EPA) is strongly polluted by various impurity [4]. The organisation of manufacture of sodium polyphosphate on the basis of EPA from phosphorites Central Kyzylkum is an actual problem of a chemical science and production workers.

Objects and methods. As a source of EPA used acid of manufacture of JSC "Ammofos–Maxam", which are obtained in the dehydrate mode of washed burnt phosconcentrate Central Kyzylkum compound (mass.%): P_2O_5–18.31; SO_3–2.32; CaO–0.31; MgO–0.68; Al_2O_3–0.77; Fe_2O_3–0.68; F–1.25.

Preliminary clearing of acid of fluorine and sulphates spent washed burnt фосконцентратом, a carbonate and sodium metasilicate at their mass ratio 1.4:1. At the first stage at introduction of metasilicate of sodium and a sodium carbonate in EPA reactions proceed:

$$H_2SiF_6 + Na_2CO_3 \rightarrow Na_2SiF_6 + CO_2 + H_2O$$
$$6HF + Na_2SiO_3 \rightarrow Na_2SiF_6 + H_2O$$
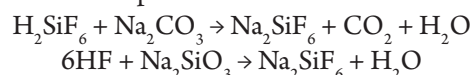
Introduction of sodium metasilicate is necessary for fluorine linkage in sodium hexafluorosilicate, since EPA from phosphorites Central Kyzylkum contains no more than 0,15% of soluble silicates. Introduction of metasilicate of sodium allows to raise degree of sedimentation of fluorine from 38–40% to 80–85% [5; 6].

Washed burnt phosconcentrate contains to 57% оксида calcium from which 15–17% is in the form of Ca O. The introduction of washed burnt phosconcentrate promotes decrease in the maintenance of sulphates as a result of reaction course [7; 8].

$$H_2SO_4 + CaO + H_2O \rightarrow CaSO_4 \cdot 2H_2O$$

The cleared acid contains (mass.%): P_2O_5–16.98; SO_3––0.74; CaO–2.09; MgO–0.64; Al_2O_3–0.73; Fe_2O_3–0.65; F–0.34.

Analysis of the acid, intermediate and final products was performed using known methods of chemical analysis [9–11].

Results and discussion. The second stage clearing EPA Central Kyzylkum consists in neutralisation of the defluorinated and desulphated acids with soda ash, as a result of which a number of chemical processes take place, described by the following equations:

$$2H_3PO_4 + Na_2CO_3 = 2NaH_2PO_4 + CO_2 + H_2O$$
$$2Ca(H_2PO_4)_2 + Na_2CO_3 = 2CaHPO_4\downarrow + 2NaH_2PO_4 + CO_2 + H_2O$$
$$Fe, Al(H_2PO_4)_3 + Na_2CO_3 = Fe, Al(PO_4)\downarrow + 2NaH_2PO_4 + CO_2 + H_2O$$
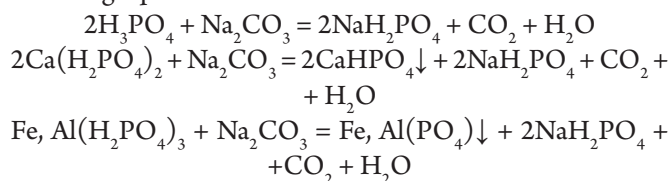
At increasing quantities of an entered carbonate of the sodium, the formed salt sodium dihydrophosphate, transmuted in sodium hydrophosphate on reaction:

$$NaH_2PO_4 + Na_2CO_3 \rightarrow Na_2HPO_4 + NaH_2PO_4 + CO_2 + H_2O$$

Regulating the ratio $Na_2O : P_2O_5$ it is possible to achieve the necessary maintenance mono- and disodiumphosphate in a solution. However, the obtained mixture of sodium orthophosphate contains 0,50–0,64% of magnesium oxide, which in final total reduces quality of sodium polyphosphate.

To reduce the content of magnesium oxide in neutralized with sodium ash EPA to pH = 6.1–6.5, gaseous ammonia was introduced in a molar ratio (NH_3 : MgO) of 1:1, 1.5:1 and 2:1. An increase in pH to 7.5–8.1 leads to the precipitation of magnesium in the form of crystallohydrates $MgNH_4PO_4 \times \times 6H_2O$ and, accordingly, to a decrease in the content of magnesium oxide.

$$MgO + NH_3 + H_3PO_4 + 5H_2O = MgNH_4PO_4 \text{ x } 6H_2O\downarrow$$

In (table 1) results of influence of the molar ratio NH_3 : MgO on the degree of magnesium deposition.

Table 1. – Influence of process ammoniation on a chemical compound of solutions of sodium phosphate

№	NH_3/MgO	pH	Na_2O	P_2O_5	SO_3	CaO	MgO	Al_2O_3	Fe_2O_3	F	$N_{tot.}$
1.	–	6.2	9.93	14.60	0.0009	0.0031	0.51	0.0024	0.0021	0.0020	–
2.	1.0	7.5	9.93	13.60	0.0010	0.0028	0.0035	0.0018	0.0016	0.0015	0.084
3.	1.5	7.8	9.89	13.54	0.0010	0.0022	0.0023	0.0016	0.0014	0.0012	0.111
4.	2.0	8.1	9.87	13.52	0.0010	0.0021	0.0022	0.0015	0.0013	0.0011	0.122

The table shows, that ammonia introduction in neutralised to pH = 6.2–6.5 a carbonate of sodium EPA sharply reduces the maintenance of magnesium oxide in a solution from 0.51% to 0.0035–0.0022% depending on the ratio NH_3 : MgO or pH 7.5–8.1. The content P_2O_5 in a solution makes 13.52–13.60%, Na_2O 9.87–9.93%. The content of other impurity changes slightly.

In (table 2) shows the data on the influences of temperature on filtration speed of the ammoniated sodium phosphate solutions.

Table 2. – Influence of temperature on the filtration speed of neutralised and ammoniated solutions

№	Temperature, °C	Filtration speed, kg/m²·h		
		on a pulp	on a deposit	on a filtrate
1.	20	6948	834	6114
2.	40	8900	1068	7832
3.	60	10080	1210	8870
4.	80	10685	1282	9403

An raising in the filtration temperature from 20 °C to 80 °C contributes to an increase in the filtration speed of the pulp from 6948 kg/m² · h to 10685 kg/m² · h. Accordingly, the filtration speed on a deposit make 834–1282 kg/m² · h and on a filtrate 6114–9403 kg/m² · h. The formed deposit magnesiumammoniumphosphate is filtered very well.

In (table 3) shows values of density and viscosity of the ammoniated solutions after branch magnesiumammoniumphosphate in dependence on temperature for pH 7.5, 7.8 and 8.1.

Table 3. – Influence of degree neutralization extraction phosphoric acid a sodium ash and ammonia on the rheological properties of the cleared solutions

pH	Density, g/cm³					Viscosity, mPa · s				
	20 °C	40 °C	60 °C	80 °C	100 °C	20 °C	40 °C	60 °C	80 °C	100 °C
7.5	1.256	1.247	1.239	1.231	1.224	5.89	3.79	2.63	2.02	1.80
7.8	1.258	1.249	1.241	1.233	1.226	5.95	3.86	2.69	2.08	1.85
8.1	1.261	1.252	1.244	1.236	1.229	6.01	3.92	2.74	2.12	1.89

Density of solutions with increase pH with 7.5 to 8.1 raise and make 1.256–1.261 g/sm³ at 20 °C and 1.231–1.236 at 80 °C.

Viscosity of solutions with increase pH also raise and make 5.89–6.01 мPa·s at 20 °C and decrease to 2.02–2.12 мPa · s at 80 °C. The cleared solutions of sodium phosphate have good rheological properties.

For obtain sodium tripolyphosphate defluorinated and desulphated EPA have neutralized with sodium ash to pH 6.2,

parity $Na_2O : P_2O_5 = 0.73$, ammoniated to pH 8.1, filtered, evaporated to a wet state, dried at temperature 100–105 °C and calcinated.

Influence of the process duration on the change in the chemical compound dehydrated sodium phosphates studied at 400 °C (tab. 4).

Table 4.– Influence of duration of process dehydration at temperature 400°C on a chemical compound of sodium phosphate, obtained at pH = 6.2 and $Na_2O : P_2O_5 = 0.73$

№	τ, min	Chemical compound, mass.%								
		Na_2O	P_2O_5	SO_3	CaO	MgO	Al_2O_3	Fe_2O_3	F	$N_{total.}$
1.	30	40.43	55.38	0.0041	0.0084	0.0087	0.0062	0.0056	0.0014	0.0751
2.	60	40.78	55.86	0.0045	0.0088	0.0091	0.0069	0.0063	0.0016	0.0556
3.	90	41.02	56.19	0.0048	0.0091	0.0094	0.0075	0.0069	0.0018	0.0433
4.	120	41.18	56.41	0.0050	0.0093	0.0096	0.0080	0.0073	0.0019	0.0358
5.	150	41.20	56.43	0.0051	0.0094	0.0097	0.0082	0.0075	0.0019	0.0394

With increase in the duration calcination raises the content of all components. The P_2O_5 content with a calcination time of 30 minutes is 55.38%, after 120 minutes it is 56.41%, the content Na_2O under these conditions raises from 40.43% to 41.18%. Other components raise on 0.001–0.002%. The nitrogen content decreases from 0.0751% to 0.0394%.

Table 5.– Influence of temperature on a chemical compound of sodium polyphosphate at process duration 2 hours

№	T, °C	Chemical compound, mass.%											P_2O_5, degree polimer.	pH 1%-s' solut-s	u.d.
		Na_2O	P_2O-$5tot.$	$P_2O_{5p\text{-}oli.}$	$P_2O_{5w\text{-}ater.}$	SO_3	CaO	MgO	Al_2O_3	Fe_2O_3	F	$N_{tot.}$			
1.	350	40.84	56.73	55.51	1.22	0.0051	0.0093	0.0100	0.0091	0.0085	0.0019	0.0510	97.85	9.6	0.13
2.	400	40.97	56.90	55.85	1.05	0.0054	0.0097	0.0104	0.0094	0.0089	0.0020	0.0364	98.15	9.6	0.13
3.	450	41.03	57.00	56.12	0.88	0.0059	0.0102	0.0108	0.0096	0.0094	0.0022	0.0280	98.45	9.6	0.12
4.	500	41.05	57.01	56.35	0.66	0.0061	0.0105	0.0109	0.0098	0.0092	0.0024	0.0215	98.84	9.7	0.12
5.	550	41.07	57.03	56.52	0.52	0.0063	0.0107	0.0111	0.0099	0.0094	0.0025	0.0172	99.10	9.7	0.12

An raising the temperature with 350 °C to 500 °C contributes to an increase the degree of polymerization from 97.85% to 98.84%. The content P_2O_5 raises from 56.73% to 57.01%, Na_2O from 40.84% to 41.05%. The optimal dehydration temperature are 450–500 °C and the duration of process 2 hours.

Conclusion. Thus, the carried out researches have shown obtaining possibility sodium tripolyphosphate with sedate to polymerisation not less than 98.0%, 57.0% P_2O_5 containing not less. For this purpose it is necessary EPA to clear of impurity by defluorization, desulfurization, deep clearing of sulphates, fluorine and the magnesium, the cleared solution evaporated at temperature 450–500 °C within 2 hours.

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CEMENTS WITH REDUCED COMPOSITION OF PORTLAND-CEMENT CLINKER

Abstract. The results of studies to reduce the amount of clinker in the cement without lowering the grade are presented. As a partial replacement of clinker, it is proposed to use a mineral additive consisting of basalt and steel slag.

Keywords: cement, clinker, mineral additive, basalt, steel slag, grade.

Introduction

One of the effective directions of reducing energy costs in the production of cement is the decreasing the clinker part on the behalf of using other structural components of cements. These measures give also the possibility of the decreasing the critical emissions of carbon dioxide into the atmosphere solving the ecological issues of the production.

The term "Composite Portland cement" is used by the European standards into the cements where as a fundamental composition of the component granulated blast-furnace slag, amorphous siliceous rocks, natural pozzolan, limestone, lime ash are used to the combinations of these cements with each other [1].

In the world cement industry there is a tendency of substantial reduction in the share of the clinker in the cement. According to the data [2] in 1990 the percentage of the clinker in the cement was $0.9\,kg/kg$, in 2003 it was reduced to $0.85\,kg/kg$, and in 2010 it was $0.80\,kg/kg$. It means that $0.20\,kg/kg$ of the cement consists of alternative substances, which are considered as the mineral additives.

In parallel with the development of human civilization the issues of the pollution of environment with the wastes of the technological origin are rising. In relation with that the works on the protection of the environment, conservation of nature and their transfer to the next generation in its unmodified form are in progress all over the world.

There are many reasons of usage of wastes. Firstly, they could be used to improve the properties of the cements, on the other hand –for the reduction of the share of the clinker in the cement. Namely, the reduction of the clinker in the cement is reached by the reduction of emissions of CO_2.

With the intensification of the requirements for the protection of environment and the balanced usage of natural resources, it is understandable that there are efforts to reduce the cost of the manufactured goods. In this case one of the perspective directions is the usage of steel smelting slag in the production of cement after its fractioning and magnetic enrichment.

Steel smelting industry is one of the important branches of the economy. Technology of the production of steel and steel smelting production is energy and resource-intensive process. In the process of steel smelting production, besides to the metal slag which is the waste of the production process is formed. Slags of steel smelting are stored in the slag-heaps, as a result needs the maintenance of special treatment for increasing the effectiveness of their usage. It is possible in the process of mechanical, chemical and thermal activation. The most perspective, according to our point of view is the mechanical treatment with the consecutive division into fractions. The intervening magnetic separation of the grinded slag allows excluding from the structure of the slag magnet attractive components. This enrichment of the wastes allows

the realization of ideas on their processing in the construction materials includingcement.

The authors [3] determined that the possibility of the introduction of the 15% of this slag as an additive into the cement. The researchers [4] studied the main characteristics and possibility of the usage of steel smelting slag as anadditive. It was shown [5] that in the introduction in the steel smelting slags with the structure tolerable to decay 30% lime and 5% gypsum the astringent substance with the activity of 20 MPa.

Aim of the research. Our researches were intended for the study of thepossibility of the usage of steel smelting slag as an additive in the production of cement, without the worsening of the physical-mechanical properties and the reduction of type of astringent.

Characteristics of the materials and the methods of the research. In the survey the clinker with the structural content 65,3% C_3S and 7,5% C_3A, fractional waste of the steel smelting production with the size less than 5 mm (slag) and basalt rock was used.

The chemical structure of the basalt rock, mass% losses in the calcinations – 6.35; SiO_2–46.09; Al_2O_3–10.54; CaO–8.47; MgO-8.91. SO_3–0.81; Chemical structure of slag. mass (%): SiO_2–18.6; Al_2O_3–5.01–5.96; Fe_2O_3–19.50–20.50; CaO–41.38–42.10; MgO-12.50–12.60; SO- 0.10–0.20; R_2O_3–0.18–0.22.

Supplements were added in diverse proportions in the grinding of clinker. Grinding of clinker with supplement was completed in the conditions of lab during 1 hour and 20 minutes and in the industrial conditions – according to the tech-

nological regulations. For the preparation of cement solution standard sand was used, and for bibbing – tap water was used. For identification of mechanical assurance factor of the cements beam – sample with the size 4x4x16 cm from the structure of cement: sand=1:3. Methodology of tests – standard.

Obtained data and their discussion. Manifestation of the hydraulic activity of the steel smelting slag is related with the fact that in its structure physical – chemical processes assistingin the increase of their hydraulic activity are undergoing. Quartz substances undergo isomorphs modifications and go into the more active form of siliceous rocks which assist to active bonds of CaO, evolved in the hydratization of cement minerals, and marl materials which are abundant in the structure of slags experience structural changes that's the kaolinite is dehydrated and its transition into the more active form – methakaolinite.

Mechanism of the process of hydratization and the solidification of composite cements could be presented in the following way. In the process of the hydratization of cement the alkalinity of the environment increases which will assist to the destruction of introduced mineral additives which in its turn will determine the process of hydratization en route to the reduction of the preparedness of the products of the solidification of the cement.

According to the results of the lab tests obtained, the introduction of the basalt and slag as amineral additive into the cement allows getting quality cement in its usage in the accessible local materials and the wastes of the production. The value of the durability corresponds to the requirements of GOST (table 1).

Table 1. – Results of the lab tests of cements

№	Supplement		Tonine of grinding,%	The time of clamping together, h-min.		Durability, pressure, MPa
	Basalt	Slag		starts	ends	28 days
1.	8.0	7.0	92.0	2–35	4–45	40.7
2.	15.0	5.0	92.4	2–45	4–55	41.1
3.	8.0	8.0	92.0	3–05	4–55	41.0
4.	7.0	8.0	91.6	2–05	4–15	42.9
5.	8.0	7.0	88.0	2–35	4–55	40.9
6.	7.0	12.0	91.5	2–45	4–25	41.5

Table 2. – The results of the industrial tests of cements

№	Supplement		Tonine of grinding,%	The time of clamping together, h-min		Durability, pressure MPa	
	Basalt	Slag		starts	ends	Steam	28 days
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1.	8.0	7.0	87.2	2–45	4–45	24.2	40.4
2.	15.0	5.0	86.4	2–25	4–35	24.5	40.1
3.	8.0	8.0	87.6	2–05	4–35	24.5	40.1
4.	7.0	7.0	87.2	2–25	4–35	24.9	40.3
5.	8.0	7.0	87.2	2–25	4–45	24.7	40.0

1	2	3	4	5	6	7	8
6.	7.0	12.0	85.6	2–05	4–25	24.3	40.2
7.	7.0	9.0	87.6	2–25	4–45	24.5	40.4
8.	8.0	10.0	88.0	2–25	4–35	24.4	40.1
9.	8.0	9.0	87.6	2–05	4–35	24.2	40.8
10.	9.0	9.0	88.2	2–35	4–35	24.2	40.3

The results of the lab tests are tested in the pipe spherical mills having the size 2.6 × 13 m in the industrial conditions (table 2). With the production of test sample of cements, it was revealed that the introduction of basalt and slag into the cement allows to the increase of the water cement ratio. Average density of cement mixture varies between the range of 26–27.75%. The presence basalt and slag extends the beginning of clamping for 10–40 minutes, and end to 20–30 minutes.

The longest time for clamping has the composition which has basalt 6–8% and slag 7–12%. Mechanical assurance factor of the Portland cements with the diverse slag tenor and basalt rock reaches to 40.1–40.8 MPa [6].

With the basalt composition of 8% and slag of 9% the assurance factor of the multicomponent cement reaches to the sample Portland-cement.

Conclusions. Consequently in the usage of the steel smelting slag it is possible to save part of the expensive clinker, recycle the wastes of the metallurgy, satisfy the requirements of the cement plant in the active mineral additive and produce cement without the reduction of the assurance factor and the type of astringent.

In general the proposed multi component compositions of the cements on the basis of local raw materials and industrial wastes could be accepted to industrial output. The efficiency of the usage of additives depends on the quality of the clinker, type and quantity of introduced additive, and the multi componential charge. The multiplication of components of the mix of the cement grinding, in some situations requires the establishment of extra measures in the introduction of mineral additives. But, the cheapness of the raw material and the wastes of the industrial output is the impulse not only for the reduction of the cost of ready products but also for the intro of measures in the usage of locally nontraditional raw material, protection of the environment in the industrially developed regions. Combing the several components of mineral additive it is possible to receive cement without worsening the physico-mechanical properties and the reduction of the type of astringent.

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EFFECT OF STORAGE AND DRYING ON COTTON FIBER SUPRAMOLECULAR STRUCTURES

Abstract. One of the direct methods for studying the supramolecular structure of polymeric materials, including cotton fibers, is the electron microscopy method. This section describes the results of studying the supramolecular structure of Yulduz variety fibers subjected to different drying temperatures. For the study, raw cotton was taken from three sections of the riot: upper, middle and lower parts. To study the change in the supramolecular structure during these transformations, two independent methods of electron microscopy were used. These research methods allow you to investigate changes occurring on the surface (replica method) and the secondary wall (hydrolysis method) of fibers.

Keywords. Supramolecular structure, polymeric materials, cotton fibers, microscopy, drying temperature.

Currently, ginneries and procurement centers a key problem is the drying of raw cotton and its storage in the riots. Analysis of the published work has shown that by drying the raw cotton at high temperatures, as well as storage in the riots there is deterioration of important characteristics such as breaking load, tortuosity, length and degree of fiber defects, and for a variety of breeding cotton varieties and variations are different [1]. The foregoing requires further study fine microstructure because strength and technological properties of cotton fibers, as well as other polymeric materials, are inextricably linked with changes in their supramolecular structure.

One of the direct methods of investigation of the supramolecular structure of polymer materials, including cotton fibers, is the method of electron microscopy. This section describes the results of studies of the supramolecular structure of fibers of "Yulduz" grade subjected to different drying temperatures. To study the raw cotton were taken from three areas of rebellion: the upper, middle and lower parts. To study changes in the supramolecular structure used two independent methods of electron microscopy studies with data transformations. These techniques allow the study to explore the changes that occur on the surface (replica method) and a secondary wall (hydrolysis method) fibers. Detailed procedure for preparing preparations described in the methodological part of the work.

It is known that on cotton seeding with excessive plant density it is created a microclimate under which the humidity of raw cotton becomes higher than in the crops with highest density and better ventilated. Procurers of raw cotton take all the necessary measures to organize seed collection and ensure the preservation of their quality during processing and storage. Mixed batch of a total fee of quite mature cotton with immature, having a high humidity leads to self-warming and damage to seeds, as well as many of the technological quality deteriorates. Storage conditions (in the riots, warehouses, etc.) stimulate the rapid growth of bacteria and fungi on the raw cotton, which absorb oxygen and release carbon dioxide and heat. Therefore, the quality of seeds and fibers deteriorates.

On cotton purchasing centers and processing plants it is kept for about 80% of procuring raw cotton. Drying conditions to standard moisture, as well as proper storage of raw cotton are key problem of cotton growing and the subject of many studies [2; 3].

The beginning of our research is devoted to the study of the topography of the surface of the raw cotton fibers, taken from the upper, middle and lower parts of the rebellion. Shelf life in the riots was three months. First of all, it should be noted that the topography of the surface of mature cotton fibers harvested from the field, depending on the variety of grades and

forms of cotton (wild, semi-wild, cultural form) is characterized by multiple folds and protrusions disposed on the surface at an acute angle relative to the fiber axis. In this case, there is also the nature of this picture. However, despite the fact that the study was one fiber grade "Yulduz", depending on the storage conditions in coils, the surfaces are slightly different fibers. Thus, the surface of the fibers subjected to the investigation of the upper portion characterized riot more homogeneous structure. Folds and protrusions are arranged at an acute angle to the fiber axis and the distance between the folds is small. The folds are distributed fairly parallel to each other and to the fiber axis. A somewhat different pattern is found when considering the surface of the fibers taken from the study for the middle and lower parts of the uprising during storage. Despite the fact that both samples belong to class "Yulduz", their surface varies dramatically: conserved folding, but the distance between the pleats is much larger than that of a sample taken from the top of riot that is especially evident in the fibers of the bottom riot at storage. The surface of the fiber has a completely different look: the surface is not uniform, there are some folds between globular and shapeless structural elements. Observed effects appear to contribute to conditions of storage of raw cotton in the bottom of the rebellion. As we noted earlier, the analysis of the technological qualities of fibers from different parts of the riot, in samples taken from the bottom of many technological qualities deteriorate sharply. Between the surface uniformity and technological qualities of fibers found in the relationship and A. Muratova and K. F. Gesos. According to the authors, more uniform surface of the fibers, the higher the quality of the fibers. In this case, more uniform surface of the fiber is observed in samples taken from the top, middle, and lower than. Therefore, the deterioration of the technological qualities of the fibers from the top to the bottom of the revolt is also confirmed by the changes occurring in the topography of the surface of the fibers studied. Similar changes were observed in the study of secondary fiber walls by acid hydrolysis.

Using the method of hydrolysis with diluted acid and subsequent dispersion ultrasonically different cotton varieties can detect the presence and quality of aggregates of elementary fibrils micro fibrils fibers. Such micro fibrils units can be regarded as the real morphological units of cotton fibers, interconnected elementary fibrils or bundles of macromolecules with a low order. Hydrolyzability drug dependence on its structure is widely used for fiber quality characteristics determination of crystalline and amorphous materials.

In electronic micrographs clearly revealed the mass of thin and fairly uniform micro fibrils and their aggregates, or so-called crystallites. Their width varies from 100 to 150 A0, depending on the storage space in a riot fiber. It was found that all crystallites aggregated and aggregation is most clearly

manifested in the study of drugs fibers taken from the upper and middle parts of the rebellion. When studying the fibers obtained from the bottom riot (relatively lower strength) together with asymmetric particles observed shapeless particles. The foregoing suggests that these samples are subjected to greater and faster hydrolysis process. From this we can conclude that hydrolyzability associated with fiber strength.

Thus, one can conclude that storage of raw cotton in coils substantially influences not only the processing characteristics, but also on the structure of the fiber, both on the surface and on a secondary wall.

Equally important is the drying of the fibers prior to storage and processing. The process of drying the raw cotton in the first period is done in general by removing the free water from the fiber surface and peeled seeds. When drying occurs in dryers rapid heating and dehydration, and the heating process is much more intense than dehydration. The mechanism of drying wet materials is determined primarily in the drying regime and forms of moisture due to the material, as a basis for the classification which adopted P. A. Rebindera scheme. According to the scheme distinguish: a bond (in the exact proportions); Physicochemical bond (in different, not strictly defined ratios), which is divided into an osmotic and adsorption.

It is known that the raw cotton is a thermo sensitive material and intensifying its drying process at high temperatures, usually accompanied by a change of mechanical properties of fibers and presentation. The scientific literature contains information on studies and the properties of the cotton fiber structure at drying. It should be noted that the difference between types of communication cotton components with moisture leads to a difference of their hygroscopic properties. According to the authors, the sorption capacity of cotton fiber depends on the presence of hydroxyl groups in the cellulose. The energy of hydrogen bonds between water molecules arising and the hydroxyl groups of cellulose is insufficient to destroy the crystal lattice. Therefore, the water sorption occurs only in amorphous regions and crystalline regions are not affected. There are conflicting views on the impact of wax surface layer on their sorption properties. So, Korolev V. K. and Schekoldin M. M. believe that the existence wax layer makes the liquid pervious fiber surface. With regard.to sorption capacity peel and seed kernels, most researchers believe that skin it is higher than that of the seed core.

Thus, raw cotton is a material having hygroscopicity as sorption properties of raw cotton are different components, the uneven moisture removal occurs between the components. In particular it is shown that the fiber drying process is faster than that of seeds. Despite the importance of cotton for the drying process, storage and processing, some aspects

of the problem remains poorly understood. Especially, it concerns the changes of the supramolecular structure of cotton fibers, originating in the process of drying the temperature of raw cotton in the riots.

We have investigated in detail the changes of the supramolecular structure of the variety of cotton fibers "Yulduz" taken from the upper, middle and lower parts of the riot, and dried at 160 and 200 °C.

First of all, look at the at drying the fibers taken from the top of the riot trial.

The topography of the surface of the fibers dried at 160 °C a little differ from sources not dried, but by the nature of the arrangement of the elements on the surface is almost identical to other mature form fibers G. Hirsutum varieties. A little different picture can be observed when drying fibers at 200 °C. Unlike the original, and dried at 160 °C, the topography of the surface is characterized by the numerous folds of the distance between them varies between 0.2–1.3 μm. Along with a smooth surface structure observed gross structural alterations, especially, dramatically changing the angle between the folds and the fiber axis.

The reason for such a violation of the structural heterogeneity of the surface is the effect of high temperature. From the literature it is known that even a short fiber drying (7–30 s) at 150–200 °C leads to structural changes in varying degrees, which confirmed a significant change in density of the cellulose fibers. Another study indicated that the intermittent heating of cellulose to 120–170 °C is no significant structural change, while heating to a temperature above 160–180 °C leads to rapid degradation of the cellulose molecules. The authors argue that this is due to thermal decomposition of the cellulose molecules. In this case also found that the drying temperature compared with the 160–200 °C substantial surface topography does not change.

When considering the hydrolyzed preparations fibers taken from the top of the storage riot also it has been found that the drying temperature is less 1600 s affect pulp fibers crystallites than 200 °C. The crystallites have the same size and shape of the aggregation, and that the original sample. In contrast, the samples dried at 200 °C along with asymmetric particles observed shapeless and globular particles.

The degree of aggregation in this case is much smaller than the previous sample. Such a sharp change of shapes and sizes at drying facilitates effect of elevated temperature.

And substantial changes in the surface of the crystallites exposed fibers, dried at 200 °C. The changes, apparently, is promoted by two factors: if the first temperature; the second is the changes taking place in different parts of the riots themselves, we have described above. However, studies have shown that between the picture surface topography and the initial fiber crystallites (the middle part of the sample) and dried at 1600 s (especially at 200 °C), there is a sharp contrast. In particular, it is well reflected in the size, shape and aggregation of hydrolyzed products.

The long sample very well distinguished small globular education and lesotsiatsity (by the way, they are also dense patches of micro fibrils). Compared with previous samples of their number is much higher than, and in size – much inferior. From the literature it is also known correlation between the crystallite size and strength characteristics of cotton fibers. Based on these considerations, this sample has less strength compared to the previous and original samples. That is, less strong fibers easily subjected to acid hydrolysis in comparison with strong fibers. Reductions of strength on the one hand contribute to the action of thermopiles fungi, which are in the middle riot storage, on the other hand increased temperature.

In the analysis of fiber samples taken from the bottom of the storage riot, very well observed the merger of the above factors impact on the variability of the supramolecular structure. It should be noted that the changes taking place on drying (160 and 200 °C) sharply reflected on the surface topography and the nature of the allocation of the crystallites, which is especially evident on the surface of the fiber. Apparently, to the formation it is mainly contributed storage conditions (place), as these conditions are very well for microorganisms developing, destroying the fiber structure and properties. Further drying at high temperature also affects to the mentioned properties, but less than microorganisms which are present in the layer riot. It should be noted that the globular particles observed in the sample were not detected in samples, samples which were taken from the top and middle portions riot. Therefore, the formation of globular particles, particularly at the surface, the influence of microorganisms promoted more than the drying effect.

It is undergoing profound changes and the secondary wall fibers that where the crystallites size and extent of aggregation differ sharply (decrease) from all investigated cotton fibers.

In addition to the asymmetric particles it is observed globular formation, the size of which varies from 10–200 A°, ie this sample is very easy exposed to dilute acid. Consequently, the strength of this sample is also slightly lower than the initial and dried at 160 oC.

Thus, we can conclude that the high temperature drying, regardless of the position in space for storing fiber coils in cotton is a significant structural change. Moreover, the higher the temperature, the greater the change. In particular it is shown that the temperature increase of the drying agent leads to increased defect microstructure on the surface, and the secondary fiber wall. It has been shown that by dry-

ing the raw cotton at temperatures above 1600 s decreases the angle between the fiber axis and the folds are formed globular particles of various sizes, as well as a sharp decrease in the crystallite sizes of micro fibrils.

It was found that the observed structural changes occurring at different storage conditions in the riots, as well as high-temperature drying of raw cotton are mandatory and must be reflected in their physical and mechanical characteristics.

Conclusions

1. Experimental study of the kinetics of destruction of fibers technological transition from rebellion to drying processes, cleaning, ginning, pressing post ginning cleaning to show:

a) the nature of the destruction of the fiber has a dual characteristic fracture occurs at a total loading of the fibers when stored in the riots, and the points of contact with the working bodies of machines;

b) the kinetics of the process is subject to the law of fatigue failure when gradually around the cracks, defects and stress raisers occur macroscopic fracture, mechanical and biomechanical nature;

c) the degree of destruction of the fibers depends on technological effects on cotton, their size and number; Therefore, the main share of growth damages the fibers accounted for ginning, ginning and post ginning cleaning; and when ginning is developing the greatest load, but the multiplicity of its small, but clean load below, but repeated many times and it is in good agreement with the theoretical model;

d) the degree of damage depends on the raw state, its moisture content, the terms and conditions of its storage and drying conditions that directly affect the characteristics of cotton material science – without destroying the ability to withstand the required number of cycles of loading technology.

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KINETICS OF CHANGE IN FIBER STRENGTH AT STORAGE AND PROCESSING OF RAW COTTON ON TECHNOLOGICAL TRANSFERS

Abstract. The kinetics of important physic mechanical and technological characteristics of the fiber and raw cotton are considered: fiber and seed damage, fiber curliness of various degrees of maturity, weediness and the content of defects - which determine to a large extent the consumer value of the cotton plant. At the same time, the effect on time and storage conditions of cotton, the temperature of drying, industrial cotton varieties both on the main technological transitions of the cotton plant from riot to press and in general has been studied. The defining indicators of fiber spinning capacity are its length, strength, linear density (microneir) and color, and in recent years, with the introduction of new international standards for fiber and modern electronic systems for its certification, the consumer market is focusing on length, microneur and color.

Keywords. Damaged fiber and seed, crimp fiber, degree of maturity, clogging, the content of defects.

Fiber tenacity P_p one of the main characteristics of the static fiber estimating maximum load on the fiber during its uniaxial loading until failure in the weakest section. And, although the fibers in the yarn product and destroyed mainly by variable effort effect mainly cyclically repeated, and as a result of friction and wear, and is very rare for a single tensile characteristic specified limit values correlated with the fatigue strength and wear resistance of fibers. So often enough to make a difference P_p (в cH), to anticipate in general and other characteristics. This assessment fiber properties of materials science dates back to the evaluation of metals, building materials, plastics, characteristics are obtained under uniaxial deformation, and the test results apply to more complex three-dimensional voltage. Using one or the other theory of strength. Maximum normal stress, the biggest tangential stress, forming energy, etc. This approach to fiber justified by the fact that although the latter can be considered close to the flexible filament in fiber points of contact with the working bodies and with each other in the yarn , fabrics and knits in the filaments occur volumetric stress state. What has been said it has been proven in the works cited previously R. G. Mahkamova, R. Z. Burnasheva et al., When the assessment of the stress in the fiber, according to the energy theory of forming, matched strains, developing it under uniaxial break.

This raises the natural question in addition to modeling the kinetics of changes in fiber strength and the problem of an adequate assessment of the value of P_p.

Before turning to the analysis of tasks, note immediately that in recent years the textile prefer this assessment values P_p (Absolute), the relative strength of the fiber P_p(cH/tex), equal to the ratio of the first linear fiber density $T_в$

$$P_p = \frac{P_p}{T_в}. \qquad (1)$$

This evaluation gives the relative characteristics of the fibers of the fortress; the value of у is sufficiently strong fibers mature fine cotton is 32–35 cN/tex, and in upland cotton cultivars 26–28 cN/tex. The values of this index below the given limits evidence of the weakness of fibers, their immaturity, which, unfortunately, is the case for almost all domestic and foreign advanced zoned selections grown in Uzbekistan. So many varieties of upland cotton, this figure does not exceed 16–19 cN/tex, with associated relatively low rate of harvesting cotton first choice, and industrial grades, and that proves developing sub-film technology of cotton sowing in the country, which share is

growing steadily and it gradually extends from Andizhan to the most regions of the republic. This method of seeding, as well as sowing of cotton by using seeds, allowed China to come out on top cotton producer, it was useful to Uzbekistan as one of the most northern zone of cotton cultivation.

Practice shows that these natural properties of the fibers do not remain constant over time and by changing the period of storage in a riot, after drying, cleaning of small, large litter, ginning, post-ginning cleaning and pressing. Such variation extends predominantly in the direction of decreasing transitions and all textile technology loosening and scutching, carding, in the manufacture of tapes, foreyarns and yarns, a knitted fabric and weaving and also in the finishing and in the manufacture of completed products.

The mechanism of these changes is similar to the kinetic law of destruction of cotton material, as described by equations for the characteristics of the material to withstand the specified limit on the number of cycles. Since different processes and corresponding fiber states these different indicators, it makes sense to talk about the different degrees of loss of fiber strength of individual technological transitions.

At the same time, cause the destruction of the fiber tensile stress concentrators are dangerous in its cross section. These may be biological and mechanical damage, overt and covert, in the absence of such a smallest cross-sectional area of the fiber. Therefore, if we assume that

$$\eta = \eta(\alpha n, N, T), \qquad (2)$$

where the number of lesions η the number of mechanical influences function αn, fiber properties N and T – the drying temperature, and the value of a function of maturity (grade) fiber, its humidity, conditions and cotton storage time, the analytical dependence of the strength can be written as

$$P_p(\alpha n, N, T) = P_o - \Delta P(\eta), \qquad (3)$$

Where P_o – the original value of the strength of the fiber prior to its processing in cotton gin plant; its value depends on the time and conditions of storage of cotton in rebellion, as well as industrial and breeding varieties of raw, being at the start of processing constant;

$\Delta P(\eta)$ – drop in strength due to fiber damage, and changes in drying temperature and humidity according to the raw (2).

Expression (3) can be represented in a somewhat different form, highlighting the separate value ΔP_2 – Decrease of the degree of strength, which depends directly from the drying process cotton, and other changes presented in the form of magnitude ΔP_1, as a function of the degree of mechanical action and material properties. Then (6.3) can be written as

$$P_p(\alpha n, N, T) = P_o - \Delta P_1(\alpha nN) - \Delta P_2(T). \qquad (4)$$

Moreover, in the formulas (3) and (4) under the influence refers to the loss of fiber strength dependence on humidity, cotton varieties not included explicitly in the ratio considered.

Let us analyze the right-hand sides of these relations.

Value P_0 it corresponds to the initial strength of the fiber at the beginning of processing of cotton ginneries. Raw cotton, formed by the party on the breeding and commercial grade, type of collection, as well as belonging to the farmer or collective farm, may have a different background:

– without going through the drying and cleaning immediately transferred for processing; Cotton is mostly manual collection, assembled in favorable conditions and having a low standard moisture;

– Require pre-treatment, and drying; is predominantly cotton collection machine increased contamination, which is just to let the technology can not be cotton plants;

– Raw cotton of manual or machine collection, that passed precleaning separators, which requires pre-drying and cleaning;

– Raw cotton previous groups, riots or stockpiled in storage for a considerable period of time (from one to several months).

In the first case, the value P_{ouc} practically equal to the natural characteristics of raw cotton in the field, from the dropdown box; the potential loss of cotton strength for manual collection and transportation of a sufficiently small quantities can be neglected.

In two other cases, you should take into account the loss of the length of the spindle when the cotton harvest, field clearing patchwork, in a tumble dryer and cleaners Dry-cleaning shop procurement centers. Obviously, in this case, the loss of strength will be high, they can not be neglected, which is usually made of raw intermediate properties analysis.

A more complicated case of the latter, when raw cotton is one of the three previous options taken by the procurement centers or having some strength (Ie less natural) laid on the long-term storage. As a result of the biological processes of seed of life, as well as the destructive effects on the fiber storage medium, this figure varies in a complicated law, similar to one described above for the values in the kinetic model.

Let the time of bookmarks cotton for storage in light of these circumstances, the fiber had a strength P_0'. Through time t_{xp} fiber strength acquired value P_o changing on a complex law, which is a product of two exponential functions - one increasing (fiber maturation), decreasing another (depending on the storage density, cotton varieties). In the first case, in addition to the exponential parameters P_0' is a constant P_∞' and the relaxation period T_1, Second respectively P_∞'' и T_2. Value P_∞' and P_∞'' respectively indicate the possible extent of the growth of strength as a result of maturation and reduce it from destruction. The first value is associated with the biology of the plant, the second depends on the density of the rebellion, the presence of microorganisms on the surface of the

fiber, etc. The time constants T_1 and T_2 mean exponential rate of change, and, as previously shown, numerically equal to the intercept of the tangent to the exponential function at the initial point of the straight line parallel to the time axis, and which tends to the exhibitor. The smaller time constant value, the process is completed faster. After a time equal to three T_1 or T_2, exponential process ends at more than 95 percent.

Such a model can be written as

$$P_o = \left[\sqrt{P_0'} - (\sqrt{P_0'} - \sqrt{P_\infty'})(1 - e^{-\frac{txp}{T_1}}) \right] \cdot$$

$$\cdot \left[\sqrt{P_0'} + (\sqrt{P_\infty^{||}} - \sqrt{P'})(1 - e^{-\frac{txp}{T_2}}) \right] \qquad (5)$$

where, in addition to the above parameters P_0', P_∞', P_∞'', t_{xp}, T_1 and T_2 by e denotes the value of nepperova $(e = 2,71828)$.

From (5) we have for $t_{xp} = 0$

$$P_0^{(0)} = \sqrt{P_0'} \cdot \sqrt{P_0'} = P' \qquad (6)$$

ie in cotton processing without storage, naturally, its initial strength fiber strength is supplied raw, and the effect on short-term storage of virtually no fiber strength.

If the cotton is stored for a long time, that is, when $t_{xp} \to \infty$, of (5) we have

$$P_{0(\infty)} = \sqrt{P_\infty' \cdot P_\infty''}, \qquad (7)$$

the geometric mean value of the function P_∞', P_∞''.

Usually P_∞' more P_0', a P_∞'' less P_0',, so $P_{0(\infty)}$. It is in the range between these limit values and perhaps only a partial increase in the strength of the fiber in storage, and then only in a limited period of time, if T_1 much less T_2, $T_1 << T_2$.

In general, for (as already mentioned earlier) the fact that cotton ripening in rebellion can not be overestimated - a long cotton storage inevitably leads to some reduction in strength, especially in the lower layers of rebellion that we studied experimentally and will be given a few below.

From (5) it is also clear that in the absence of one of these events - the prevailing role is played by the second - ripening or degradation of the fibers.

So in case of equality P_0', and P_∞', ie Stowing ripe cotton under $t_{xp} \to \infty$ value P_o is $\sqrt{P_0' P_\infty''}$, those. fiber strength is inevitably reduced.

Conversely, if it were possible to eliminate degradation of the fiber at the same time its ripening, the $P_{0(\infty)}$ would equal $\sqrt{P_\infty' P_0'}$, and hardening it happened.

It was pointed out that the decrease in the fiber strength is closely related to his injury on technological transitions depends on the number and size of mechanical and fiber properties that are affected by drying temperature, time and conditions for cotton storage in a riot, and represents some kinetic function of type, mostly non-linear extent $\frac{m}{p}$.

In the previous section of the paper when considering damage kinetics and tortuosity cotton compare these parameters was performed as a comparative diagrams for six measuring points – from riot (0) prior to compression (5) in different sections of the values of cotton varieties, time and storage density riot two dryer coolant temperature levels.

In such diagrams is possible to recreate the necessary dependence of these parameters on the degree of exposure to raw cotton, but rather speculative. There is no question of function, functional dependence is out of the question, as a continuous variable value is not plotted on the x-axis, and only the technological transition number.

To obtain the functional dependency is not desirable to have the serial number of the physical process, but a continuous value. This acts as the technological line of cotton plants, the mechanical effects of cotton in these processes, allowing you to go off the charts according to the curves - in this case, type $P_p(\alpha n)$.

But these dependences are not sufficiently smooth, as provided in section 3 of the assessment of each technological transition on the degree of exposure approximate and varies depending on cotton varieties and, most importantly, apply in varying degrees to the entire population of the fibers.

So obviously, at a variable step position on the horizontal axis of the measuring points in some cases, possible local breaks depending, in particular a sharp length reduction (relative) in the individual drying conditions, especially low grades, as well as ginning, when the maximum load experienced by all, without exception, seeds separated from the fiber.

More will be smooth curve P_p, and ΔP, if the delay on the x-axis is not simply the sum of normalized mechanical influences and their dependency to the characteristics, different for each junction. However, to perform this transformation is not yet possible to sufficiently correct for variations of the values depending on the processing conditions. The reverse task of smoothing the curve $P_p(\frac{\alpha \tilde{n}}{N})$ technically it is easy to perform, but it is not entirely correct, because of the random nature of the sample average values.

In the latter case, both these functions would be of a direct or $(\frac{m}{p} = 1)$, a parabolic curve $(\frac{m}{p} > 1)$. In this case represents one of the curves of the analyzed models of the kinetics of fiber fracture, although not completely coincide with those for damage and crimping.

Select from the ΔP to separate the value of the temperature change in strength, presenting (3) in the form (4). To do this, there are two reasons: the first is that the effect of temperature relatively short time and can lead to irreversible fiber properties, which are accounted using the kinetic parameter in future technology transition is difficult and does not reveal

the essence of the process. And second, the change will allow to reveal the essence of the problem is not on the mechanical and physical level, and to a large extent solve the problem give the inner meaning, and not only the kinetic and statistical.

Here are just a general model of the phenomenon, based on the equations S.N.Zhurkova. Equation binds time (durability) to fracture fibers voltage, attached thereto, provided its complete destruction

$$\tau^* = \tau_o \exp(\frac{U_o - \gamma\sigma^*}{kT}), \qquad (8)$$

where τ_o – constant, close to the period of the thermal vibrations of the atoms (10^{-12}–10^{-13} c); U_o – the activation energy of a mechanical break ties; γ – coefficient depending on the fiber structure and takes into account the heterogeneity of the distribution of stresses on the fiber and microregions molecular chains; K – Boltzmann constant.

This equation is valid for a wide range of voltage variations and temperature T, K.E.Perepelkin applied to the study of tensile strength fiber strands in accordance with GOST 3274.1-72 standard dynamometer using LH-3M, replacing γ on γ_1 – structurally sensitive factor, characterized by, on the grounds that the gap fiber does not occur simultaneously.

Logarithm (8) based on this model allows you to define the breaking stress:

$$\sigma^* = \frac{U_o}{\gamma_1} - \frac{kT}{\gamma_1}\ell n\frac{\tau^*}{\tau_o}. \qquad (9)$$

And fibers voltage condition is equality unit Bailey criterion

$$\int_o^{\tau^*} \frac{d\tau}{\tau[\sigma(\tau)]} = 1, \qquad (10)$$

where σ from τ – Voltage dependence on time. This dependence has been identified by us in the study of the process of breaking pendulum dynamometer fiber scheme is simple. Its essence is that the ends of the fibers are wound onto eyelets radius load torque arm, rejected at break at an angle α. Here m – pendulum mass, R – distance from the center of rotation to the center of gravity, and – the acceleration of gravity.

From the equation of equilibrium of the pendulum

$$P \cdot r = mgR\sin\phi, \qquad (11)$$

at a small angle α, when $\alpha = \sin\alpha$, we have

$$\alpha = \frac{\mathrm{P}r}{Rmg}. \qquad (12)$$

As for the time τ clip falls at a distance ℓ and the pendulum is deflected by an angle α, the value of the fiber deformation amount

$$\ell = \upsilon r = r\alpha, \qquad (13)$$

where – clamp lowering speed. From the last two formulas have the value of fiber tension

$$P = \frac{\upsilon Rmg}{r^2}\tau, \qquad (14)$$

function.

At a time when the fiber is stretched by uniaxial tension, between the stress and effort of the link is the cross sectional area of the fibers, ie,

$$P = \sigma S. \qquad (15)$$

After the reforms, taking into account these relations have a record function of voltage, which can be reduced, denoting complex value, and includes

$$\sigma = \frac{\upsilon Rmg}{r^2 S}\tau = c\tau. \qquad (16)$$

After simple transformations we can obtain the dependence in a slightly different form

$$\tau[\sigma(\tau)] = \tau_o \exp(\frac{U_o - \gamma c\tau}{kT}) = \tau_o \exp(A + B\tau), \qquad (17)$$

где $A = \frac{U_o}{kT}, B = \frac{\gamma c}{kT}$.

Substituting from (17) into (10), we obtain the criterion Bailey equation for the unknown quantity that is being allowed a relatively unknown, takes the form

$$\tau^* = -\frac{1}{B}\ell n(-B\tau_o e^A + 1). \qquad (18)$$

Substituting the last equation in the stress function, we have the expression

$$\sigma^* = \frac{U_o}{\gamma_1} - \frac{kT}{\gamma_1}\ell n\left[\frac{\ell n(1 - B\tau_o e^A)}{B\tau_o}\right], \qquad (19)$$

clearly showing that the temperature increases fiber strength decreases linearly.

Formula (19) it is easy to rewrite the value of the breaking load, directly under study:

$$P_p = \frac{U_o S}{\gamma_1} - \frac{kTS}{\gamma_1}\ell n\left[-\frac{\ell n(1 - B\tau_o e^A)}{B\tau_o}\right]. \qquad (20)$$

Let us analyze the formula (20). Firstly, it makes sense that, since negative numbers do not have the logarithm (with a positive basis – 2.71828). We expand the logarithm of the specified power series convergent with the rapidly decreasing terms, allowing limited only to two senior members of the decomposition

$$\ell n(1 - B\tau_o e^A) = -(B\tau_o e^A + \frac{(B\tau_o e^A)^2}{2}). \qquad (21)$$

Substituting this formula in (20), we have a simple expression

$$P_p = \frac{U_o S}{\gamma_1} - \frac{kTS}{\gamma_1}\left[A + \ell n(1 + \frac{B\tau_o}{2}e^A)\right]. \qquad (22)$$

Repeatedly expanding the logarithm of expression (22) in a row, containing the first two terms of the expansion

$$\ell n(1 + \frac{B\tau_o}{2}e^A) = \frac{B\tau_o}{2}e^A + (\frac{B\tau_o e^A}{2})^2\frac{1}{2}. \qquad (23)$$

and substituting (23) into (22), we finally have an analytic function

$$P_p = \frac{U_o S}{\gamma_1} - \frac{SkT}{\gamma_1}\left[A + \frac{B\tau_o}{2}e^A + \frac{(B\tau_o e^A)^2}{8}\right]. \qquad (24)$$

Recall that the accepted shorthand and includes in both cases indicated temperature and, if you deploy (24) based on these values; we obtain a structurally bulky, but an explicit function. We will not give it in full, and give in short form, convenient for analysis:

$$P_p = a_o e^{\frac{a_1}{T}} (1 + \frac{a_2}{T} e^{\frac{a_3}{T}}), \qquad (25)$$

where a_o, a_1, a_2, a_3 – constant coefficients.

The obtained ratios indicate complex influence of temperature on the strength of the fiber, and its growth is reduction in strength with increasing temperature. It is in these moments, when the fiber is warming up the coolant, its strength is low. And when the individual fibers are applied tensile load, or contacts, the latter may be destroyed, to receive mechanical damage and largely losing valuable quality - crimp.

This phenomenon as mentioned above, takes into account the kinetic model of changes in fiber properties, also it is revealed the essence of the process, its physics. One does not contradict the other.

Note that the direct influence of temperature on the subsequent behavior of the fiber has almost no, really, high temperatures can lead to irreversible changes in the outer layer of paraffin, to some extent, cotton cellulose. The main thing is that the fibers are damaged when heated in the drying drum at a subsequent mechanical effects continue to develop and indirectly affects the temperature to reduce the strength of the remaining technological transitions cotton plants - spinning, weaving, etc.

Conclusions

1. Reduction of fiber strength is closely related to his injury on technological transitions depends on the number and size of mechanical and fiber properties that are affected by drying temperature, time and conditions of storage of cotton in a riot, and is a certain kinetic feature.

2. It has been experimentally proved that the fact that cotton ripening in rebellion can not be overestimated – a long cotton storage inevitably leads to some reduction in strength, especially in the lower layers of rebellion.

3. A kinetic model of changes in fiber properties also it is revealed the essence of the process, its physics.

4. These relations indicate complex influence of temperature on the strength of the fiber, and its growth is reduction in strength with increasing temperature. It is in these moments, when the fiber is warming up the coolant, its strength is low. And when the individual fibers are applied tensile load, or contacts, the latter may be destroyed, to receive mechanical damage and largely losing valuable quality-crimp.

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FORECASTING OF THE EMERGENCE OF THE ABSORPTION OF WASHING SOLUTIONS IN THE CONDITION OF DRILLING WELLS IN INTERFACE DEPTH

Abstract. An explanation of the reason for the absorption of flushing solutions under conditions of drilling wells in intermontane valleys is given. On the basis of the analysis of field material, maps of the prediction of solution absorption along the Fergana intermountain depression are presented. The dependence of the relative frequency of occurrence of absorption due to hydraulic fracturing of weakly cemented and fractured rocks on the distance between the center of the area and the fracture zone is established.

Keywords: area, drilling, section, rock, fracturing, hydraulic fracturing, washing fluid, absorption, optimization.

The prediction of absorption zones is widely consecrated in the literature. However, many studies in the prediction of absorption zones did not take into account the geological features of the structure of the region. The patterns of the influence of tectonic disturbances in clayey sediments with the absorption zones of the washing solution related to fractured rocks have not been studied to a sufficient degree.

In the oil and gas industry of Uzbekistan, the absorption of drilling fluid during drilling often occurs in the Fergana and Surkhandarya intermountain depressions.

In order to investigate the causes of the occurrence of washing solution absorption, and the development of effective warning methods, we collected systematized and analyzed materials for well drilling during the last 35 years, where well construction was accompanied by absorption of the washing solution.

As a result of the analysis of the actual material, it is revealed that the absorption of the solution is mainly due to crackle, porosity and permeability of reservoirs and occur for the following reasons:

1. due to the presence in the section of weakly cemented rocks prone to fracturing, to predict their distribution, it is necessary to use them paleogeographic map of the region;

2. the presence of absorption zones is associated with tectonic faults, for their prediction it is necessary to use a tectonic map of the area of the areas;

3. the presence of absorption zones at a large depth associated with karostnyh phenomena, which are poorly predicted. The degree of manifestation of the absorptive capacity of these drilling intervals will largely depend on the optimization of the drilling technology, the minimum repression during drilling and tripping, the development of optimal parameters of the drilling fluid.

Depending on the stratigraphy of sediments, the intensity of acquisitions, methods of preventing and combating them will also be different. For example, the geological and lithological conditions of the Fergana Basin are very diverse. Here, to eliminate the absorption of the solution in the Sokhko-Bactrian tiers, the method of controlling the parameters of the washing solution and their quality are widely used.

Using this method, about 50% of the total number of acquisitions were eliminated. In the case when the specified method is ineffective, complicated intervals passed without exit (3–5%) of the circulating agent. The method of filling absorbing channels with fillers (sawdust) and installing tampons, pouring FSN and others eliminated about 35% of acquisitions. In other cases, due to the low efficiency of the above methods, the absorption zones are blocked by the descent of the column.

The absorption of drilling mud in pale pink and brick-red suite of the Neogene is much inferior in intensity and frequency of absorption in the Quaternary sediments. The rocks of these suites have low reservoir properties due to the abundance of cementing material in them. Therefore, in the process of drilling wells there is a slight absorption of the drilling fluid. To prevent and eliminate it, it is enough to add inert fillers to the solution in order to completely block the absorbing channels.

The absorption of the solution in Paleogene and Cretaceous sediments is observed, on the contrary, in heavily drained and exhausted by previous exploitation productive strata with low reservoir pressures. The degree of manifestation of the absorption capacity of these reservoirs will largely depend on the optimization of the drilling technology, the minimum repression during drilling and tripping, the development of optimal parameters of the washing solution, etc. As the experience of drilling wells in Paleogene and Cretaceous sediments shows, with high quality of the solution, good cleaning of it from drilling, and observance of the technological rules, the section is opened without complications.

So, for example, when drilling wells in the areas of West Palvantash (well №№ 111, 150, 151), Izbaskent (well №№ 143, 144), Shorsu (well №№ 3, 5), Northern Alamyshik (well № 12), Suzak (SLE. Nos. 7, 8, 10), while observing all the technological rules and improving the quality of the washing fluid in the indicated sediments, the solution was not absorbed, although complete escapes of the solution were observed in neighboring wells. In this case, partial absorption of the solution was most often eliminated by decreasing the density of the solution and switching to a less forced drilling mode.

At full absorption at shallow depths, complicated intervals were drilled without circulating, followed by casing, or at any depth, drilling fluids with fillers were used to partially or completely block the absorbing channels.

It should be noted that in the southern, southwestern and southeastern regions of the Fergana depression, represented mainly by terrigenous sediments, the main number of acquisitions occur in fractured rocks. Absorption due to hydraulic fracturing of weakly consolidated rocks and associated with karst phenomena, in frequency and intensity occupy a subordinate position.

The most effective way to reduce the damage caused by the absorption of the drilling fluid is to predict them, which allows in many cases to avoid them, as well as to prepare for their manifestation in a timely manner. In this regard, a significant number of works are devoted to the issues of predicting the absorption of drilling fluids when drilling wells in various geological and technical conditions [2; 3; 4]. In [2], it was shown that the frequency of absorption depends on tectonic disturbances on drilled areas. In the development of this situation, we analyzed the field data on the absorption of drilling mud in the Fergana intermontane depression. The obtained results can be represented as a map of the forecast of acquisitions [1].

Data from field material leads to the conclusion that the most frequent absorption occurred in the peripheral and near-side zones of the Fergana depression. This is due to three factors:

1. The presence of powerful tectonic faults bordering the depression in the near-side zone. This led to localization in areas adjacent to the fault line, fractured sediments, prone to the absorption of drilling fluids.

2. In the direction from the periphery to the center of the Fergana depression, there is an increase in the average depth of sedimentary strata, which helps to reduce the frequency and intensity of absorption due to the closure of cracks and pores with increasing depth of the reservoir.

3. In the direction from the periphery to the center of the Fergana depression, the degree of homogeneity of sedimentary deposits increases, their sorting increases, the content of fine fractions in them, which act as a filler and cementing element, increases.

All these factors act in the same direction if the exploration areas are located south of the northern zone of tectonic faults and north of the southern zone. In this regard, in the direction from the onboard zone to the center of the Fergana depression, the frequency of cases of absorption of drilling mud due to hydraulic fractures of weakly cemented rocks decreases. This makes it possible to confidently predict a reduction in the risk of absorption of drilling mud as the explored area approaches the center of the intermontane depression (in this case, Fergana), which is confirmed by the graph in fig. 1, built according to field data.
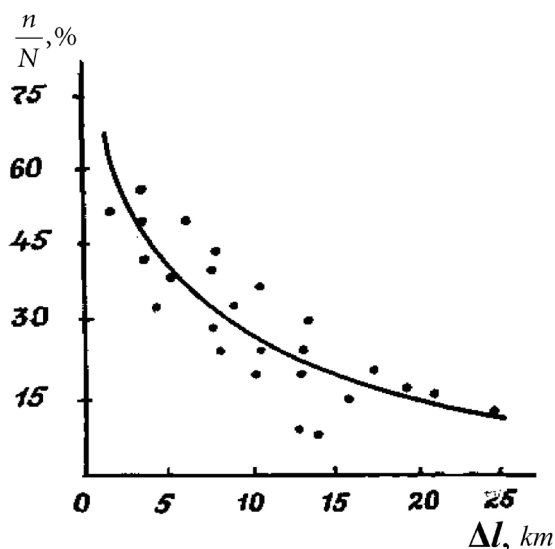
Figure 1. The dependence of the relative frequency of occurrence of absorption, caused by fracturing weakly cemented rocks, from the distance between the center of the area and the fault zone

More difficult is the problem of the role of tectonic disturbances as a factor affecting absorption caused by the absorption of washing fluid into fractured pores. In this case, this type of absorption includes liquid withdrawals in sediment "coke" and "bacterium". There is reason to assume that as the distance from the fault lines increases, the probability of their occurrence will decrease, since at the same time, other things being equal, there will be a decrease in the degree of fracturing of rocks, due to tectonic movements of the blocks of the earth's crust.

Of course, it is necessary to take into account the complexity of the phenomena, in particular, to keep in mind the factors noted in [2]. However, it is expedient to search for patterns of the influence of fault lines on the localization of the absorption zones of drilling fluids in fractured rocks.

In this regard, we have constructed a graph of the relative frequency of absorption versus the average distance between the center of the oil and gas bearing area and the line of tectonic disturbances. At the same time, we proceed from the

premise that the relative frequency of drilling fluid absorption cases, i.e. the ratio (where N is the number of wells drilled in a given area, n is the number of wells in which absorption was observed in this area), is more objective characteristic of the capacity of wells for absorption than just n, since it is clear that, other things being equal, n depends on N.

In fig. Figure 2 shows a plot of the relative number of removals in sediments "cox" and "bacterium" versus the distance between the center of a given area and the fault line.

The graph in (fig. 2) indicates that there is a correlation between the quantities in question. A certain variation in the dependencies between the quantities considered is caused by not taking into account a number of factors affecting the frequency of absorption, such as the thickness of the reservoir, the depth, the drilling mode, etc. There is reason to believe that the established dependencies relate not only to the Fergana Depression, but are more general in nature and are inherent in other intermountain depressions.
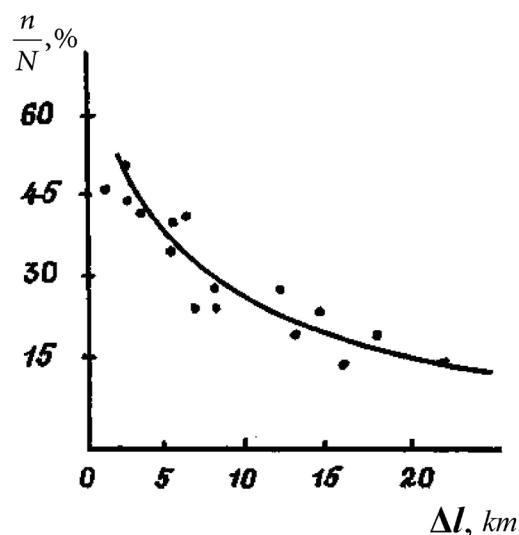
Figure 2. Dependence of the relative frequency of absorption in fractured rocks on the distance between the center of the area and fault zone n is the number in which the absorption in this area was noted during the drilling process is a more objective characteristic of the area's absorption capacity than just n, since clear things being equal n depends on N

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OPTIMIZATION (UNIFICATION) OF PARAMETERS OF ELECTRICAL SUPPLY SYSTEMS UNDER THE CONDITIONS OF UNCERTAINTY OF LOAD DEVELOPMENT

Abstract. The problem of optimization (unification) of the parameters of power supply systems under conditions of uncertainty in the development of electric load is considered. The choice of the optimal number of cross sections is taken into account, taking into account the development of the load, and proves the expediency of using a very limited number of cross-sections in the power supply system (using one or two standard cross sections for a wide range load density).

Keywords: unification, optimization, cross-sections, factor, analysis, accounting, load growth.

When planning and forecasting the optimal development of power supply systems (PSS), it is necessary to take into account the technical and economic possibilities of broad optimization and unification of parameters (in particular, nominal cross-sections of the lines and power of transformers) with the development of electrical loads in fairly wide limits.

At the same time, based on the mathematical models of the PSS, the optimal parameters of the system are identified, corresponding to the series of changes in the initial information, and the optimal construction of the PSS for a number of parameters is revealed, which on a certain scale reflects the development of this system in time. The obtained sets of optimal parameters determine the rational construction of the system and the strategy for the development of structure and parameters [1].

It should be noted that the problem of optimization (unification) of PSS parameters is solved taking into account the uncertainty of the complex of factors characterizing the development of the load in the period under consideration. Such factors are: the laws of load growth in time; factors of annual load growth, year of achievement of the design load from the moment of commissioning, the period of time under consideration, for example, the estimated period of operation of the projected network before its reconstruction.

In addition, in the problems of optimization and unification of parameters, taking into account the development of

PSS, significant and at the same time uncertain are the development of the load in time. It is advisable to take into account the possibilities of various laws, namely, the growth of the load according to the laws of uniform and uneven load growth.

The use of the law of uniform load growth allows one to conduct research for the conditions of a constant annual increase in the load. In this case, the function $\Psi(t)$ is by following expression

$$\Psi(t) = \beta^{t-1} \qquad (1)$$

The law of uneven load growth allows one to conduct research in conditions of decreasing the annual increase in the load. This law of load growth is close to the real operating conditions, when the load in the line reaches a certain limit (the design level) and remains subsequently constant due to its redistribution. This model of load growth corresponds to the modern principle of integrated urban development. In this case, the function $\Psi(t)$ can be determined from the expression:

$$\Psi(t) = 1 + (\frac{1}{K} - 1)(\frac{t}{t_p})^\vartheta, \qquad (2)$$

where $K = \dfrac{I_1}{I_{tp}}$ – the load share of the first year of operation (I_1) from the load of the last year of the period under consideration (I_{tp}),

t_p – is the considered period of time, v is the factor of the annual non-uniform growth of the load, $v > 0$.

In the technical and economic analysis, taking into account the change in the load in time, the initial load and design ratio(I_{np}), the year of achievement of the design load (t_{np}), etc. are significant.

The account of these characteristics allows to carry out the research also under conditions close to the actual ones, when in the first year of operation only a certain part of the designed design electric load of the distribution grids is observed. In this case, the load grows with an undetermined load growth factor (depending on the year of achievement of the design load) to the achievement of the design level, and then one or another of its further growth is observed until the end of the period under consideration.

In this study, the energy losses are determined by the currents (loads) of the head sections of the lines, which also vary with time. In view of the above, the problem of optimization or unification of parameters (number of sections) of SES distribution networks, taking into account the development of the load, can be solved by the following technical and economic model:

$$3_i = \delta_{1,i} + \delta_{2,i} + \delta_{3,i} N_{F,i}^{-1} + \delta_{4,i} \varphi(t) N_{F,i}^{0,3} \qquad (3)$$

The function $\varphi(t)$ is a resultant undefined factor, for which only the maximum values can be set:

$$\Phi_{min}(t) \le \Phi(t) \le \Phi_{max}(t)$$

where

$$\varphi_{\min}(t) = K_{np}^2 \left[E_{н.н.} \sum_{t=1}^{t_{p\min}} \frac{\psi^2_{\min}(t)}{(1 + E_{н.н.})^t} + \frac{\psi^2_{\min}(t_{p\min})}{(1 + E_{н.н.})^{tp\min}} \right] \qquad (4)$$

$$\varphi_{\max}(t) = K_{np}^2 \left[E_{н.н.} \sum_{t=1}^{t_{p\max}} \frac{\psi^2_{\min}(t)}{(1 + E_{н.н.})^t} + \frac{\psi^2_{\max}(t_{p\max})}{(1 + E_{н.н.})^{tp\max}} \right] \qquad (5)$$

These boundary values of the function $\Psi(t)$ are determined by the maximum and minimum values of the quantities v, β and tp. The increment value $\beta1$ is determined by the period t_{np}, at which the design load is reached. Usually in the design calculations of distribution electrical networks, the value of t_{np} is assumed to be 5–7 years. However, as practice shows the operation of large urban distribution networks, often the design load is achieved much later, for example, after 10 years or more. Therefore, in our case, the deadline for achieving the project load of 2 and 10 years is adopted. In accordance with these, the values of load growth factors $\beta1$ and $v1$ are chosen.

The growth rates of loads of distribution electric networks are in a very wide range from 0.5 to 6% per year. In our studies, the following limit values of the factor $\beta2$ are considered for the period t_{np}, under the law of uniform load growth: $\beta2(min) = 1.01$, $\beta2(max) = 1.1$.

Accordingly, the maximum and minimum values of the factor $v2$ are determined for the time (t_{np}), for the law

of uneven load growth. In the calculations, the limit values of the calculation period Tp are $Tp\ (min) = 10$ years and $Tp\ (max) = 25$ years. To solve problems of optimization (unification) of parameters under conditions of uncertainty of the initial information, the method of zoning of the set of vectors of the "state of nature" [2] can be applied. This method provides specific optimization solutions and gives recommendations on the use of the solutions obtained.

With respect to the problem of choosing the number of line cross-sections used, the zoning method consists in splitting the set S of possible values of the resulting indeterminate factor Φ into regions in each of which the optimal strategy is optimal (in our case, a certain number of cross-sections of the lines from the set N).

The zoning method is based on the operation of dividing the set S for a subclass of the two strategies NF and $NF + 1$.

The equation of the pair boundary is determined by the equality of the optimization criteria for the strategy NF and $NF + 1$, that is

$$3(N_F, \Phi) = 3(N_F + 1, \Phi) \qquad (6)$$

If the pair boundary passes outside the field of state vectors, i.e.

$$max\ \Delta3(\Phi) < 0\ min\ \Delta3(\Phi) \ge 0$$

where

$$\Delta3(\Phi) = 3(N_F, \Phi) - 3(N_F + 1, \Phi), \qquad (7)$$

then one of the strategies cannot be optimal under any conditions and is excluded from consideration.

If the pair boundary intersects the field of state vectors of nature, i.e. $max\ \Delta3(\Phi) \ge 0\ min\ \Delta3(\Phi) < 0$, then an equation of the pair boundary is constructed whose solution with respect to $ determines the optimality zone of some strategy, i.e.– some number of applied cross-sections of lines.

In the problem under consideration, due to the linear dependence of the optimization criterion on the resulting indefinite factor Φ outside the pair boundary, there is a strict optimality of one strategy over the other.

The equation for the pair boundary is:
$$\delta_1 + \delta_2 + \delta_3 N_F^{-1} + \delta_4 \Phi_{nap} N_F^{-0,3} =$$
$$= \delta_1 + \delta_2 + \delta_3 (N_F + 1)^{-1} + \delta_4 \Phi_{nap} (N_F + 1)^{0,3}, \qquad (8)$$

Here Φ_{nap} – characterizes the boundaries of the region in an undefined factor, in which the optimal strategy is optimal.

By the solution, the equation for Fap is determined by the region of optimality of applying a certain number of cross-sections of the lines:

$$\Phi_{nap} = \frac{\delta_3}{\delta_4} \frac{(N_F + 1)^{-1} - N_F^{-1}}{N_F^{0.3} - (N_F + 1)^{0.3}}, \qquad (9)$$

With the help of the obtained formulas and with the accepted initial data, the zoning of the resultant indeterminate factor is carried out by the number of cross-sections of the RS lines. Here, for each value of the electric load density, an

uncertainty zone corresponding to the maximum and minimum values of the indeterminate factor is determined. The zones between the curves determine the optimal number of cross-section lines used.

If, however, in the zone of uncertainty $\Phi min \div \Phi max$ optimality zones of several numbers of line cross sections fall, then in this case it is impossible to obtain an unambiguous solution. Such a case arises at low load densities ($\delta < 10$ kW/km^2), when loop networks are used. For example, at $\delta = 5$ MW/km^2, three zones of optimality of different amounts of the cross sections of the $NF = 1.2$ and 3 lines enter the zone of uncertainty $\Phi min = 2$, $\Phi max = 4(8)$. In such cases, it is recommended to partially or density to remove the uncertainty on based on additional information on the values of uncertainty based on additional information about the values of uncertain factors [2].

Sources of such information can serve as observations and measurements, expert assessments, etc.

Expertise is used as additional information on the values of uncertain factors.

With the help of expert assessments, the minimum and maximum values of the load growth factor $\beta(v)$, the values of the calculation period Tp and the value of the project load time tpr, are specified and their most probable values $\beta av = (v_{av}) = 1.02$ (0.4), $tp.sp. = 5$ years, $Tp = 25$ years, then the value of the resulting undetermined factor is $\Phi av = 2.7$ (3.8).

For $\delta < 10$ kVT/km^2, at $\Phi av = 2.7$, which corresponds to the uniform law of load growth, the application of one or two cross-sections of the lines is optimal. And at $\Phi av = 3.8$, which corresponds to the non-uniform law of load growth, one cross section of the lines is optimal. At high electric load densities ($\delta \geq 10$ kW / km^2) over the entire range of the resulting uncertain factor, the use of one line section is optimal.

At the same time it is recommended at high load densities – to apply a section of 150 mm^2; at low load densities – one section of 150 mm^2 or two sections of 185 and 95 mm^2.

The obtained results on the number of applied line cross-sections in SES correspond to similar foreign solutions (France, Poland, Russia, etc.), which is a definite confirmation of the reliability of the results obtained.

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NUMERICAL SOLUTION OF THE BOUNDARY VALUE PROBLEM OF UNSTEADY FILTERING IN EARTH DAMS WITH ACCOUNT OF FILTRATION ANISOTROPY IN SOILS BY THE METHOD OF FINITE DIFFERENCES

Abstract. An algorithm for the solution of the problem of unsteady filtering in earth dams taking into account the anisotropy of soil using the finite difference method is given in the paper. The capabilities of the developed methodology, program for calculating unsteady filtering and the assessment of the reliability of the results obtained are illustrated by the example of filtration problems.

Keywords: earth dams, filtration, unsteady filtering, abrupt drop in water level in the upstream, rate of drop in water level, finite difference method, filtration anisotropy of soils.

During construction and operation of earth dams erected of clay and loamy sand soils, depending on the type of machinery used and production technology the soil of the dam body in some cases acquires anisotropic water permeability. Material of the dam body may be uniformly anisotropic or consist of alternating thin-layer isotropic layers with different values of filtration coefficient K. In the embankments erected by layered soil rolling or by means of hydro-mechanization, the value of K_x can exceed the value of K_y by the order of magnitude.

It is known that in vertical direction the permeability of loess soils (in natural occurrence) is greater than in horizontal direction. With other types of soils the opposite picture could be observed.

The study of filtration in earth dams with account of anisotropic water permeability has been studied by many researchers, including: N. N. Pavlovsky, V. I. Aravin, S. N. Numerov, P. Ya. Polubarinova-Kochina, V. P. Nedriga, L. N. Rasskazov, N. A. Aniskin, K. N. Anakhaev, R. A. Lyakhevich, M. Memarianfard, Kh. Fayziev, S. N. Babakayev et al.

Solution of filtering problem in an anisotropic earth dam by exact methods is very difficult. Naturally, a qualitatively higher level of solving such problems is achieved using numerical methods of finite differences. Mathematical formulation of considered initial-boundary problem of anisotropic unsteady filtering in general case is described by three-dimensional nonlinear parabolic equations at various boundary conditions [2]. In particular, taking into account the symmetry along some spatial axes these equations can be reduced to two-dimensional equations in rectangular region $\Omega = \left\{ a \leq x \leq b, \ c \leq y \leq d, t_n \leq t \leq t_k \right\}$, and written in the following form

$$A_0 \frac{\partial U}{\partial t} = A_1 \frac{\partial}{\partial x}\left(A_2 \frac{\partial U}{\partial x} \right) +$$
$$+ A_3 \frac{\partial}{\partial y}\left(A_4 \frac{\partial U}{\partial y} \right) + A_5 \frac{\partial U}{\partial x} + A_6 \frac{\partial U}{\partial y} + F, \quad (1)$$

at boundary conditions

$$g_{11} \left. \frac{\partial U}{\partial x} \right|_{x=a} + g_{12} U(a, y, t) = \varphi_1(y, t), \qquad c \leq y \leq d, \quad (2)$$

$$g_{21} \left. \frac{\partial U}{\partial x} \right|_{x=b} + g_{22} U(b, y, t) = \varphi_2(y, t), \qquad c \leq y \leq d, \quad (3)$$

$$g_{13} \left. \frac{\partial U}{\partial y} \right|_{y=c} + g_{14} U(x, c, t) = \varphi_3(x, t), \qquad a \leq x \leq b, \quad (4)$$

$$g_{23} \left. \frac{\partial U}{\partial y} \right|_{y=d} + g_{24} U(x, d, t) = \varphi_4(x, t), \qquad a \leq x \leq b, \quad (5)$$

and initial condition

$$U(x, y, t)\big|_{t=0} = \psi(x, y), \qquad (6)$$

Where coefficients A_k $\left(k = \overline{0.6}\right)$ and function F can be the functions of t, x, y, U, U_x and U_y, in particular, the constants used to describe equation (1); the coefficients g_{ij} are used to describe various boundary conditions. $\phi_1, \phi_2, \phi_3, \phi_4$ and ψ – are the given continuous functions. Assume that the given functions satisfy all the conditions under which there is a unique solution to the problem. To solve the problem (1) – (6), which in the general case is nonlinear, it is possible to apply various numerical methods of solution and linearization. According to the above, the main goal of the study is to create an algorithm and program for the numerical solution of this problem.

For numerical simulation of the problem (1) – (6) the method of variable directions (MVD) is used. First the continuous region Ω is reduced to a discrete one $\Omega_{hl\tau}$, with constant steps $h = (b-a)/(m-1); l = (d-c)/(n-1); \tau = (t_k - t_n)/(p-1)$ along the Ox, Oy and Ot axes, respectively. After that, the approximation of the problem (1) – (6) at nodal points $x_i = a + (i-1)h$, $y_j = c + (j-1)l$ and $t_s = t_n + (s-1)\tau$ could be applied to the grid domain $\Omega_{hl\tau}$ and reduced to a finite-difference equation depending on the chosen method. Nonlinear function F on the right-hand side of equation (1) can be linearized using the Picard or Newton linearization method. Other methods of linearization also exist, but in practice the mentioned methods are the most

applicable. According to the Picard method, the values of non-linear functions are determined from the values of the previous period of time and for the iteration case – from the previous iteration. In the algorithm, this is implemented by introducing a certain parameter μ_1, so that its value can be used to choose a linearization method [3]. If the nonlinearity of F is related only to U, then the linearized function F has the following form:

$$F(t,x,y,U,U_x,U_y) \approx F(t_s,x_i,y_j,(U)_{ij}^s,(U_x)_{ij}^s,(U_y)_{ij}^s) + \\ + \mu_1 F_U^{'}(t_s,x_i,y_j,(U)_{ij}^s,(U_x)_{ij}^s,(U_y)_{ij}^s)(U_{ij}^{s+1} - U_{ij}^s) \tag{7}$$

As a result of the linearization method used, at $\mu_1 = 0$ the Picard method is obtained and at $\mu_1 = 1$ – the Newton method. If the nonlinearity refers to U_x, U_y then they could be linearized in the same way:

$$F(t,x,y,U,U_x,U_y) \approx F(t_s,x_i,y_j,(U)_{ij}^s,(U_x)_{ij}^s,(U_y)_{ij}^s) + \\ + \mu_1 (F_{U_x}^{'}(t_s,x_i,y_j,(U)_{ij}^s,(U_x)_{ij}^s,(U_y)_{ij}^s)((U_x)_{ij}^{s+1} - (U_x)_{ij}^s) + \tag{8} \\ + F_{U_y}^{'}(t_s,x_i,y_j,(U)_{ij}^s,(U_x)_{ij}^s,(U_y)_{ij}^s)((U_y)_{ij}^{s+1} - (U_y)_{ij}^s))$$

For numerical solution of the problem it is advisable to apply absolutely stable implicit schemes, such as the MVD, with weight factor σ, used to select calculation formulas using an explicit ($\sigma = 0$), implicit ($\sigma = 1$) and symmetric ($\sigma = 0.5$) schemes. Bearing in mind the essence of the MVD, the calculation formulas are obtained first in x direction in the intermediate segment ($s + 1/2$) in the form:

$$A_{0ij}^s \frac{U_{ij}^{s+\frac{1}{2}} - U_{ij}^s}{\tau} = \sigma A_{1ij}^s \frac{1}{h}\left[A_{2\,i+1j}^s \frac{U_{i+1j}^{s+\frac{1}{2}} - U_{ij}^{s+\frac{1}{2}}}{h} - A_{2\,ij}^s \frac{U_{ij}^{s+\frac{1}{2}} - U_{i-1j}^{s+\frac{1}{2}}}{h}\right] + (1-\sigma)A_{3ij}^s \frac{1}{l}\left[A_{4\,ij+1}^s \frac{U_{ij+1}^s - U_{ij}^s}{l} - A_{4\,ij}^s \frac{U_{ij}^s - U_{ij-1}^s}{l}\right] + \sigma A_{5\,ij}^s \frac{U_{i+1j}^{s+\frac{1}{2}} - U_{i-1j}^{s+\frac{1}{2}}}{2h} +$$

$$+ (1-\sigma)A_{6\,ij}^s \frac{U_{ij+1}^s - U_{ij-1}^s}{2l} + F_{ij}^s + \mu_1 F_{Uij}^{'s}\left(U_{ij}^{s+\frac{1}{2}} - U_{ij}^s\right), \tag{9}$$

and similar type of calculation formula in y variable in $s + 1$:

$$A_{0ij}^{s+\frac{1}{2}} \frac{U_{ij}^{s+1} - U_{ij}^{s+\frac{1}{2}}}{\tau} = (1-\sigma)A_{1ij}^{s+\frac{1}{2}} \frac{1}{h}\left[A_{2\,i+1j}^{s+\frac{1}{2}} \frac{U_{i+1j}^{s+\frac{1}{2}} - U_{ij}^{s+\frac{1}{2}}}{h} - A_{2\,ij}^{s+\frac{1}{2}} \frac{U_{ij}^{s+\frac{1}{2}} - U_{i-1j}^{s+\frac{1}{2}}}{h}\right] + \sigma A_{3ij}^{s+\frac{1}{2}} \frac{1}{l}\left[A_{4\,ij+1}^{s+\frac{1}{2}} \frac{U_{ij+1}^{s+1} - U_{ij}^{s+1}}{l} - A_{4\,ij}^{s+\frac{1}{2}} \frac{U_{ij}^{s+1} - U_{ij-1}^{s+1}}{l}\right] +$$

$$+ (1-\sigma)A_{5\,ij}^{s+\frac{1}{2}} \frac{U_{i+1j}^{s+\frac{1}{2}} - U_{i-1j}^{s+\frac{1}{2}}}{2h} + \sigma A_{6\,ij}^{s+\frac{1}{2}} \frac{U_{ij+1}^{s+1} - U_{ij-1}^{s+1}}{2l} + F_{ij}^{s+\frac{1}{2}} + \mu_1 F_{Uij}^{'s+\frac{1}{2}}\left(U_{ij}^{s+1} - U_{ij}^{s+\frac{1}{2}}\right). \tag{10}$$

Simplifying the coefficients standing before $U_{i-1j}^{s+\frac{1}{2}}$, $U_{ij}^{s+\frac{1}{2}}$, $U_{i+1j}^{s+\frac{1}{2}}$ in (9) and before U_{ij-1}^{s+1}, U_{ij}^{s+1}, U_{ij+1}^{s+1} in (10), the three-diagonal systems of equations of special type are obtained

$$A_{ij}^s U_{i-1j}^{s+\frac{1}{2}} + C_{ij}^s U_{ij}^{s+\frac{1}{2}} + B_{ij}^s U_{i+1j}^{s+\frac{1}{2}} = D_{ij}^s, \tag{11}$$

$$A_{ij}^{s+\frac{1}{2}} U_{ij-1}^{s+1} + C_{ij}^{s+\frac{1}{2}} U_{ij}^{s+1} + B_{ij}^{s+\frac{1}{2}} U_{ij+1}^{s+1} = D_{ij}^{s+\frac{1}{2}}. \tag{12}$$

Here $i = \overline{2,m-1}$; $j = \overline{2,n-1}$; A_{ij}^s, C_{ij}^s, B_{ij}^s, D_{ij}^s $A_{ij}^{s+\frac{1}{2}}$, $C_{ij}^{s+\frac{1}{2}}$, $B_{ij}^{s+\frac{1}{2}}$, $D_{ij}^{s+\frac{1}{2}}$ are determined from (9)–(10). To

solve the systems (11) and (12), the following formulas of the scalar sweep method [2] are used:

$$\alpha_i^s = -\frac{B_{ij}^s}{C_{ij}^s + A_{ij}^s \alpha_{i-1}^s}, \beta_i^s = \frac{D_{ij}^s - A_{ij}^s \beta_{i-1}^s}{C_{ij}^s + A_{ij}^s \alpha_{i-1}^s} \left(i = \overline{2,m-1},\, j = \overline{2,n-1}\right) \tag{13}$$

$$U_{ij}^{s+\frac{1}{2}} = \alpha_i^s U_{i+1j}^{s+\frac{1}{2}} + \beta_i^s \left(i = m-1, m-2,...,3,2;\, j = \overline{2,n-1}\right) \tag{14}$$

The values α_1^s and β_1^s in (13) are determined by the boundary condition (2). In particular, for the boundary condition of the first kind obtained by $g_{11} = 0$, $g_{12} = 1$, (the Dirichlet problem) we get $\alpha_1^s = 0$ and $\beta_1^s = U_{1j}^s = \varphi_1$. Con-

sidering this and other cases of boundary conditions on the left border $x = a$, the following algorithm is proposed. It is known that the three-point approximation of the boundary condition (2) of problems (1) – (6) has the form:

$$g_{11} \frac{-U_{3j}^{s+\frac{1}{2}} + 4U_{2j}^{s+\frac{1}{2}} - 3U_{1j}^{s+\frac{1}{2}}}{2h} + g_{12}U_{1j}^{s+\frac{1}{2}} = \varphi_{1j}, \quad (15)$$

Using this and formulas (11) at $i = 1$, (14) at $i = 2$ the following system of equations is obtained relative to $U_{1j}^{s+\frac{1}{2}}, U_{2j}^{s+\frac{1}{2}}, U_{3j}^{s+\frac{1}{2}}$:

$$\begin{cases} A_{2j}^{s}U_{1j}^{s+\frac{1}{2}} + C_{2j}^{s}U_{2j}^{s+\frac{1}{2}} + B_{2j}^{s}U_{3j}^{s+\frac{1}{2}} = D_{2j}^{s} \\ U_{1j}^{s+\frac{1}{2}} = \alpha_1^s U_{2j}^{s+\frac{1}{2}} + \beta_1^s \\ g_{11}\left(-U_{3j}^{s+\frac{1}{2}} + 4U_{2j}^{s+\frac{1}{2}} - 3U_{1j}^{s+\frac{1}{2}}\right) + 2hg_{12}U_{1j}^{s+\frac{1}{2}} = 2h\varphi_{1j}^s. \end{cases} \quad (16)$$

From the first equation we get

$$U_{3j}^{s+\frac{1}{2}} = (D_{2j}^s - A_{2j}^s U_{1j}^{s+\frac{1}{2}} - C_{2j}^s U_{2j}^{s+\frac{1}{2}})/B_{2j}^s,$$

substituting it in the third equation (16), the following could be determined

$$U_{1j}^{s+\frac{1}{2}} = -\frac{g_{11}\left(C_{2j}^s + 4B_{2j}^s\right)}{g_{11}\left(A_{2j}^s - 3B_{2j}^s\right) + 2hg_{12}B_{2j}^s}U_{2j}^{s+\frac{1}{2}} +$$

$$+\frac{2hB_{2j}^s\varphi_{1j}^s + g_{11}D_{2j}^s}{g_{11}\left(A_{2j}^s - 3B_{2j}^s\right) + 2hg_{12}B_{2j}^s}.$$

Hence:

$$\alpha_{1j}^s = -\frac{g_{11}\left(C_{2j}^s + 4B_{2j}^s\right)}{g_{11}\left(A_{2j}^s - 3B_{2j}^s\right) + 2hg_{12}B_{2j}^s},$$

$$\beta_{1j}^s = \frac{2hB_{2j}^s\varphi_{1j}^s + g_{11}D_{2j}^s}{g_{11}\left(A_{2j}^s - 3B_{2j}^s\right) + 2hg_{12}B_{2j}^s}. \quad (17)$$

In a similar form, to find the boundary value, the function $U_{mj}^{s+\frac{1}{2}}$ is found from (3), on the right border $x = b$ at $i = m-1$ equations (11), (14) and a three-point approximation in (3) are used:

$$\begin{cases} A_{m-1j}^s U_{m-2j}^{s+\frac{1}{2}} + C_{m-1j}^s U_{m-1j}^{s+\frac{1}{2}} + B_{m-1j}^s U_{mj}^{s+\frac{1}{2}} = D_{m-1j}^s, \\ U_{m-1j}^{s+\frac{1}{2}} = \alpha_{m-1}^s U_{mj}^{s+\frac{1}{2}} + \beta_{m-1}^s, \\ g_{21} \frac{3U_{mj}^{s+\frac{1}{2}} - 4U_{m-1j}^{s+\frac{1}{2}} + U_{m-2j}^{s+\frac{1}{2}}}{2h} + g_{22}U_{mj}^{s+\frac{1}{2}} = \varphi_{2j}^s. \end{cases} \quad (18)$$

Determine $U_{m-2j}^{s+\frac{1}{2}}$ from the first equation and substituting it in the last equation, using the second equation (18) we get:

$$U_{mj}^{s+\frac{1}{2}} = \frac{2hA_{m-1j}^s\varphi_{2j}^s - g_{21}D_{m-1j}^s + g_{21}\left(4A_{m-1j}^s + C_{m-1j}^s\right)\beta_{m-1}^s}{g_{21}\left(3A_{m-1j}^s - B_{m-1j}^s\right) + 2hg_{22}A_{m-1j}^s - g_{21}\alpha_{m-1}^s\left(4A_{m-1j}^s + C_{m-1j}^s\right)} \quad (19)$$

The calculation method for solving the system of equations (12) in the direction of y variable is similar to the one in (13)–(14):

$$\alpha_j^{s+\frac{1}{2}} = -\frac{B_{ij}^{s+\frac{1}{2}}}{C_{ij}^{s+\frac{1}{2}} + A_{ij}^{s+\frac{1}{2}}\alpha_{j-1}^{s+\frac{1}{2}}},$$

$$\beta_j^{s+\frac{1}{2}} = \frac{D_{ij}^{s+\frac{1}{2}} - A_{ij}^{s+\frac{1}{2}}\beta_{j-1}^{s+\frac{1}{2}}}{C_{ij}^{s+\frac{1}{2}} + A_{ij}^{s+\frac{1}{2}}\alpha_{j-1}^{s+\frac{1}{2}}} \quad \left(i = \overline{2, m-1}, \ j = \overline{2, n-1}\right) \quad (20)$$

$$U_{ij}^{s+1} = \alpha_j^{s+\frac{1}{2}}U_{ij+1}^{s+1} + \beta_j^{s+\frac{1}{2}} \quad \left(i = \overline{2, m-1}; \ j = n-1, n-2, ..., 2\right). \quad (21)$$

Then the formula for the calculation of (20) at $y = c$ can be determined:

$$\alpha_1^{s+\frac{1}{2}} = -\frac{g_{13}\left(C_{i2}^{s+\frac{1}{2}} + 4B_{i2}^{s+\frac{1}{2}}\right)}{g_{13}A_{i2}^{s+\frac{1}{2}} - 3g_{13}B_{i2}^{s+\frac{1}{2}} + 2g_{14}lB_{i2}^{s+\frac{1}{2}}},$$

$$\beta_1^{s+\frac{1}{2}} = -\frac{2lB_{i2}^{s+\frac{1}{2}}\varphi_{3i} + g_{13}D_{i2}^{s+\frac{1}{2}}}{g_{13}A_{i2}^{s+\frac{1}{2}} - 3g_{13}B_{i2}^{s+\frac{1}{2}} + 2g_{14}lB_{i2}^{s+\frac{1}{2}}} \quad (22)$$

and the function value at $y = d$:

$$U_{in}^{s+1} = \frac{2lA_{in-1}^{s+\frac{1}{2}}\varphi_{4i}^s - g_{23}D_{in-1}^{s+\frac{1}{2}} + g_{23}\left(4A_{in-1}^{s+\frac{1}{2}} + C_{in-1}^{s+\frac{1}{2}}\right)\beta_{n-1}^{s+\frac{1}{2}}}{g_{23}\left(3A_{in-1}^{s+\frac{1}{2}} - B_{in-1}^{s+\frac{1}{2}}\right) + 2g_{24}lA_{in-1}^{s+\frac{1}{2}} - g_{23}\left(4A_{in-1}^{s+\frac{1}{2}} + C_{in-1}^{s+\frac{1}{2}}\right)\alpha_{n-1}^{s+\frac{1}{2}}} \quad (23)$$

The calculation process can be carried out by time or iterations. It is known that if the calculations are carried out by time intervals only, i.e. without iteration, the linearization is performed based on the previous time intervals. As for the iteration case, the calculations are carried out between the time intervals and such iteration process continues until the condition of convergence is satisfied

$$\max_{ij}\left\{\left|U_{ij}^{(k+1)s+1} - U_{ij}^{(k)s+1}\right|\right\} < \varepsilon \quad (24)$$

where ε is a sufficiently small number, $0 < \varepsilon < 1$; k is the number of iteration, $k = 0, 1, 2$

For this algorithm for solving problem (1) – (6) using the scalar sweep method, a program for calculating unsteady filtering in earth dams has been developed.

Test problem. Consider the equation

$$\mu\frac{\partial H}{\partial t} = K_x\frac{\partial}{\partial x}\left(H\frac{\partial H}{\partial x}\right) + K_y\frac{\partial}{\partial y}\left(H\frac{\partial H}{\partial y}\right) \quad (25)$$

initial conditions at $K_x = K_y$ are taken the same as at isotropic filtering by the formula

$$H(t,x,y)\big|_{t=t_n=0} = \sqrt{H_1^2 - \frac{H_1^2 - H_2^2}{L}x} \qquad (26)$$

At anisotropic filtering, the initial position of the depression curve $t = 0$ is taken according to the formulas proposed in [4].

Boundary conditions are:

$$\mathrm{H}(t,x,y)\big|_{x=a} = H_1 - \vartheta_1 t \qquad (27)$$

$$\mathrm{H}(t,x,y)\big|_{x=b} = H_2 \qquad (28)$$

$$\frac{\partial H}{\partial y}\bigg|_{y=c} = 0 \qquad (29)$$

$$\frac{\partial H}{\partial y}\bigg|_{\substack{y=d \\ v_1}} = 0 \qquad (30)$$

Where $H -$ is the pressure function in the computational domain, depending on coordinates and changing over time, m; $t -$ is the time in days; $a,b,c,d -$ are the borders of the domain of calculated profile; $K_x, K_y -$ are the filtration coefficients in vertical and horizontal directions, respectively, they are constant, m/day; $\mu -$ is the coefficient of water loss in soil of the dam body; $H_1, H_2 -$ are the depths of the water in the upstream and downstream, respectively; v_1, $v_2 -$ are the rates of water drop in the upstream and downstream, respectively.

The developed methods allow solving the problems of unsteady filtration in earth dams without drainage and with various types of drainage systems (drainage prism, tubular drainage, layered drainage, etc.) with impermeable and permeable bases.

The possibilities of the developed methods of unsteady filtering and the assessment of the reliability of the results obtained are illustrated below using the filtration problems [3].

A homogeneous earth dam with a drainage prism in the downstream with an impermeable base is considered here. The initial depth of the upstream is 22 m; the laying of the upstream face is $m_1 = 3$; the laying of the downstream face is $m_2 = 3$. The ratios of soil filtration coefficients in horizontal and vertical directions is $K_x/Ky = 4.0$, the coefficient of water loss of soil of the dam body is $\mu = 0.1$; the rate of water level drawdown in the reservoir is $\vartheta = 1.0$ m/day, the level of the downstream is assumed unchanged and equal to $H_2 = 3$ m.

Results of solving this non-stationary problem by the finite-difference method (FDM) and their comparison with the N. A. Aniskin and M. E. Memarianfard method [4] are presented in the table and (figure 1).

Captions to the figure and table of the article "Numerical solution of the boundary value problem of unsteady filtering in earth dams with account of filtration anisotropy in soils by the method of finite differences".
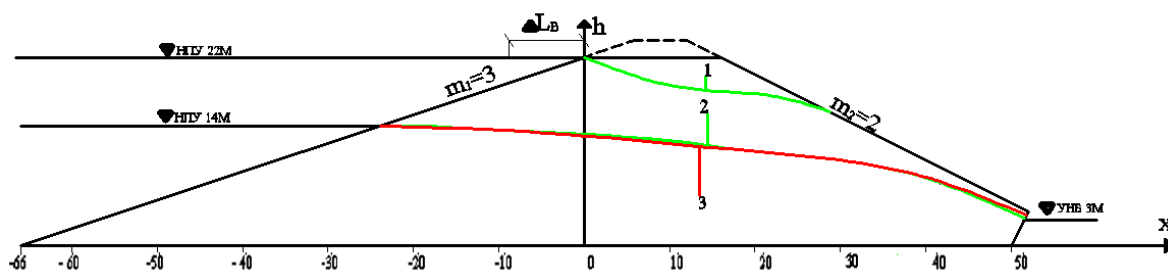
Figure 1. Results of calculations of unsteady filtering: 1 – initial depression curve at $t = 0$; 2 – positions of the depression surface by the N. A. Aniskin and M. E. Memarianfard method at $t = 8$ days; 3 – positions of the depression surface according to the FDM at t = 8 days

Table 1. – Results of calculations of unsteady filtering in a homogeneous dam with drainage prism and impermeable base

X, m	FDM method	FEM method	Deviation%
−24	14	14	0
−20	13.96	13.75	1.5
−10	13.5	13.0	3.70
0	12.7	12.2	3.94
10	11.94	11.5	3.68
20	11.4	11.0	3.5
30	10.3	10.0	2.91
40	8.0	7.9	1.25
52	3.4	3.5	−2.94

In conclusion, it can be noted that the proposed numerical method for calculating unsteady groundwater filtration takes into account the anisotropy of soils in different directions. The calculations have shown that the results obtained using the FDM are quite true, qualitatively and quantitatively agree with the results of other methods compared, which indicates the reliability of numerical calculations.

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STRENGTH OF COARSE-FRAGMENTAL SOILS OF RETAINING PRISMS OF PSKEM STONE-EARTH DAM

Abstract. The issues of the laying of stone material into the dam body are discussed in the paper; the control density of the laying is substantiated and the strength characteristics of the rock mass are roughly determined.

Keywords: sample, soil, coarse-fragmental soils, strength, shear coefficient, shear angle.

Uzbekistan has rich hydropower resources. Suffice it to say that the volume of hydropower resources of the Republic of Uzbekistan, technically suitable for the development, amounts to 27.4 billion kilowatt-hours of annual electric-power generation.

Given that hydropower resources are a natural, renewable and environmentally friendly energy source, the all-round increase in their use is in line with the modern development strategy of the Republic of Uzbekistan. This ensures guaranteed coverage of the growing electricity needs of industrial and municipal enterprises, agriculture and the population of the regions, it contributes to saving and rational use of organic fuel in the country and reducing emissions of harmful substances into the environment.

The main priorities of the development of the industry in this direction are determined by the approved Resolution of the President of the Republic of Uzbekistan dated May 2, 2017 No. PP-2947 "Program of measures for the further development of hydropower for 2017–2021. According to the program, 32 investment projects are being implemented in the system of JSC Uzbekgidroenergo to modernize and develop power plants and their networks for a total of $2.6 billion.

Investment projects include the construction of the Pskem hydroelectric power station on the Pskem river; it is one of the largest projects in the Republic. The Pskem hydropower plant (HPP) will be the second largest hydropower plant in Uzbekistan after the Charvak HPP. The zone of its influence will be the basin of the Chirchik river, the most economically developed and densely populated area of the republic and Central Asia.

The complex of the main tasks solved by this construction includes an increase in the share of hydropower facilities in the structure of the country's energy balance. Creation of new generating capacities in the electric power industry is connected to the wide use of the water-energy potential of the country's natural watercourses – renewable and environmentally friendly hydro resources, such as the Pskem river.

Considerate attitude to water potential of the republic consists in effective water management. The hydropower potential of the middle course of the Pskem river is used in order to:

– generate environmentally clean electric power and to save organic fuel;

– generate peak capacity to cover the deficit of regulatory power in the schedule of power system loads;

– implement seasonal regulation of river flow for guaranteed provision of water users of the Tashkent region in the agreed upon mode;

– develop the recreational potential of the Chimgan-Charvak resort area.

The volume and nomenclature of the estimated capacity of the Pskem HPP is 404 MW; the average annual electric power generation is 900 million kWh, the total capacity of the reservoir is 520.8 million m^3; the useful capacity is 486.5 million m^3.

The structure of the Pskem hydroelectric power plant includes the following main facilities:

– a dam built of earth materials of 195 m high with a core of loam (Fig. 1);

– a system of water discharge and water-energy facilities of the construction and operation periods;

– a building of hydroelectric station;

– a reservoir of seasonal flow regulation.

The main elements of the Pskem dam are a loamy core and retaining prisms built from the rock mass of pit No. 7. The issues of the laying of stone material into the dam body are considered in the paper and the control density of the laying is substantiated; the strength characteristics of the rock mass are roughly determined.

In working out the bedrock, a rock mass is obtained with different coefficients of inhomogeneity depending on the rock strength of the worked out package, its fracturing and interlayers of weaker rocks in the main massif.
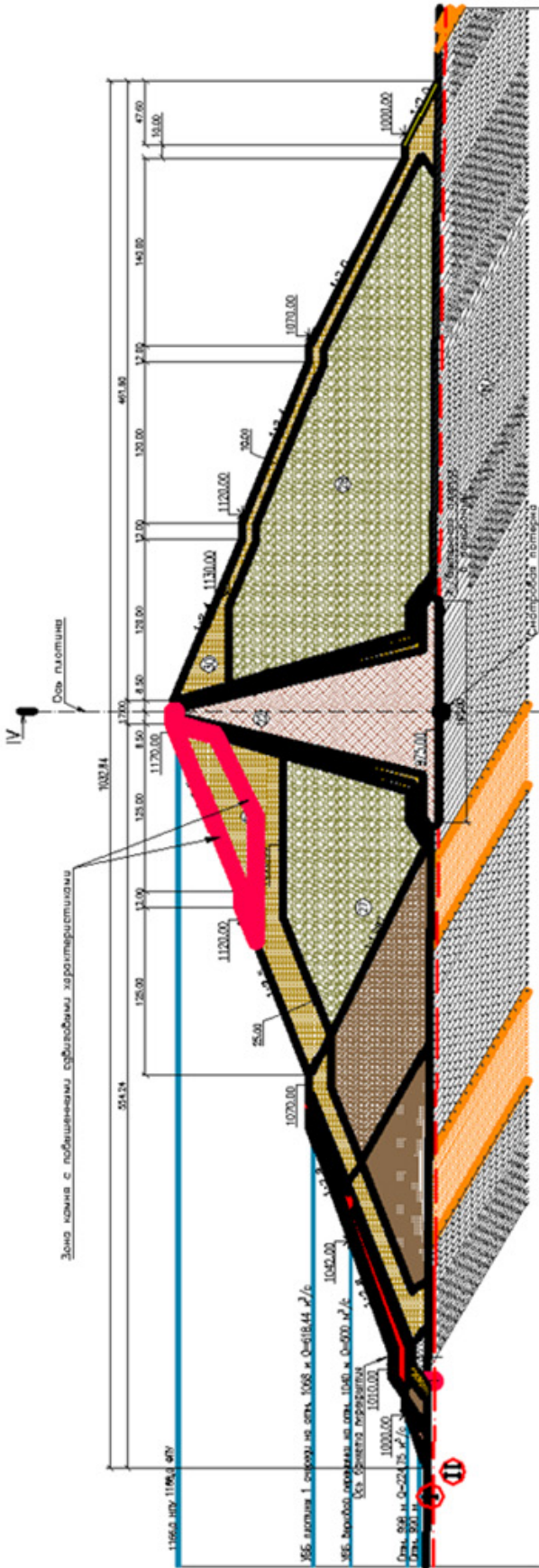
Figure1. Longitudinal profile of the dam, M 1: 2000

The strength of coarse-fragmental soils, used as materials of retaining prisms, is one of the main parameters that determine the design, dimensions and, to some extent, the technology of construction of stone-earth and rock-fill dams. In mass construction, the effective use of any materials is possible only with the standardization of their properties, and this fully applies to the strength.

This is due to the fact that despite the wide studies of the strength on each object, they are all carried out on different devices, according to different methods and are interpreted by different methods. All this leads to a low reliability of results.

In this regard, with account of ever-increasing volume of earthworks in hydro-engineering construction, the problem of the strength of coarse-fragmental soils is now one of the most pressing.

Studies have shown that the strength of coarse-fragmental soils can vary in a very wide range. The shear coefficient for one type of soil in different experiments varied by a factor of three and more (68, 97, 98).

The recommended grain compositions of the rock mass for the laying of retaining prisms of the Pskem dam are divided into three zones by the summation curves of the grain compositions. These compositions differ in terms of the content in the mix composition of fine earth (fr. < 5 mm), coarse fractions, coefficient of inhomogeneity. Therefore, in each case, it is necessary to establish experimentally the design characteristics put into the project.

Given that in the grain composition of the rock mass when conducting drilling and blasting operations (limestone) to get the minimum amount of fine earth (fr. < 5mm) ~ 5% is very difficult, the range between curves 1–3 is taken as the main composition. The curve of grain composition No. 2 is an average one for this range, for which the calculated characteristics for the corresponding number of shears are determined according to regulatory requirements.

The experiments have been carried out on a large-scale device, the use of which made it possible to carry out material tests with the inclusion of 140 mm fractions satisfying conditions $5D_{max} \leq d_{min}$ of the device. The presence of 500–900 mm fractions in the full-scale material necessitates the switching to a model composition of material.

The calculation of the regulatory and calculated characteristics of "$tg\phi$" and "c" is carried out using the formulas of the least squares method of the straight-line dependence of the form $\tau = Ptg\phi + c$ for the whole set of experimental data. The calculation of the regulatory values of tgφn and sn is given in (Table 1).

Table 1.

No	σ_i, kg/cm²	σ_i^2, kg/cm²	τ_i, kg/cm²	$\sigma \cdot \tau_i$ kg/cm²
1.	2	4	2.20	4.40
2.	2	4	2.30	4.60
3.	2	4	2.15	4.30
4.	2	4	2.10	4.20
5.	2	4	2.35	4.70
6.	2	4	2.25	4.50
7.	4	16	3.80	15.20
8.	4	16	4.0	16.40
9.	4	16	3.96	15.84
10.	4	16	3.71	14.84
11.	4	16	4.30	17.20
12.	4	16	4.00	16.00
13.	8	64	7.0	56.0
14.	8	64	7.75	62.0
15.	8	64	7.20	57.6
16.	8	64	6.80	54.4
17.	8	64	7.36	58.88
18.	8	64	7.30	58.40
19.	12	144	9.45	113.40
20.	12	144	10.75	129.0
21.	12	144	10.50	126.0
22.	12	144	10.00	120.0
23.	12	144	10.50	126.0
24.	12	144	10.20	122.4
Σ	156	1368	142.03	1206.26

The calculated strength values are obtained by dividing the regulatory values by the safety factor for soil, the physical meaning of which is that the actual values of the strength characteristics will not exceed the limit strengths of soil at an appropriate confidence probability.

The safety factor for soil is calculated from a set of paired measurements of vertical stresses and shear loads from σ_{min} to σ_{max} and depends on the variation of these values, that is, on the coefficient of variation "V".

$$\Delta = n\sum_{i=1}^{n}(\sigma_i)^2 - \left(\sum_{i=1}^{n}\sigma_i\right)^2 = 241368 - 24336 = 8496$$

$$tg\phi = \frac{1}{\Delta}\left(n\sum_{i=1}^{n}\tau_i\sigma_i - \sum_{i=1}^{n}\tau_i\sum_{i=1}^{n}\sigma_i\right) =$$

$$= \frac{1}{8496}(241206.26 - 14203.156) = 0.798$$

$$c = \frac{1}{\Delta}\left(\sum_{i=1}^{n}\tau\sum_{i=1}^{n}\sigma^2 - \sum_{i=1}^{n}\sigma_i\sum_{i=1}^{n}\tau_i\sigma_i\right) =$$

$$= \frac{1}{8496}(14203 \cdot 1368 - 156 \cdot 1206.26) = 0.720$$

Calculation of the safety factor for soil

Initial data: $n = 24$; $\sum_{i=1}^{24}\sigma_i = 156.0$; $\sum_{i=1}^{24}\tau_i = 142.03$;

$\sigma_{\frac{min}{max}12} = 2.0$; $tg\phi^\text{н} = 0.798$; $c^\text{н}=0.72$; $\bar{\sigma} = 65$; $\sum(\sigma_i - \bar{\sigma}) = 354.0$;

$$S_i = \sqrt{\frac{1}{n-2}\sum_{i=1}^{n}(c^\text{н} + \sigma_i tg\phi^\text{н} - \tau_i)^2} = \sqrt{\frac{1}{22}(2.076)} = 0.307 ;$$

$$G = \frac{\sigma_{min} - \bar{\sigma}}{\sqrt{\sum_{i=1}^{n}(\sigma_i - \bar{\sigma})^2}} = \frac{2.0 - 6.5}{\sqrt{354}} = -0.239 ;$$

$$D = \frac{\sigma_{max} - \bar{\sigma}}{\sqrt{\sum_{i=1}^{n}(\sigma_i - \bar{\sigma})^2}} = \frac{12.0 - 6.5}{\sqrt{354}} = 0.292 ;$$

$$\lambda = \sqrt{\frac{1}{2}\left[1 - \frac{1 + nGD}{\sqrt{(1 + nG^2)(1 + nD^2)}}\right]} = 0.566 ;$$

The confidence interval

$T_{min} = c^\text{н} + G_{min}tg\phi^\text{н} = 0.72 + 2 \cdot 0.798 = 2.316;$
$T_{max} = c^\text{н} + G_{max}tg\phi^\text{н} = 0.72 + 12 \cdot 0.798 = 10.296;$

$$S_{\underset{max}{min}} = \frac{V_T S_i}{\sqrt{n}} \sqrt{1 + \frac{n(\sigma_{\underset{max}{min}} - \bar{\sigma})^2}{\sum_{i=1}^{n}(\sigma_i - \bar{\sigma})^2}} = \frac{0.197}{0.223};$$

V_{T-} is the coefficient at $\kappa = 2$ and α is the confidence probability 0.95 (81, 82, 83) $V_T = 2.04$; $S_{\underset{max}{min}} = \frac{0.197}{0.233}$;

$$\gamma_\partial = \frac{T_{min} + T_{max}}{T_{min} - S_{min} + T_{max} - S_{max}} =$$

$$= \frac{2.316 + 10.296}{2.316 - 0.197 + 10.296 - 0.233} = 1.034;$$

According to the Building norms and codes, a safety factor for soil is 1.05: then the calculated values are:

$$tg\phi^P = \frac{tg\phi^H}{\gamma_\partial} = \frac{0,798}{1,05} = 0,76; \quad c^P = \frac{c^H}{\gamma_\partial} = \frac{0,72}{1,05} = 0,686, \text{kg/cm}^2.$$

Using the calculated characteristics of the strength of the rock mass for the average curve of the grain composition No. 2. and the methodological guidelines for account of strength characteristics dependence on the static stress state, we get:

$$tg\psi = tg\phi^P + \frac{c^P}{\sigma}$$

Table 2.

σ, MPa	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
tgψ	1.103	0.932	0.874	0.846	0.828	0.817	0.809	0.803	0.798	0.794
ψ°	47.8	43.0	41.2	40.2	39.6	39.2	39.0	38.8	38.6	38.4

As follows from the table a decrease in strength occurs with an increase in stresses, which allows us to conclude that the retaining prism of the dam should be erected with the requirements of their stressed state. To obtain the homogeneity in physical and mechanical properties of material, the requirements should be imposed on the laying of material in different zones of the dam body that ensure the homogeneity of strength properties.

Conclusions

In material obtained after the explosion it is recommended to sort out the rock mass by shoveling and dumping of fine-grained material, i.e. to produce a capping inside a pit, by segregating the rock mass. The possibility of using a material with a high content of fine earth above the upper curve T.U. is limited to a load of 0.4 MPa.

According to the results of numerous strength tests of the coarse-fragmental soils of theTupalang, Pskem, and Rezaksay dams, the following aspects have been determined:

– shear angle φ, used in calculating the slope stability depends both on the grain composition of material and on the density;

– with an increase in the size of material characterized by a average weighted diameter, in the experiments $d_{cp.838}.$–36.4 and $d_{cp.838}$–56.56 the shear angle increases as well;

– as the density increases, the shear angle increases as well;

– shear angle is a variable value, it decreases with an increase in normal stress.

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DEFORMABILITY DETERMINATION OF COARSE-FRAGMENTAL SOILS

Abstract. The definitions of strain properties of non-cohesive soils are given in the paper; these properties make it possible to account for lateral friction in the process of testing and to obtain soil strains corresponding to its work in full-scale conditions.

Keywords: sample, soil, coarse-fragmental soils, deformability, friction, odometer, stress, stamp.

Deformability determination of coarse-fragmental soils is usually carried out on an odometer with a rigidly fixed bottom and a movable upper stamp through which a vertical load is applied to the sample.

The disadvantage of this method is that it does not take into account the lateral friction of soil against the walls of the device in which the sample is tested. The stresses in the sample decrease from the surface to the rigid bottom not only due to the friction of the particles, but also due to the friction against the walls of the device. The value of friction against the walls of the device is in functional dependence on the load applied to the sample of tested material, its grain composition, the particle shape factor, etc. The results of compressibility obtained on such devices do not allow us to estimate the actual compressibility of soils.

The method for determining the compressibility of soils in the odometer takes into account lateral friction. The method we have developed for determining the strain properties of non-cohesive soils makes it possible to take into account lateral friction in the process of testing and to obtain soil strains corresponding to its work in fill-scale conditions.

In this method, an account of soil friction against the walls of the device is conducted by parallel testing of two samples of soil of equal height. The first sample is tested in the odometer of conventional type with a movable top stamp and a bottom rigidly fixed to the walls. The stresses applied to soil continuously decrease along the depth of the sample down to its base (Fig. 1) due to the friction of the particles and their friction against the walls of the device. The value of friction against the walls of the device is in functional dependence on the load applied to the sample, as well as on a number of other factors: material, density, grain composition, particle shape factor, etc.

The second sample is tested in the odometer of the same diameter as the first one, but here both the upper stamp and the lower stamp are movable and the pressure is transferred to the sample through both stamps. Here, at the top of the sample and at its base the stresses are equal to the applied load and they decrease according to the same law from both surfaces of the sample to its middle (Fig. 1, b).

In accordance with the above, in the second sample the average stress is two times greater than in the first one, due to the reduction of lateral friction. Parallel testing of soil on two devices of the same diameter makes it possible to eliminate lateral friction and to calculate the actual soil strain according to:

$$i_{\partial} = i_2 + (i_2 - i_1)\frac{\dfrac{kh}{R} - (1 - e^{\frac{-kh}{R}})}{0.5 - (1 - e^{\frac{-kh}{R}})^2} \tag{1}$$

where i_{∂} – is the actual relative soil strain; i_2 – is the relative strain at load application on the sample with two movable stamps; i_1 – is the relative strain at load application on the sample with one movable stamp; e – is the base of natural logarithm; R – is the radius of the device; h – is the height of the sample; k – is the friction coefficient.

In the general case, soil friction against the walls of the device "τ" is determined by the normal compressive stresses "σ" occurring between them.

$$\tau = f(\sigma) \tag{2}$$

Without changing the generality, the following can be written

$$\tau = k\sigma \tag{3}$$

where k is taken as a function "σ".

Consider the equilibrium of the elementary soil layer of a thickness of dx in the odometer; the layer is subjected to compressive stresses equal to σ of the top surface. The equilibrium equation of this layer has the form:

$$\pi R^2 d\sigma = -2\pi R k \cdot \sigma\, dx \tag{4}$$

$$\frac{d\sigma}{\sigma} = -\frac{2k}{R} dx ;$$

$$\int_{\sigma_0} \frac{d\sigma}{\sigma} = -\frac{2k}{R} \int_0^x dx ;$$
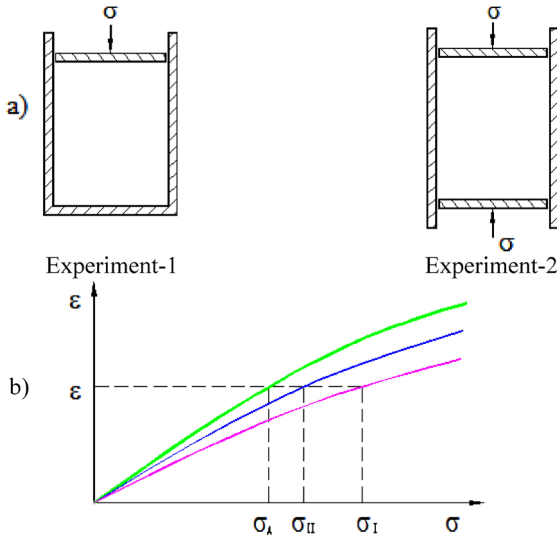
Figure 1. Determination of the scale effect of strain of coarse-fragmental soils due to friction against the side surfaces of the samples: a) scheme of experiments, b) graphics of deformability: 1 – experiment I; 2 – experiment II; 3 – real curve

$$\ln\frac{\sigma_x}{\sigma_0} = -\frac{2k}{R}x \rightarrow \frac{\sigma_x}{\sigma_0} = e^{-\frac{2k}{R}x};$$

$$\sigma_x = \sigma_0 e^{-\frac{2k}{R}x}$$

$$\sigma_{cp} = \frac{1}{n}\int_0^n \sigma_0 e^{-\frac{2k}{R}x}dx = \frac{\sigma_0}{h}\int e^{-\frac{2k}{R}x}dx = -\frac{2k}{R}x = z \rightarrow \frac{2k}{R}dx = dz$$

$$dx = \frac{R}{2k}dz \quad x = 0 \rightarrow z = 0 \quad x = h \rightarrow z = -\frac{2k}{R}h$$

$$\sigma_{cp} = \frac{\sigma_0}{h}\int_0^h \sigma_0 e^{-\frac{2k}{R}x}dx = \frac{\sigma_0}{h}\int_0^{-\frac{2k}{R}h} e^z dz = -\frac{\sigma_0 R}{2kh}(e^{-\frac{2k}{R}h}-1)$$

$$\sigma_{cp} = \frac{\sigma_0 R}{2kh}(1-e^{-\frac{2kh}{R}}) \qquad (5)$$

The second odometer

$$h \rightarrow \frac{h}{2} \quad \sigma_{cp} = -\frac{\sigma_0 R}{2hk}\int_0^{1/2} e^z dz = -\frac{\sigma_0 R}{2hk}e^{-\frac{5kh}{R}}+c$$

$$c \rightarrow h = 0; \; \sigma_{cp} = \sigma_0 \; \sigma_{cp} = \frac{\sigma_0 R}{kh}(1-e^{-\frac{kh}{R}}). \qquad (6)$$

As a result of the tests two compressibility curves $\sigma \div i$ are obtained. Sectioning these curves in an arbitrary point with horizontal lines, two values of stresses σ applied to both samples are obtained; the samples strains are equal. The equality of

strains is a consequence of the equality of the average compressive stresses. In accordance with this, it can be written:

$$\frac{\sigma_1 R}{2kh}(1-e^{-\frac{2kh}{R}}) = \frac{\sigma_2 R}{kh}(1-e^{-\frac{kh}{R}}) \qquad (7)$$

The average stress in the odometer with two movable stamps (the right side of the equation) is calculated taking into account the fact that with such an experiment scheme, the strains and stresses in the sample are symmetrical about its midpoint. Solving this equation, we get

$$\kappa = -\frac{R}{h}\ln(2\frac{\sigma_{(2)}}{\sigma_{(1)}}-1). \qquad (8)$$

With known value of "k", corresponding to stress range $(\sigma_1 \div \sigma_n)$ it is possible to calculate the average stresses in the same range for each sample

$$\sigma_{cp(1)} = \sigma_0 \frac{R}{2kh}(1-e^{-\frac{2kh}{R}}) \qquad (9)$$

At small changes in stresses, the strains proportional to them, can be written as:

$$\begin{cases} \sigma_{cp(2)} - \sigma_{cp(1)} = \kappa(i_2 - i_1) \\ \sigma_0 - \sigma_{cp(2)} = \kappa(i_0 - i_2) \end{cases} \rightarrow \frac{\sigma_{cp(2)} - \sigma_{cp(1)}}{\sigma_0 - \sigma_{cp(2)}} = \frac{i_2 - i_1}{i_0 - i_2}$$

Hence

$$i_0 = i_2 + (i_2 - i_1)\frac{\sigma_{cp(2)} - \sigma_{cp(1)}}{\sigma_0 - \sigma_{cp(2)}} =$$

$$= \frac{\sigma_0 - \sigma_0\frac{R}{kh}\left(1-e^{-\frac{kh}{R}}\right)}{\sigma_0\frac{R}{kh}\left(1-e^{-\frac{kh}{R}}\right) - \sigma_0\frac{R}{2kh}\left(1-e^{-\frac{2kh}{R}}\right)} =,$$

$$= i_2 + (i_2 - i_1)\frac{\frac{kh}{R} - (1-e^{-\frac{kh}{R}})}{1-e^{-\frac{kh}{R}} - \frac{1}{2} + \frac{1}{2}e^{-\frac{2kh}{R}}} \qquad (10)$$

$$i_0 = i_2 + (i_2 - i_1)\frac{\frac{kh}{R} - (1-e^{-\frac{kh}{R}})}{0.5(1-e^{-\frac{kh}{R}})^2}$$

Conclusion

Experiments conducted with conventional odometers at load transfer through one movable stamp have shown that the relative settlement obtained at different values of density is 1.8–2 times less than at load applied to the sample from two sides. This is explained by the fact that the friction of soil against the walls of the device reduces the stresses acting on soil.

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TO THE QUESTION OF CAPACITY DETERMINATION OF TUNNEL SPILLWAYS

Abstract. This article presents the results of hydraulic studies to determine the capacity of a tunnel spillway at partial opening of the gates, and shows the curves of water flow as a function of the water depth of the upstream at various stages of gate opening.

Keywords: capacity, water discharge, tunnel spillway, head, upstream level, discharge coefficient, compressed depth, differential.

The main purpose of these studies is to determine the capacity of a tunnel spillway at various stages of gate opening and water levels in the upstream.

When conducting research, a tunnel spillway of hydro power plant No. 1 on the Vakhsh river has been chosen as an object of the study; it includes the power supply path. The water power supply structure also includes a water intake of 40 m height of tower type with two openings of total width of 10 m.

Since the solution of the problem of capacity determining by the calculation method with sufficient accuracy is not possible because of the inconsistency of the design scheme, the studies have been conducted on the hydraulic model of the tunnel spillway built on a scale of 1:60 of actual size.

The model shows:

1. A section of the upstream with dimensions of 120 × ×120 m with bottom relief.

2. Entry crown of the right thread and transition section from the entry crown to the supply tunnel.

3. The headrace energy path with connection to the actual spillway tunnel.

4. The downstream channel section of 200 m length.

The tunnel model is made of organic glass.

The flow through the tunnel passes at an appropriate water levels in the downstream along the flow curve of the water gauge station. Water levels in the upstream and downstream have been recorded on the model with water-measuring needles, and water flow has been measured at the end of the model with a trapezoid spillway 0.5 m deep across the bottom.

Water is supplied to the model through a pipeline from a pumping station connected to a reservoir located in a closed circuit of water supply and water discharge paths.

The research includes the following issues:

– determination of flow rates and water levels in the upstream at randomly selected stages of gate openings, $a = 0.98$; 2.0; 4.0; 6.0; 8.0m

– determination of the dependence of discharge coefficients "μ" of the spillway on gate opening and the water depth in the upstream.
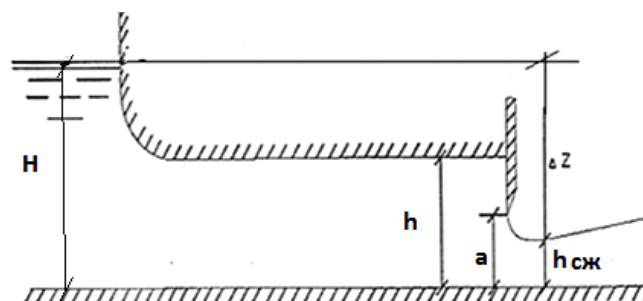
Figure 1. Hydraulic design

It should be noted that the capacity definition of a tunnel spillway is usually determined by design scheme 1 shown in (Fig. 1). However, the design scheme adopted for our design of the spillway (see figure 2) differs from the design (scheme 1).

The difference lies in the fact that directly behind the gate in the bottom of the spillway, a ledge of 0.5 m high is arranged (see Fig. 2).

The following assumptions have been made.

1. The ledge in the bottom is moved down to a distance $l \geq \alpha$

2. The compressed depth is moved to the bottom behind the ledge without taking into account the pressure losses in this area (as immeasurably small).

3. The additional head formed when transferring hcomp to the bottom behind the ledge is not taken into account, since its magnitude is a fraction of a percent of the total head, and could be neglected.

Water discharge in scheme 2 is determined by the formula.

$$Q = \mu\,a\,b\,\sqrt{2g \cdot \Delta z} \tag{1}$$

where μ – is the coefficient of discharge.

b – is the span width, m

a – is the height of gate opening, m

Δ – is the design head, m

$$\Delta Z = H + P_{set} - h_{comp} \tag{2}$$

where: H is the water depth in the upstream relative to the bottom of the threshold, m

P_{set} – is the height of the ledge, m

h_{comp} – is the water depth in the compressed section, m

$$h_{comp} = \varepsilon \cdot \alpha \tag{3}$$

ε – is the vertical compression ratio of the jet $\varepsilon = f(a/h)$ [2].

Figure 2. Hydraulic design
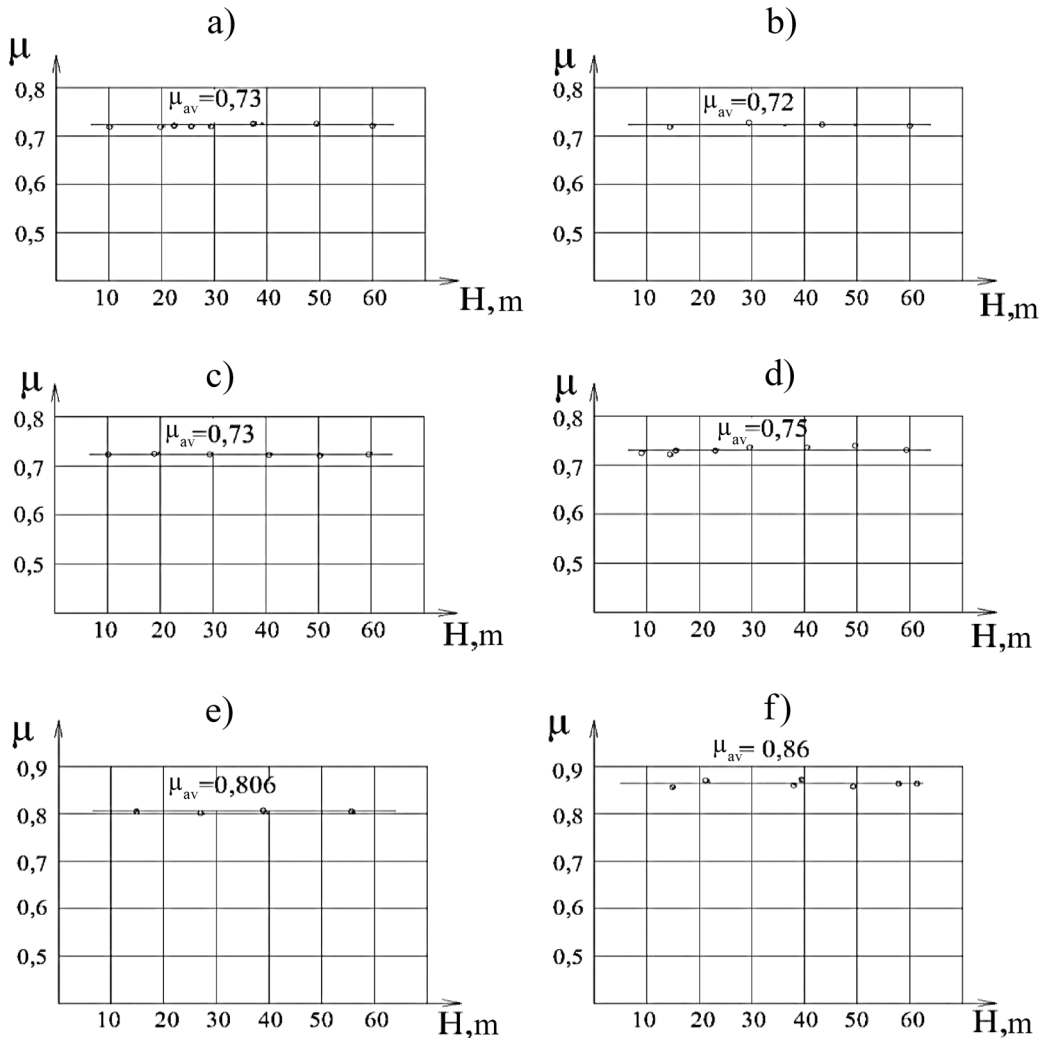
Figure 3. Dependences of the discharge coefficient "μ" on the head "H": a) at gate opening $a = 0.98$ m; b) at gate opening $a = 2.0$.m; c) at gate opening $a = 4.0$.m; d) at gate opening $a = 6.0$.m; e) at gate opening $a = 7.0$.m; f) at gate opening $a = 8.0$.m

The capacity of the spillway was determined experimentally on the model. Experiments have been carried out at gate openings a = 0.98; 2.0; 4.0 6.0; 8.0 m, in symmetrical operation of the gates and separate operations of each opening. At the same time, the water depth in the upstream and the corresponding flow rates have been measured.

Based on the results of experiments, the discharge coefficient of the spillway "μ" in the section upstream-compressed depth was determined.

The definition of design head was made taking into account the above-mentioned ledge in the bottom of the spillway behind the gates.

According to the results of experimental studies, the dependences of the change in the discharge coefficients "μ" on gate opening "a" and on water depth in the upstream "H" have been constructed. (Figure 3, a–f).

The analysis of these dependences allows us to conclude that within a single opening of the gate, the flow coefficient "μ" can be considered constant, regardless of the change in water depth in the upstream.

Based on the curves of dependences $\mu = f(H)$, a curve for the opening of the gates versus the flow coefficient $\mu = f(a)$ has been constructed.

This dependence curve (see Fig. 4) shows that the flow coefficient μ remains constant for the values of gate opening "a" from 0 to 4.5 m: and then increases with increasing "a" (Fig 4).
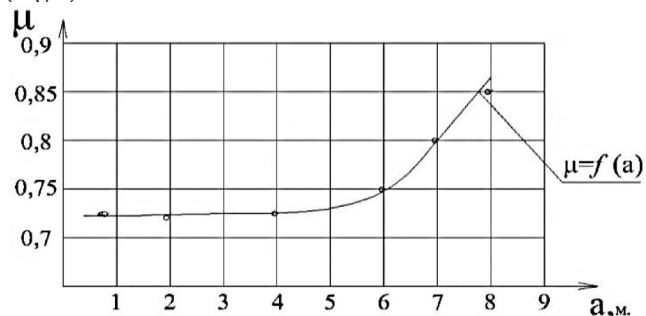
Figure 4. Dependence of the discharge coefficient "μ" on gate opening "a" in the range of head change "H" from 8.0 to 60 m
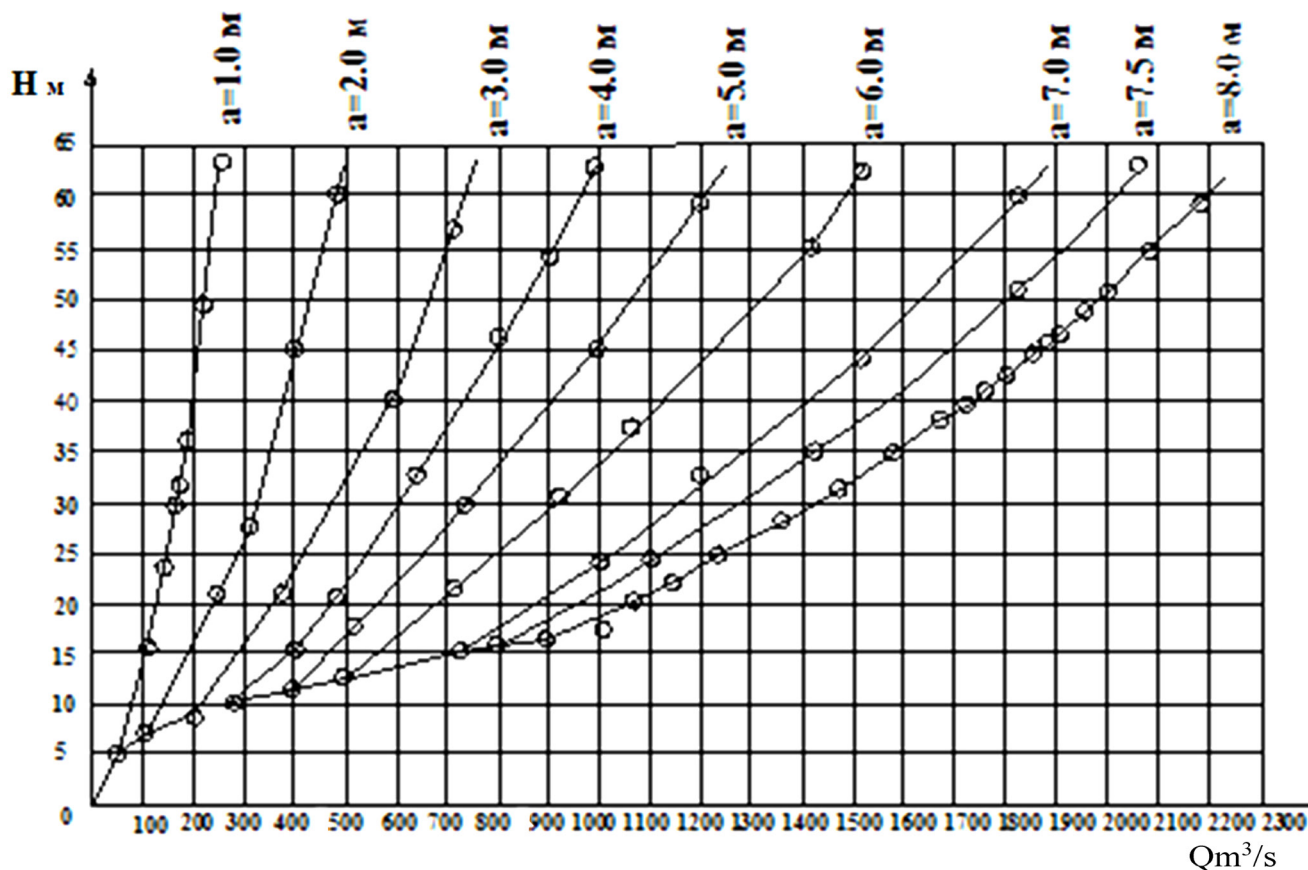
Figure 5. Dependences of water depth in the upstream "H" of a tunnel spillway on the flow rate "Q" at various stages of gate opening

The dependence $\mu = f(a)$ makes it possible to determine the value of "μ" for various openings of the gates "a" and then calculate the capacity of the spillway at different water depths in the upstream.

The results of calculation are presented in the form of the curves of water flow Q through the spillway versus the depth of water in the upstream at various stages of gate opening with intervals of 1.0 m (Fig. 5).

It has been established by experiments that when one span is operating, the value of the flow coefficient "μ" versus the gate opening "a" practically does not differ from the dependences $\mu = f(a)$ for symmetric operation of two openings.

Consequently, according to the dependences $Q = f(H; a)$ shown in Figure 5 it is possible to determine the flow rate of the tunnel spillway at any opening of the gates.

It should be noted that the data on water discharge calculated by the first design scheme compared with those calculated by the second design scheme (experimental data) show significant deviations – the relative error is about $\delta = 15$–20%, which is unacceptable (Table 1).

Table 1.

H, m.	a, m	Q, m³/s Design scheme 2 (experiment)	Q, m³/s Design scheme 1
61.2	0.98	248.31	193.3
24.4	0.98	156.25	125.18
60.4	4.0	993.45	814.7
42	4.0	812.42	678.9
12.6	4.0	397.9	378.0
42.66	6.0	1257.15	1028.0
24.54	6.0	910.27	789.1
61.8	8.0	2245.0	1847.0
24.8	8.0	1294.0	1060.0

So, in hydraulic calculations of tunnel spillways of this type, the scheme 2 should be used as a design scheme (Figure 2).

Thus, the water discharge through a tunnel spillway with a known opening of gates and known water depth in the up-stream is determined by formula (1) or by curves (Fig. 5) for symmetrical opening of the gates.

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ON THE CALCULATION OF THE NON-SCOURING VELOCITIES OF A STATIONARY WATER FLOW IN CHANNELS LYING IN DIFFERENT SOILS

Abstract. The article deals with the problems of determining the non-scouring velocities of water flow in the channels of non-cohesive, cohesive and saline soils. Modified dependences are proposed on the basis of the formulas of the Acad. S. E. Mirtskhulava.

Keywords: non-scouring velocity, tractive force, adhesive force, saline soil.

With the correct choice of the value of the non-scouring velocity, the possibilities of planned and deep deformations of the channel bed, as well as deformations along its length, are significantly reduced. In the literature, there is a large number of computational dependencies, which are recommended for establishing cross-sectional dimensions and values of non-scouring flow velocities in earthen channels [1].

The study of non-scouring velocities is connected with the study of the channel flow. The interaction of the stream and the channel is studied experimentally, theoretically, based on the discovery of the limiting equilibrium of individual particles or the initial moment of their displacement with the bottom.

When the channels are washed away, the nature of the current is determined by the active forces, and the properties of the soils are passive (resistance forces).

Two approaches are used to simulate the stability of beds for erosion: 1) the method of non-scouring velocities, which makes it possible to obtain design formulas that represent a generalized hydraulic characteristic of soil stability to erosion, and; 2) the method of tractive force (shear force or friction force) that acts on channel bed in the direction of flow.

At the present time, there are a large number of formulas for determining the non-scouring velosities of the water flow for non-cohesive and cohesive soils, both empirically and on the basis of certain preconditions for limiting equilibrium of particles, with the introduction of a number of additional parameters for taking into account various factors affecting soil erosion and values empirical coefficients

Analysis of the formulas shows that each author, offering his dependence, proceeds from its greatest correspondence with the available experimental data available to him.

Compared with other dependencies, it can be assumed, that in the most complete form of the main erosion factors are taken into account in the formulas of S. E. Mirzkhulava [1], which found wide application in the domestic practice of hydraulic calculations and in the design of hydraulic structures.

An analysis of the existing dependencies shows that, as non-cohesive soils, and for more complete under conditions of cohesive soils, the main factors in the S. E. Mirzkhulava formula that are reflected in the normative documents are taken into account. They depend on the depth of flow h, the specific cohesion between soil particles C, Pa, and the content of readily soluble salts.

To use these formulas, the calculation of the channels requires fairly complete data on the structure of the flow and the properties of the bed of the channel bed.

However, not all factors are taken into account in the proposed formulas of S. E. Merzkhulava. For example, the

cross-section of the trapezoidal channel, since the earth channels are built according to the trapezoidal shape of the section.

In order to obtain a parameter taking into account the shape of the cross-section of the trapezoidal channel in conditions of cohesive soils, an experimental study was carried out on the basis of the dependencies of S. E. Mirtskhulava. Laboratory experiments were conducted in the laboratories of the "Methods of hydraulic research" of the Central Scientific Research Institute of Transport Construction of the Russian Federation (SNIIS) and the Karshi Engineering and Economics Institute of the Republic of Uzbekistan.

Experimental studies were conducted to study the following problems: the establishment of non-scouring flow rates in various (non-cohesive, cohesive and saline) soils; experimental studies on the establishment of non-scouring water flow rates were carried out on the trapezoidal channel model. On the slopes and at the bottom of the canal, nests for metal cassettes with dimensions of 0.33 × 0.15 × 0.10 m in the central part of the canal bottom were arranged. In the cassettes the investigated soils were laid [2; 3; 4]. In the cassettes, the investigated soils were laid. On this model, experimental studies were carried out to establish the non-scouring velocities of the water flow in non-cohesive, cohesive and saline soils.

The method of carrying out experimental studies and preparing soils for experimental studies completely corresponded to the methodology of S. E. Mirzkhulava, set forth in [1].

Before and after each experiment, the physico-mechanical parameters of the investigated soils were established.

In the first series, 10 experiments were carried out for 5 samples of non-cohesive soil with the following fractions [2]:

$d_{med} \leq 0.315\ mm; 0.315 < d_{med} < 0.63\ mm;\ 0.63 < d_{med} < 1.25\ mm;$ $1.25 < d_{med} < 5.0\ mm.\ 2.5 < d_{med} < 5.0\ mm.$

In the second series of experiments, 6 samples of the disturbed structure of cohesive soils were used, which differed from each other in the content of different amounts of solid material [4].

In the third series, experiments were conducted to establish the non-scouring velocities of the water flow in conditions of saline soils. Five samples of the disturbed structure of cohesive saline soils were studied. Which were prepared as follows: the first soil sample was represented by a non-saline light sandy loam, and salt solutions with concentrations of 10 g/l were gradually added to the ostal samples; 20 g/l; 35 g/l and 50 g/l; the resulting mixtures were thoroughly mixed and uniformly compacted in metal cassettes; cassettes of soil samples were placed in five baths in which solutions of salt of the appropriate concentration were found and held for 10–15 days [3].

The following calculation formulas are obtained for determining the non-scouring velocities of the water flow of the bottom and channel slopes:

In non-cohesive soils [2]

$$\vartheta_{_H} = \left(\lg \frac{8,8h}{d_{cp}} \right) \sqrt{ \frac{2m_1}{0,44 \cdot \eta \rho n_1} \left[g\left(\rho_s - \rho \right) d_{cp} + 2C_{y_1}^H K_1 \right] };\ (1)$$

In cohesive soils

$$\vartheta_H = \left(\lg \frac{8 \cdot 8h}{d} \right) \sqrt{ \frac{2m_2}{2,6\rho n_1} \left[g\left(\rho_s - \rho \right) d + 1,25 \cdot \phi C_{y2}^H K_2 \right] }.\ (2)$$

According to studies, it is justified that for non-cohesive soil the value of the coefficient η for the bottom $\eta = 1,41$ and for the slope $\eta = 1,52$, and for cohesive soils the value of the coefficient ϕ for the bottom $\phi = 2,6$ and for the slope $\phi = 2,7$.
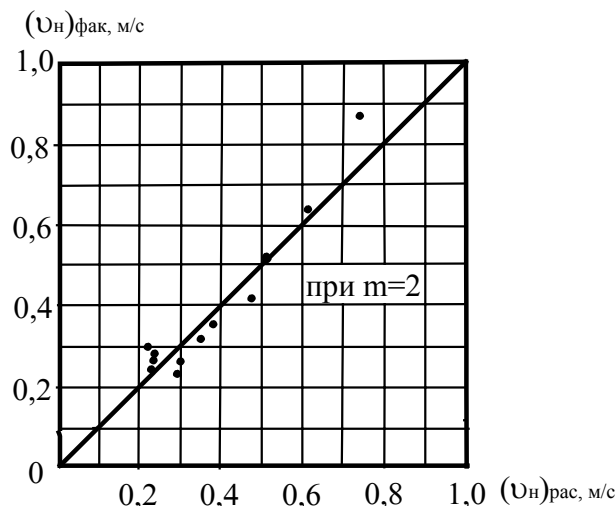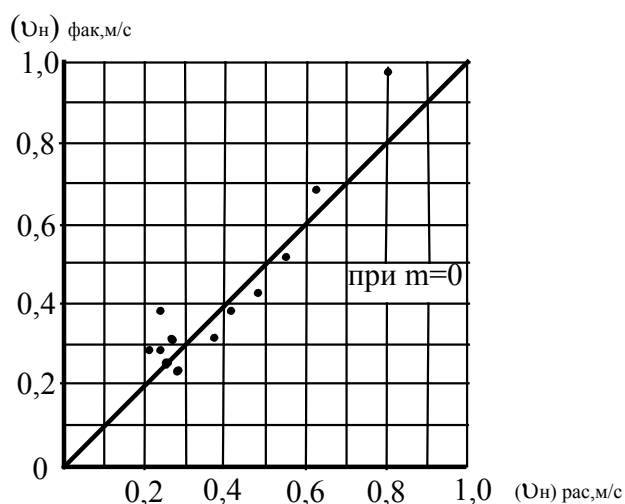
Figure 1. Comparison of the non-scouring velocities of the water flow in conditions of non-cohesive soils with the calculated dependence (1)

Comparison of the experimental data with the computed dependences (1) and (2) shows a close correspondence between them (Fig. 1, 2).

When the water flow passes over saline soils, the salts are leached and their parts are carried away by the water flow.
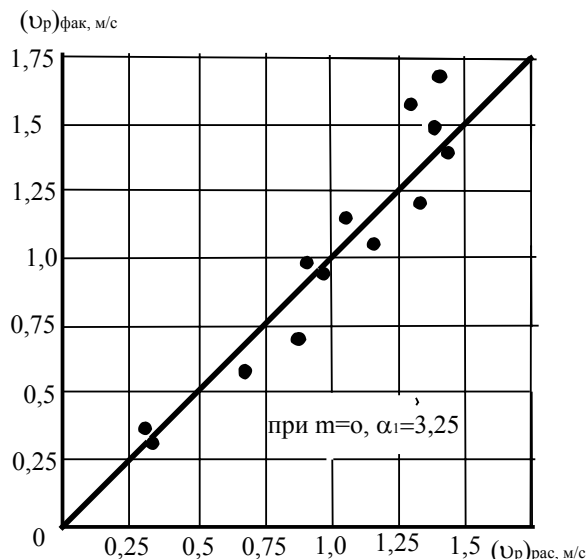
At the same time, the connection between aggregates of soil are destroyed and the erosion process begins earlier than in un-saline soils.
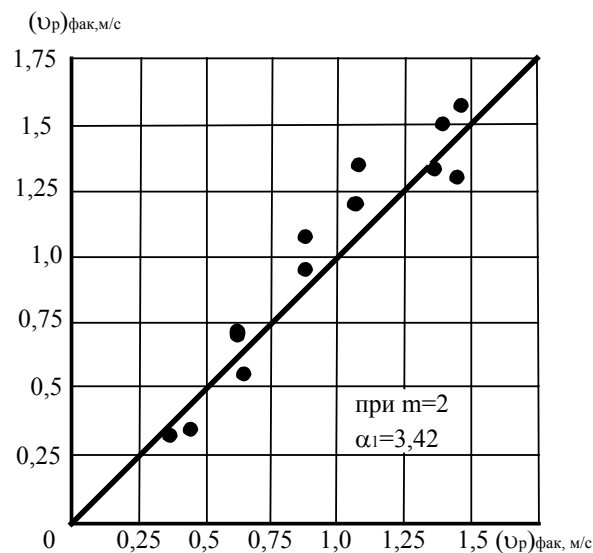
Figure 2. Comparison of the scouring velocities under conditions of cohesive soils with the calculated dependence (2)

The existing studies have improved the existing methods of calculation by determining the non-washing velocities of the water flow in saline soils [3].

As a result, the definition of the dependence of the non-scouring velocities of the water flow in the cohesive soils, we write for the saline soil in the following form:

$$\vartheta_H = \left(\lg \frac{8 \cdot 8h}{d} \right) \sqrt{ \frac{2m_2}{2,6\rho n_1} \left[g(\rho_s - \rho)d + \psi C_{y2}^H K_2 \right]}, \ (3)$$

where ψ – is the parameter depending on the salinity of the soil, which is taken from the graph of dependence $\psi = f(\zeta)$ (Fig. 3).

Comparison of the results of the experimental studies on non-scouring velocities in different (non-cohesive, cohesive and saline) soils with the calculated values proposed by the modified dependences yield reliable results.
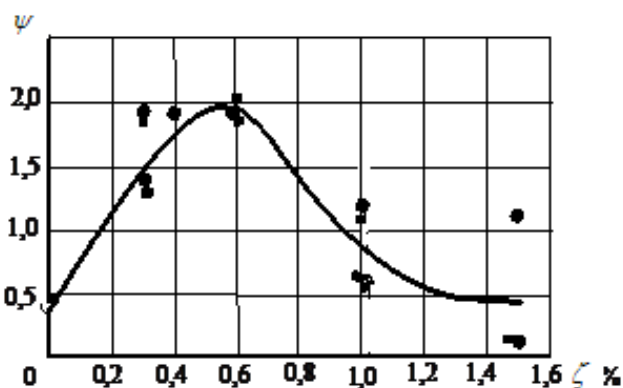
Figure 3. Graph of dependence $\psi = f(\zeta)$.

Thus, to calculate the non-scouring velocities of the water flow in the trapezoidal channels lying in different soils, can be used the dependences (1), (2), and (3).

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KNITTED FILTERS AND THEIR APPLICATION IN INDUSTRY

Abstract. This article presents the results of research on knitted filled filters, their application in the food industry, in particular when filtering juices.

Keywords: filtration, textile fabrics, cleaning, sleeve, filler, filled knitted filter, composites.

Introduction. Advances in the development of new filter materials with specific properties associated with the emergence of new fibers and new ways of modifying existing canvases, as well as a new approach to their formation. The properties of various materials are most successfully realized in their compositions, when the shortcomings of one material are covered by the merits of another or new properties appear that are not inherent in individual components.

Non-traditional fibers (sorption, antimicrobial, basalt, etc.), in particular, chemisorption fibers have low mechanical properties, which makes it difficult to form yarn from them for the manufacture of textile material. All attempts to improve the mechanical properties of nonwoven fabrics formed from them are accompanied by a deterioration in the sorption properties. Fabrics have significant hydraulic resistance when filtering. The lack of physical and mechanical properties of nonwovens, and the increased complexity of the formation of a solid tubular shape in both ways makes it promising to create filtering composite solid sleeves based on knitted fabric with a filler of the above-mentioned bulk fibrous materials.

Based on the above, a new approach to the formation of filters has been developed, using the capabilities of knitting equipment, including a method for producing filled knitwear from various types of raw materials, both for the base and for the filler, taking into account their thermal resistance, chemical resistance to acid and alkaline media, oxidizing agents, solvents, etc.

Technological regulations for the production of the proposed product have been developed, it is implemented in the production condition of PE "Gani Rakhimov Ishonch" and a pilot batch of highly efficient filter cloths with imitating fibrous materials like cotton and polyacrylonitrile yarn has been obtained. The technological parameters, physicomechanical and operational properties of experimental samples (Tables 1 and 2) were investigated.

Table 1. – Refueling and technological parameters filter cloths

Linear density (number) of raw materials, basis filler	Density on 100 mm hinges		A, mm	B, mm	The length of the thread in the loop, L, mm	Q, g/m²
	Wg	Rv				
Cotton yarn 17.5 (№ 34) t× 1 × 2	54	88–44	0.92	0.6–1.1	4.5	435
Cotton yarn 21 (№ 28) t × 1 × 2						
PAN21 (№ 28) t × 2	48	76–38	1	0.7–1.3	5.1	534
Cotton yarn 21 (№ 28) t × 1 × 2						

Table 2. – Physico-mechanical and operational properties of the filter cloths

Thickness, mm	Breaking load, N		Relation. elongation,%	Abrasion resistance, cycle	Breathability **, cm³/cm² s
	length	width			
1.35	345	292	9.4	12500	41
1.65	471	201	7.9	28000	101

Note: * force above 6 N; ** P = 1 ATM

Taking into account the particular demand of the industry for high-performance filters, new samples of filled knitwear from 100% cotton raw materials have been tested in the chemical and food industries.

– In the chemical industry.

The filtering properties of the filled knitted fabric by comparison with the data of the fabric were tested in laboratory conditions by JSC "Navoyiazot" when filtering liquid samples of the following theorem production flows (TM):

1. Solution of rhodium ammonium for purification from impurities after decomposition of ammonium polysulfide pos. P 301.

2. Suspensions of double salt (DS) after the washer of item 203 for the separation of the double salt from the solution of rhodium ammonium (RA).

The filtering ability of the tested knitted fabric was compared under similar test conditions with the filtering capacity of cotton filter cloth (FST Uz 6.1–56–96) used in the production of theorem.

When filtering a solution of rhodium ammonium from insoluble sulfur-containing compounds, the amount of impurities trapped on the filter, the filtration rate and the optical density of the filtered solution were determined.

The test results on the filtration of the rhodium solution p. P 301 are given in (table 3.)

As can be seen from (table 3), the cleaning efficiency of the test knitted fabric from sulfur-containing impurities is lower than that of cotton filter cloth.

Table 3. – Test results on filtration of the birthing solution

No. p/o	Name of the indicator	The norm under the rules № 63	The solution of rhodium ammonium p. P 301		
			Before filtering	After filtering	
				Test stuffed jersey	Severe fabric STP Uz 6. 156–96
1.	Mass fraction of polysulfides in solution in terms of sulfur,%	n/b 0.028	0.012	0.011	0.0069
2.	Optical density, cu	n/b 0.8	0.012	0.006	0.0045
3.	Degree of cleaning,%	–	–	50.0	62.5
4.	Filtration rate (0.5 dm³), s		–	20	30

When testing samples during the filtration of double salt, the yield and composition of the double salt were evaluated. The ratio of TM: RA was determined in the double salt and mother liquor. By the same indicators, the initial suspension of p. 203 was also analyzed. In addition, the filtration rate of the suspension was determined through the test and compared samples.

Filter samples were pre-soaked in water. In the amount of 0.5 dm³ of the DS suspension, p. 203 was filtered on a Buchner funnel under a vacuum of 0.5 ÷ 0.6 kg/cm² through filter samples.

The filtered crystals were diluted to a salt concentration (35 ÷ 37)% and the ratio TM: PA was determined.

The test results are shown in (table 4).

Table 4. – Sample Test Results

No p/o	Name of the indicator	Ex. Sample suspension DS (TM: RA)	After filtering			
			Through the test filled jersey		Through the compared fabric SPT Uz 6.1–56–96	
			Double salt (TM: RA)	Mother liquor	Double salt (TM: RA)	Mother liquor
1.	The amount of salts (TM + PA) in suspension,% G	62.87	36.5 235.09	58.4 490.6	36.0 236.1	57.2 478.5
2.	Ratio (TM: RA),% G	16.07: 46.8	20.1: 16.4 47.3: 38.5	11.75: 46.65 57.6: 228.9	21.3: 14.7 50.3: 34.7	10.2: 47.0 48.8: 224.9
3.	Filtration rate (0.5 dm³) s	–	75	–	96	–

As can be seen from the data on the output of double salt given in (Table 4), filtering samples (test and harsh cloth (STP Uz 6.1–5696)) showed approximately the same results.

The ratio of TM: RA in this salt was slightly better when filtered through the compared severe fabric.

Filtration rate through the test filled knit more than through harsh fabric.

On the basis of the conducted studies, it can be concluded that the filled knitwear is inferior to the harsh fabric currently used in the shop in terms of the filtering ability of the RA solution from impurities (STP Uz 6.1–56–96).

Manufacturers found that for a more accurate assessment of the filtering ability of the subject filled with knitwear when filtering double salt requires experimental testing on a pilot plant.

– in the food industry.

On the filters, the juice is passed through a porous septum, sediment is retained. Cardboard, pressed asbestos, and bulk materials – fibrous asbestos, diatomaceous earth, bentonite clay, which are applied to the metal mesh or filter fabric (belting) are used as a partition. Consideration is being given to replacing the filter fabric with a fabric filled jersey filter.

The sediment contained in the juice, partially deposited on the surface, and partially penetrates into the pores of the filter septum. In this case, the filtering is intermediate between the slurry and clogging. The sediment first accumulates in the pores of the material used, then forms a layer of particles on the surface. Due to the growth of sediment filtering takes place at a variable pressure.

Fruit juices are filtered only at constant and low pressure – up to 68.6–78.4 kN/m^2 (0.7–0.8 atm.). The sediment consisting of organic particles contained in the juice is easily compressed at an elevated pressure, which causes a filter blockage that prevents further process.

The studies were conducted on grape and Jerusalem artichoke juices, under the production conditions of LLC "Dalvarzintamirlash", "SAYOHAT AGRO MAHSULOT" in the Tashkent region LLC "Namangan Sharbati" in the Namangan region. The filtration rate increases significantly with decreasing precipitate amount. To speed up the process, the clarified juice is decanted from the precipitate and centrifuged, and then filtered.

The filtering process requires a pressure drop on both sides of the filter septum. With an increase in pressure, the porosity of the septum, as well as the speed of the process, first increase, and then due to slump compression and clogging of the filter pores. For grape juice, the highest filtration rate is achieved at a pressure drop of 68.6 KN/m^2 (0.7 atm), apple juice – 78.4 KN/m^2 (0.8 atm).

The precoat filter consists of vertical frames, covered on both sides with a thick metal mesh and located in a common receptacle for unfiltered juice. A layer of fabric knitted fabric filters is applied to the mesh. The filtered juice is collected in the space between the grids and is discharged through a common channel. Before starting, the filter frames are removed and washed, as well as the internal cavity of the filter with hot water. Then the filter is collected.

Textile bag filter from the filled jersey is washed and sterilized for 30 minutes in water with a temperature of 550 °C, after which the water is wrung out.

To charge the filter, juice is loaded into the pressure tank in such a way that it is possible to fill the filter and pipelines with a slight excess. The prepared filter material in the amount of 125–150 g/m^2 of the filter septum is stirred in the juice in the pressure tank. The mixture is fed into an empty filter, after opening the purge valves to remove air, which resists filtering.

The filtered juice is allowed to be recycled until the filtrate becomes crystal clear. After that, the filtered juice is fed for bottling, and new portions of unfiltered juice are loaded into the pressure tank, but without adding any filtering material.

During operation, shocks and vibrations of the apparatus, as well as reduction of the juice level should not be allowed, in order to avoid breaking the continuous filtering layer and clouding the juice.

As sediment deposits, the filtration rate slows down, so the filter is periodically stopped, the precipitate is removed along with the filtering material, and the process starts over.

In the production of fruit juices, chamber and frame filter presses are used.

Chamber filter press consists of filter plates, equipped with two protruding hollow ribs. The edges are located on one side of the slab (top and bottom). The surface of the plates has grooves and communicates with the hollow space of the flanges.

When assembling the filter plate even numbers set flanges in one direction, and odd – in the opposite direction. In this case, the holes in the flanges of each row form channels. The upper and lower channels of odd numbers (1.3) are used to supply juice, even numbers (2.4) – to drain the filtrate. The movement of the juice can have the opposite direction – from even to odd numbers.

The material or plates sandwiched between the plates of the filter press serve simultaneously as a partition and filter material.

The juice supplied by the pump enters the channels formed by the flanges of one row, then goes to the plate grooves, passes through the filter septum and falls on the grooves of adjacent plates, from where it is drained through the flanges of the plates of the opposite side of the filter.

Frame filter press in contrast to the chamber consists of alternating plates and frames. Each frame with plates adjacent to it from two sides forms a chamber. The filter is placed between the plates and the frames.

A sample of the filled knitwear is placed between the plates of the filter press and tightly clamped with a screw. Then open the air purge valves on the filter press and pump the pre-clarified and decanted or centrifuged juice. When the filter is filled with juice, the air taps are closed. The first portions of juice may be cloudy. In this case, they are fed for recycling. Since the release of crystal clear juice, it goes on bottling.

Thus, the results of the research and the judgments of the manufacturers confirm that the filled one-piece bag filters can be formed only in the knitted way. With an increase or decrease in the proportion of filler in the process of knitting, it is easy to adjust the technological parameters, physic-mechanical and other operational properties of the filter used. By applying various specific raw materials, both base and filler, according to the production requirements, you can create a series of import-substituting and export oriented filter materials.

In filter presses, porous knitted material (without filler) can be used to clean unclarified juice from large particles of fruit tissue. The porosity and deformability of the structure of the filled knitwear, in contrast to the fabric, positively accelerates the process of filtration and removal of sediments prior to re-use. Replaceable performance filters periodic action depends on the recharge mode. Since the filtering goes with a gradually decreasing speed, the more often the filtering layer changes, the higher the filtrate yield per unit time of useful work. However, with an increase in the number of recharges, which require a large expenditure of time on disassembling the filter, changing the filter layer and assembling the apparatus, the downtime is significantly longer.

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Section 10. Transport

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STOCHASTIC MODEL ACTIVITY SYSTEM OF RAIL TRANSPORT

Abstract. This article lists possible models of the rail transport system. To analyze the functioning of the rail transport system, a mathematical model was developed which illustrates the state of affairs and claims that the Markov process is accompanied by a separate number of cases.

Keywords: Rail transport, RTRS. customs post, cargo control, goods.

Rail transport regional system (RTRS) is directed to control influence of different factors that reduce working conditions according to each target structural unit in the process of real factual service. Random character of rising relevant factors reduces to probabilistic analysis of belief degree in RTRS activity.

Transport is an integral part of economic sphere. Transport system structure of goods and passengers transportation is seen in stated below system of public and special transport (figure 1).

RTRS is structural elements that are in complex interrelation and integrating a coherent whole used for transportation of goods and passengers.

RTRS has the following properties innate to complex technical systems:

– Quantity of interrelated elements with structure of complex purpose;

– All elements subordination that forms local lower system of one target function;

– Presence of security features and system protecting systemic failure and dealing with violation consequences;

– Presence of random factors impacting for violation consequences.

Many lowest systems are used for investigating of comprehensive structural forms [1].
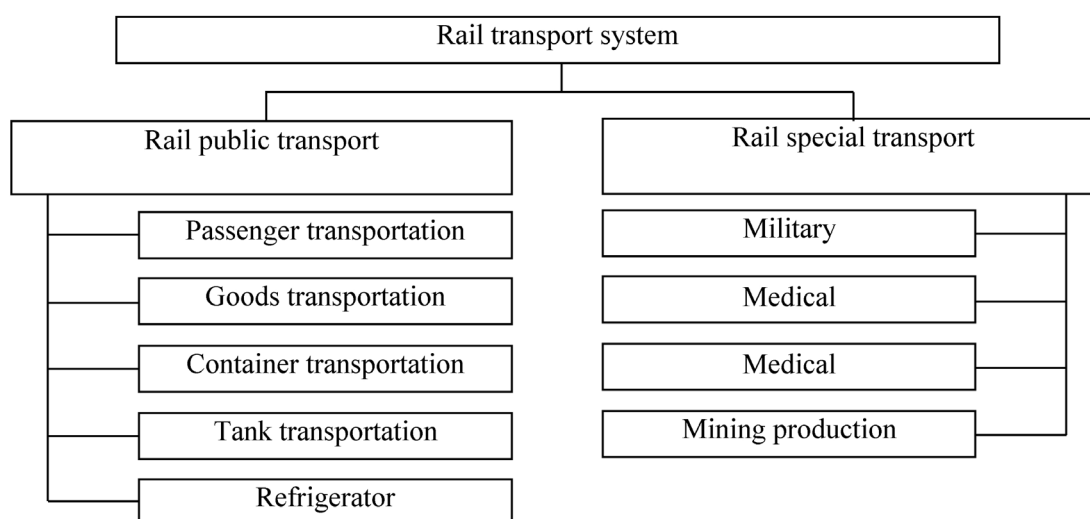
Figure 1. Structural scheme of transport system

Factors defining confidence degree to RTRS activity is referred to as systemic and divided into technical or human nature [1; 5]. Primarily there are moral, ethical and social dimension of technical factors. Non-systemic factors include probability factors not connected to surrounding features of RTRS.

Management decision taken at supporting RTRS activity is the basis to work in expected conditions.

Stochastic model defining regional RTRS activity is used for making record keeping of separate structural feature of stochastic model and random factors connecting with its activity.

RTRS stochastic model supplies opportunity of system analysis execution.

Potential source of random factors, safety, mutual activity of RTRS elements under special circumstances, quantitative importance of RTRS implementing can be identified by using model.

In RTRS assumption that specific circumstance will be committed according to the law of random events is considered probability evaluation during work.

Factors area impacts on RTRS safety supplying activity includes the following:
- Failure of transport, additional vehicle and machineries;
- Personnel failure providing transport process;
- Environmental negative factors.

Influence of each group on RTRS activity that leads to loss of overall control estimated by particular analytical measures.

For estimating of initial situations intensity (random factors) used statistic criteria, expert peer review or policy indicators.

Initial situations statistical indicator is the only objective definition and divided into absolute and relative ratio.

Stochastic model of RTRS activity can be considered as continuous random factors or random process.

The basic process for some situations is multidimensional probability distribution. If probability of system each state in future depends on the present state and do not depend on the way the system comes to this state, in that case particular random process is called Markovian process [2].

Probability distribution of system state for some time t_j may be the distributed way for previous time $t_i < t_j$ expressed through previous process record.

For practical researches recommended to use Markovian process having discrete number of system state and continuous time and finite number of and discrete number of system state will be specified u: $u_0, u_1, u_2, ..., u_n$ and transition between states.

If system is any state u_i, thus regardless of the state to the time t_0, after time t probably transfer to state u_j. Probability having type $P_{ij}(t)$ is called process transit probability.

If indicate as $P_i(t)$ probability of system state in u in state u_i at moment of time t, for all states of time probability sum will be equal to unit [4]:

$$\sum_{j=0}^{\infty} P_i(t) = 1. \tag{1}$$

Task solution is to find t_i for probability of all $P_0(t), P_1(t), ... P_n(t)$ in accordance with definite discrete system state $u_0, u_1, u_2, ..., u_n$.

Mobility between system states $P_{ij}(t)$ defines quantitative importance of movement intensity between system states [3]:

$$\lambda_{ij} = \lim_{\Delta t \to 0} \frac{P_{ij}(\Delta t)}{\Delta t}. \tag{2}$$

At low values Δt probability of transition $P_{ij}(t)$ will be equal to:

$$P_{ij}(\Delta t) \approx \lambda_{ij}\Delta t. \tag{3}$$

For analysis of RTRS activity the mathematical model expressing condition and condition flow together with discrete amount of condition probabilities of Markovian process as in graph № 2 was developed (figur 2).
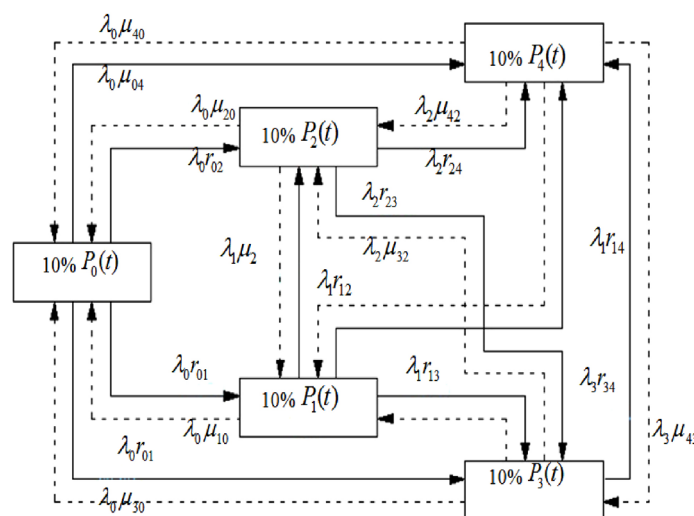
Figure 2. RTRS Graph condition

Graph conditions is a physical system (RTRS) and designates a random process occurring during time t, that is, activity implementation of considering regional transport system in the most stressed period of the year.

For arbitrary condition of the time $t_i \neq t_0$ RTRS discrete condition can be any of five conditions, and for random process $P_0(t)$ it is expressed as $P_1(t)$, $P_2(t)$, $P_3(t)$, $P_4(t)$.

For graph condition RTRS the following conditions are accepted:

- conditions expected from activity implementation (CEAI) regional RTRS – condition $P_0(t)$;
- CEAI RTRS complication is equal to loss of 5% of value cost of installed RTRS conductivity – condition $P_1(t)$;

- CEAI RTRS complication is equal to loss of 10% of cost of the value of installed RTRS conductivity – condition $P_2(t)$;
- CEAI RTRS complication is equal to loss of 25% of cost of the value of installed RTRS conductivity – condition $P_3(t)$;

The amount of graph conditions of RTRS condition that equal of five is displayed as rational co-ordination between necessary accuracy and complexity of the problem solving.

For conditions graph of RTRS (pic. 2) the Kolmogorov system of differential equations [3] will have following kind:

$$
\begin{cases}
-(\lambda_0 \cdot r_{01} + \lambda_0 \cdot r_{02} + \lambda_0 \cdot r_{03} + \lambda_0 \cdot r_{04}) \cdot P_0(t) + \lambda_0 \cdot \mu_{10} \cdot P_1(t) + \lambda_0 \cdot \mu_{20} \cdot P_2(t) + \\
+ \lambda_0 \cdot \mu_{30} \cdot P_3(t) + \lambda_0 \cdot \mu_{40} \cdot P_4(t) = P_0'(t); \\
\lambda_0 \cdot r_{01} \cdot P_0(t) - (\mu_{10} + \lambda_1 \cdot r_{12} + \lambda_1 \cdot r_{13} + \lambda_1 \cdot r_{14}) \cdot P_1(t) + \lambda_1 \cdot \mu_{21} \cdot P_2(t) + \\
+ \lambda_1 \cdot \mu_{31} \cdot P_3(t) + \lambda_1 \cdot \mu_{41} \cdot P_4(t) = P_1'(t); \\
\lambda_0 \cdot r_{02} \cdot P_0(t) + \lambda_1 \cdot r_{12} \cdot P_1(t) - (\lambda_0 \cdot \mu_{20} + \lambda_1 \cdot \mu_{21} + \lambda_2 \cdot r_{23} + \lambda_2 \cdot r_{24}) \cdot P_2(t) + \\
+ \lambda_2 \cdot \mu_{32} \cdot P_3(t) + \lambda_2 \cdot \mu_{42} \cdot P_4(t) = P_2'(t); \\
\lambda_0 \cdot r_{03} \cdot P_0(t) + \lambda_1 \cdot r_{13} \cdot P_1(t) + \lambda_2 \cdot r_{23} \cdot P_2(t) - (\lambda_0 \cdot \mu_{30} + \lambda_1 \cdot \mu_{31} + \lambda_2 \cdot r_{32} + \lambda_3 \cdot r_{34}) \cdot P_3(t) + \\
+ \lambda_3 \cdot \mu_{43} \cdot P_4(t) = P_3'(t); \\
\lambda_0 \cdot r_{04} \cdot P_0(t) + \lambda_1 \cdot r_{14} \cdot P_1(t) + \lambda_2 \cdot r_{24} \cdot P_2(t) + \lambda_3 \cdot r_{34} \cdot P_3(t) - \\
- (\lambda_0 \cdot \mu_{40} + \lambda_1 \cdot \mu_{41} + \lambda_2 \cdot r_{42} + \lambda_3 \cdot r_{43}) \cdot P_4(t) = P_4'(t)
\end{cases}
\tag{4}
$$

Factor of graph movement of RTRS conditions in form r_{ij} defines transition property by the system weight rank from low condition to high condition, at the same confidence degree of RTRS activity is decreased.

Graph movement factor μ_{ij} of RTRS conditions defines transition property on the system weight rank from high condition to low condition, at the same time degree confidence degree of RTRS activity is increased.

The records value for denying rate of the regional RTRS main components for the period equal to $N = 30$ calendar days is listed in the (table 1).

Table 1. – Denying rate values of the main components of difficult annexes

The specific case rank	Denying rate of RTRS main components, day^{-1}				The rate amount of rank
	Automobile transport	Railway transport	Air transport	Waterway transport	
loss of 5% property	$24/30 = 8.0 \times 10^{-1}$	$6/30 = 2.0 \times 10^{-1}$	$16/30 = 5.33 \times 10^{-1}$	$2/30 = 6.67 \times 10^{-2}$	1.60
loss of 10% property	$4/30 = 1.33 \times 10^{-1}$	$2/30 = 6.67 \times 10^{-2}$	$8/30 = 2.67 \times 10^{-1}$	$1/30 = 3.33 \times 10^{-2}$	0.50
loss of 25% property	$2/30 = 6.67 \times 10^{-2}$	$1/30 = 3.33 \times 10^{-2}$	$2/30 = 6.67 \times 10^{-2}$	$0/30 = 0$	0.17
loss of 50% property	$1/30 = 3.33 \times 10^{-2}$	$0/30 = 0$	$1/30 = 3.33 \times 10^{-2}$	$0/30 = 0$	0.07
The deny amount of on the components	1.031	0.30	0.90	0.10	2.333

Calculations results of RTRS condition probabilities at impact of initial factors are presented in (Figure 3–5).
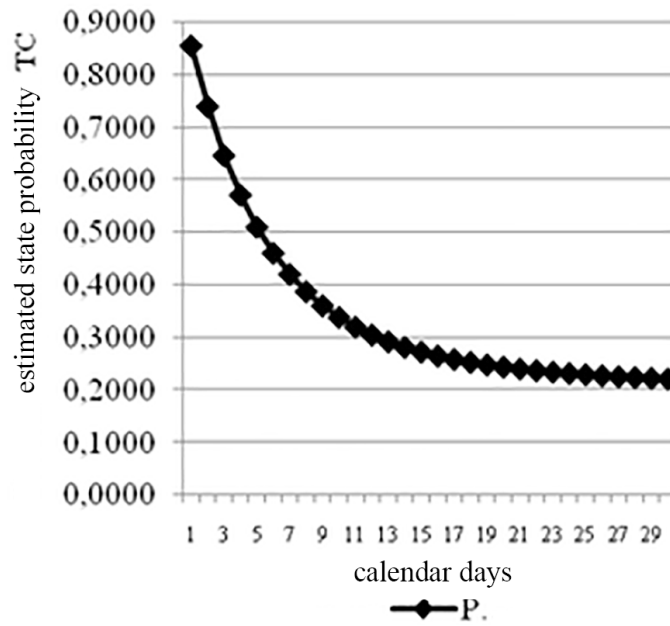
Figure 3. Distribution of RTRS condition probability at $P_0(t)$
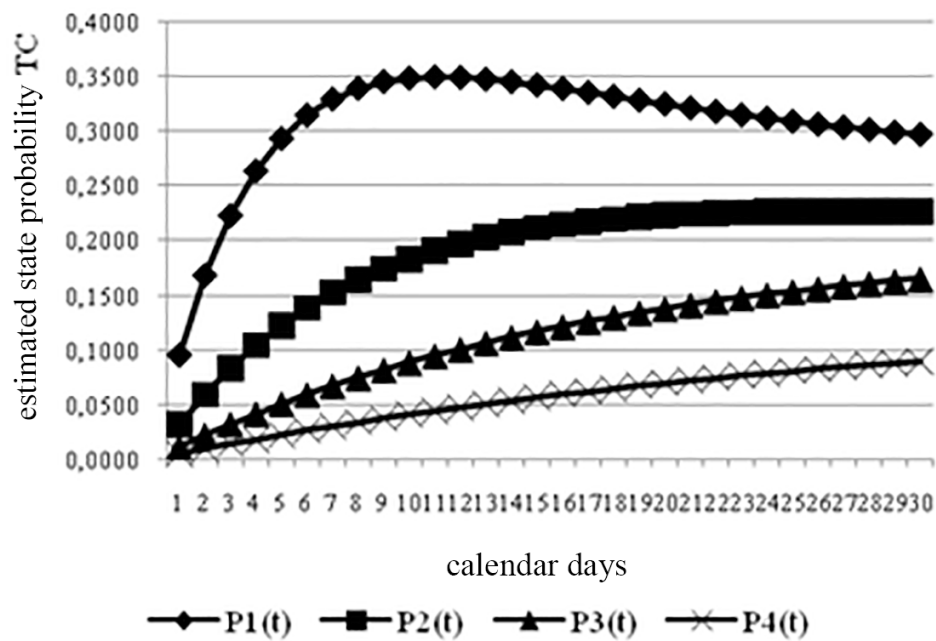
Figure 4. Distribution of RTRS condition probability at $P_1(t) \div P_4(t)$

Information of RTRS specific cases fender for accounted period is listed in the (table 2):

Table 2. – The value of probabilities of fender of denies of RTRS components

The specific case rank	Total of denies becoming the reason of specific case occurrence	The amount of parried denies	Probabilities of denying fender
loss of 5% property	48	21	21/48 = 0.438
loss of 10% property	15	9	9/15 = 0.600
loss of 25% property	5	2	2/5 = 0.400
loss of 50% property	2	1	1/2 = 0.500
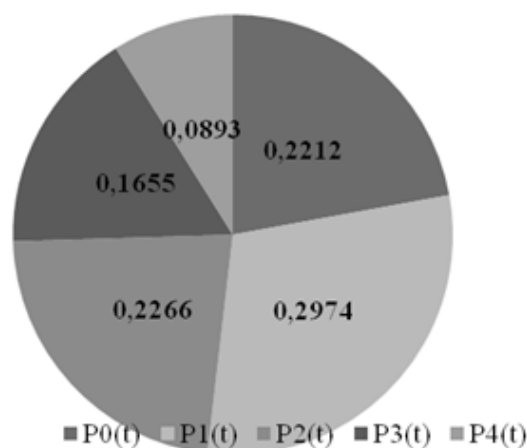
Figure 5. Distribution of RTRS condition probability at $P_0(t) \div P_4(t)$ for the last day allocated for analysis (n=30)

Check of mandatory condition performance (1):

$$\sum_{i=0}^{\infty} P_i(t) = \sum_{i=0}^{4} P_{0+4}(t) = 0.2212 + 0.2974 + 0.2266 + 0.1655 + 0.0893 = 1.0 \qquad (6)$$

Condition is performed that means calculations are correct.

Conclusion

In this thesis simulation conditions technique of transport system is offered, degree of regional RTRS reliability is appreciated. As well, distribution of probabilities for cases of accepted during installed operation is presented.

Received quantitative values can be assumed as a basis for making a decision regarding conformity of a real level of RTRS functioning to given properties.

Acknowledgements

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ANALYSIS OF THE EVALUATION FACTORS FOR THE AUTOMOBILE TRANSPORT SYSTEM PERFORMANCE

Abstract. This article expounds factors affecting to performance of road transport systems, methods, and criteria for performance also the results of their calculations.

Keywords: road transport, international cargo, quality of performance, factors, integral indicators, expert evaluation, discounting.

As it is known, the competitive environment in the activity of the International Cargo Transport Enterprise (CTE) is one of the main sources of development. However, many competitors, including large transport companies with substantial resources, do not have the capability to meet all the needs of their customers, while they spend most of their time on their activities.

In their activities, motor transport companies use different forms and methods of competition and their different exploitative qualities (1figure).

Competitiveness is a complex concept, and it is described in various scientific sources [1–6]. The quality of CTE competitiveness is practically determined by their exploitation characteristics. It is therefore desirable to disclose this concept.

First of all, it is necessary to define the concept of exploitation characteristics of the motor transport enterprise. The exploitation characteristics of the vehicle transport company are the ability to maintain a leading position among other transport companies for a long time in the market of transport services (TSCs).
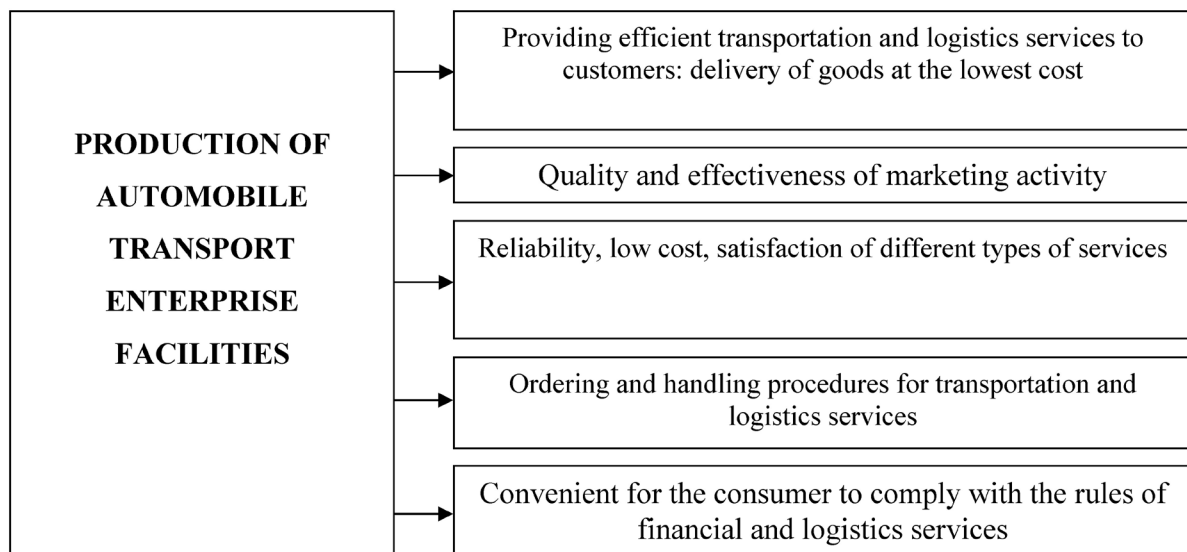
Figure 1. – Sources of exploitation characteristics of the motor transport enterprise

The main principle of logistics approach to this issue is the priority of client's interests.

Quality and exploitation quality of carriage services in transport market service (TMS) is a combination of technical and technological features, guarantee system, compensation and benefits that reflect customer satisfaction and the level of traffic, the level of its purchasing, at a specific time of the within a specific segment of competitiveness.

The exploitation quality of the automobile transport enterprise CTE is not immanent, because it operates in a certain competitive environment, which is influenced by factors.

Based on the aforementioned, we can say that external and internal factors influence the CTE competitiveness.

The use of a structured approach has allowed to systematize the factors identified by the source of inputs, quality and price components. The concept of exploitative quality also applies to road transport vehicles other than the CTE (Table 1).

In analytical systems of exploitative attributes value is calculated by using the methods of calculation. The following are most commonly used: differential, complex and combined styles.

Table 1. – Factors influencing the exploitation characteristics of motor vehicles

Factor initiator	Factors influencing the quality of transport products	Factors affecting exploitation characteristics of transport services
Car traffic management system	Normative documents, appearance of new varieties of enterprises in motor transport	Change of ownership and business structure in motor transport
Government	Environmental policy, normative documents	Economic, credit-monetary, fiscal, customs policy, political factors, economic, political and social stability
Customers	Customer needs	Demand law, price elasticity of demand, segmentation
Competitors	Quality of competitive transport products	Price Strategies, Competitive Transport Costs
Partners	Strategic potential of partner companies	Partner behavior
Investors	Investment Terms	Interest rates on loan, debt repayment
Working Resources	Quality of human resources	Workforce Cost
Environment	Climate, road conditions	Climate, road conditions
Freight Suppliers	Quality of material resources, availability of resources	Level of material resources prices
Non-budgetary funds	Funding policy	Interest rates and conditions
Illegal environment	Racer, theft, the sharp deterioration of the situation	Racer, theft, the sharp deterioration of the situation
Casualty	force-major cases	force-major cases
ATC environment	Efficiency, corporate governance structure, business strategy of enterprise strategic capacity	Organizational business strategy – organizational structure and market strategies management, type of transport
Car transport system	Advances in scientific and technical development of the motor transport	ITT achievements in motor transport, trends in the economy, level of development of demand for goods

In the composite set of indicators commonly used, an integral indicator of exploitative quality can be determined which can be determined by the sum of the sum of the action of the tool of action, in relation to the total cost of its creation and operation:

$$K_И = \frac{П_Σ}{X_Я + X_Э}, \qquad (1)$$

where: P'S – the sum of the effects of the tool operation;

XYA – sum of cost of creating the tool;

XE – the sum of exploitation costs.

In the various sources [4; 7; 8], the use of exploitative quality assurance methods is based on the conventional assessment of the results of expert evaluations. The drawback of this approach is that attracting experts can lead to such a situation in which it is impossible to guarantee that some of the values of the indicators reflect the objective situation.

Therefore, this research has suggested a methodology for re-evaluating expert assessments.

The following list of quality indices can be developed using this technique in the scope of research of exploitation characteristics of vehicles.

Transportation and logistics systems (LTS) are not limited to the transportation process. They do not depend on the type of transport used by carriers or passengers, but by taking into account the required dimensions, duration and quality characteristics. Thus, he uses the principle of constructing a multitude of logistics modeling systems that allows the management of logistics systems on a single basis.

Evaluation of factors influencing the exploitation quality characteristics of motor transport enterprises is carried out in several stages.

If experts have been forced to give the same or average color to several factors in the process of color separation, then in this case, the Co-ordination Coefficient can be determined using the following formula:

$$W = \frac{S}{\frac{1}{2}m^2(K^3-K)-m\sum_{j}^{m}T_j}, \qquad (2)$$

$$\sum_{d}^{m}T_j = \frac{1}{12}\sum_{i}(t_i^3-t_i), \qquad (3)$$

where the number of identical colors in ti-j-colors.

The coefficient of conversion varies between $0 < W < 1$. When W is greater than 0, the opinions of the expert are so compatible. The significance of the coefficient of the coefficient is estimated by the Xi-square (Pyrrhic Conformity):

$$X^2 = \frac{12S}{mK(K+1)} \qquad (4)$$

If it is determined by formula 6, then:

$$X^2 = \frac{S}{\frac{1}{2}mK(K+1)-\frac{1}{K-1}\sum_{j}^{m}T_j}, \qquad (5)$$

Detecting the table value of Xi is 95% probability for practical matters. If $X2jad(0.05; k) < X2$, it is possible to estimate 95% probability of the experts' opinions.

Let's go back to the question now. Experts' assessments are based on the matrix of color-based distribution factors (Table 2).

As seen in the table, experts have estimated several factors. Therefore, we have to calculate the corresponding colors:

$$T_1 = 2^3-2=6; \; T_3 = 2^3-2 = 6; \; T_5 = 2^3-2 = 6;$$
$$T_6 \, (2^3-2) + (2^3-2)= 6 + 6 = 12$$
$$T_7 = 2^3-2 = 6; \; T_{10} = 2^3-2 = 6;$$
$$T_j = \frac{6+6+6+12+6+6}{12} = \frac{42}{12} = 3.5$$

The coefficient of the coincidence is:

$$W = \frac{2612.5}{\frac{1}{12}*10(7+1)-\frac{1}{7-1}*3.5} = x =$$

$$= \frac{2612.5}{46.6-0.58} = x = \frac{2612.5}{46.02} = 56.8$$

Calculate the sum of the square of xi:

$$X2his = x = \frac{2612.5}{\frac{1}{12}*10*7(7+1)-\frac{1}{7-1}*3.5} =$$

$$= \frac{2612.5}{46.6-0.58} = \frac{2612.5}{46.02} = 56.8$$

95% of the square value of the square of Xi; with probability and k 6, $X2 = (0.05/6) = 12.59$.

$12.59 << 56.8$ so, 95% of probability is that the opinions of the experts are compatible.

Table 2. – Factors Conditional mark Conditional number of experiment
Colors set Color coefficient of color combination Volatility

№	Factors	Conditional mark	Conditional number of the experiment										COLOR collection	An average deviation of the color combination	Heavy Quadrature
			1	2	3	4	5	6	7	8	9	10			
1.	Delivery Guarantee	X_1	1.5	2	1	2	1	2	1	2	2	2	16.5	−23.5	552.25
2.	Delivery time	X_2	1.5	1	2	1	2	1	3	1	1	1	14.5	−25.5	650.25
3.	Delivery to destination	X_3	6	5	4	5	4	3.5	4	4	4	3	42.5	2.5	6.25
4.	Delivery of the required volume of cargo	X_4	3	4	5	3	5	3.5	2	3	3	4	35.5	−4.5	20.25
5.	Full satisfaction of transportation needs	X_5	5	3	3	4	3	5	5	5	5	5.5	43.5	3.5	12.25
6.	Providing the requested type of transport	X_6	4	6	6.5	6	6.5	6.5	6.5	6	6	5.5	59	19	361
7.	Choosing the optimal shipping scheme	X_7	7	7	6.5	7	6.5	6.5	6.5	7	7	7	68.5	28.5	812.2
													280		2612.2
													T = 40		

When selecting the factors affecting exploitative quality characteristics of the motor vehicle, the diagram of their color distribution is shown in the following figure (Figure 2).

Table 2. – Diagram of the colors by factors influencing the performance characteristics of road transport

10	14.5						
20		16.5					
30			35.5				
40				42.2			
50							
60					43.5		
70							
80						59.1	
90							
100							68.5

It is therefore desirable to systematize the basic requirements for trucks involved in international cargo transportation (Figure 3–4).

Investigations on the problem of re-production of fixed capital of motor transport, according to approaches [9–10], cannot be the basis for the development of methods of investment in competitive action instruments.

Thus, transportation of international goods by motor transport requires a number of transport, technical, organizational, legal and economic issues that are not found in the domestic market.

Competing for international carriage of goods by way of automobile transport, the formation of a bank of similarities can be carried out on the basis of classification in the market of certain transport services, taking into account their purpose, operational conditions and life cycles.

At the stage of identifying the most competitive vehicle, we have considered the following cars: Volvo FH-12, DAF FT 95XF, Mercedes Benz Actros, MAN TGS19,400. The summary of these tools is shown in (Table 1).

Table 3. – The price of cars included in a similar bank

Vehicle model	Customs duties and taxes, US $	Total Customs Duties and Taxes, US Dollars	Customs Duties and Taxes, U. S. Dollars
Volvo FH 12–460	105000	26250	131250
DAF FT 95XF	106484	26621	133105
Mercedes-BenzActros 1846 LS	110600	27650	138250
MAN TGS19.400 4 × 2 BLS	114913	–	114913

Table 4. – Competitiveness index for technical and operational characteristics for cars entering similar banks

Vehicle model	Discounted Gross Income from Expropriation of Movement, (USD Thousand)	Discounted total exploitation costs associated with earnings, (thousand US dollars)	Cost of Competitive Indicators for Technical Exploitation Indicators
Volvo FH 12–460	6719008	4770496	1.09
DAF FT 95XF	6719008	4972066	1.05
Mercedes-BenzActros 1846 LS	6719008	5576777	1.00
MAN TGS19.400 4 × × 2 BLS	6719008	4165785	1.22

Estimates on financial results are shown in (Table 5).

It is possible to conclude that the purchase of 50 trucks by credit will allow expanding the process of transportation.

Taking into account the return of loan amount in the first year of 1621045 thousand soums in the first year of the enterprise, it is 1580063 thousand soums, of which profit is 40982 thousand sums. Project profitability is 38%. NPV – 1734 518, IRR – 8%. Period of validity is 6 years.

Table 5. – Financial outcomes (thousand sums)

Revenue from sales	10361 088
VAT	315770
Net trading income	**10045318**
Cost of goods sold	6701901
Gross income	**3343417**
The running expenses	61800
Other expenses	282524
Tallage	403729
Implementation costs	207222
Income from operating activities	**2388142**
Credit payment	663626
Pre-tax income	**1724 516**
Single tax	6%
(calculation)	103471
Net profit	1621045

One of the special methods of financial and economic assessment of investment projects efficiency was discounting [11]. In the calculation of future values special tables are used, as well as the special tables included in the ratios of the initial rate of investment of different amounts r and t. ($r = 7$ percent $t = 1.07$ for one year, 2 years 1.145, 3 years 1.225, 4 years 1.311, 5 years 1.403, 6 years 1.501 coefficients)

$$FV = PV*(1 + r)^t \qquad (6)$$

FV – value of the next period;

PV – valid value;

r – investment profitability, interest rate;

t – time interval, number of circuits.

Revenue from investment project in national currency for the first year was 10361088 sums, discounted income for the remaining years in foreign currency.

$FV1 = 6279447 * 1.07 = \$6719008$ thousand US dollars

$FV2 = 6279447 * 1.145 = 7189966$ thousand US dollars

$FV3 = 6279447 * 1.225 = 7692322$ thousand US dollars

$FV4 = 6279447 * 1.311 = \$8232355$ thousand US dollars

$FV5 = 6279447 * 1.403 = 8811064$ thousand US dollars

$FV6 = 6279447 * 1.501 = \$9425449$ thousand US dollars

According to the results of analysis of tables 6, 7 the highest indicator of technical competitiveness is the MAN TGS19.400 4 × 2 BLS.

Table 6. – Calculating the Comparative Cost and Competitiveness
Criteria for Performance Models of the Study Models

Vehicle model	$Ц^{эт}_{п}$, USD Thousand	A_{Σ}, USD Thousand	3_{Σ}, USD Thousand	$Ц_{экв}$, USD Thousand	$K_{пп}$
Volvo FH 12–460	129380	6719008	4770496	131250	1.00
DAF FT 95XF		6719008	4972066	133105	1.13
Mercedes-BenzActros 1846 LS		6719008	5576777	138250	1.42
MAN TGS19.400 4 × 2 BLS		6719008	4165785	114913	0.68

Table 7. – Computation of the integral criterion of competitiveness

Vehicle model	A_{Σ}, USD Thousand	3_{Σ}, USD Thousand	Kpp	Kint
Volvo FH 12–460	6719008	4770496	1.00	1.25
DAF FT 95XF	6719008	4972066	1.13	1.22
Mercedes-BenzActros 1846 LS	6719008	5576777	1.42	1.18
MAN TGS19.400 4 × 2 BLS	6719008	4165785	0.68	1.38

The calculations show that similar vehicles of international motor transport are the most competitive in the bank as the MAN TGS19.400 4 × 2 BLS.

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Section 11. Physics

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THE LINEAR CIRCULAR DICHROIZM OF ONE PHOTON ABSORBTION OF POLARIZATION LIGHT IN p-Te

Abstract. The spectral and temperature dependences of the one photon absorption coefficient of polarized radiation are calculated and the linear-circular dichroism in hole conductivity tellurium is investigated. In this case, the coherent saturation of the final state of holes is taken into account.

Keywords:

Nonlinear absorption of light in a semiconductor with a degenerate valence band, due to direct optical transitions between subbands of heavy and light holes and depending on the state of polarization of the radiation, was researched in [1–8]. In these works, it is signed that nonlinearity in the dependence of the one photon absorption coefficient on intensity occurs due to resonance absorption saturation. This saturation is due to the photoinduced change in the distribution functions of light and heavy holes in the region of the momentum space near the surface $E_{hh}(\vec{k}) - E_{hl}(\vec{k}) - \hbar\omega = 0$ corresponding to the resonance condition. Here $E_{hh}(\vec{k})\left(E_{hl}(\vec{k})\right)$ is the energy spectrum of heavy (light) holes, ω is the frequency of light.

In [8], a multiphoton linear-circular dichroism (LCD) in *p-Ge* was investegated in the developed nonlinearity mode, when n-photon processes with $n = (1 \div 5)$ a comparable contribution to absorption occur. In [9], four-photon processes in semiconductors due to optical transitions between the subbands of the valence band were investigated. However, one photon linear-circular dichroism in a semiconductor with a "camel's back" band structure remained open, to which this article is devoted.

Here we consider the one photon linear-circular dichroism of the absorption of polarized light, taking into account the effect of coherent saturation [3; 4] in the hole conduction tellurium, due to direct optical transitions between the valence band subbands. In this case, we assume that the photon energy satisfies the inequalities $\hbar\omega << E_g, \Delta_{SO}$, where E_g is the width of the forbidden zone, Δ_{SO} is the spin-orbit splitting of the valence band.

Due to the smallness of the wave vector of the photon compared to the wave vector of the electron (hole) formed as a result of absorption, when calculating the absorption coefficient of light, we can assume $\left|\vec{q}\right| << \left|\vec{k}\right|$ and put $\left|\vec{q}\right| = 0$ where $\vec{q}(\vec{k})$ is the wave vector of the photon (hole).

Then, following [3], the one photon absorption coefficient can be written as

$$K(\omega,T) = \frac{2\pi}{\hbar} \frac{\hbar\omega}{I} \sum_{\vec{k}} \left(f_{1\vec{k}} - f_{2\vec{k}}\right) \left|M_{2\vec{k};1\vec{k}}(\vec{k})\right|^2 \delta\left(E_{2\vec{k}} - E_{1\vec{k}} - \hbar\omega\right), (1)$$

where $M_{2\vec{k};1\vec{k}}(\vec{k})$ is the matrix element of a one photon optical transition from state $\left|1\vec{k}\right\rangle$ to $\left|2\vec{k}\right\rangle$, $I = \frac{n_\omega \omega^2 A_0^2}{2\pi c}$ is the light intensity, $E_{l\vec{k}}$ is the energy spectrum of holes in the subzone

l (for p-Te $l = M_1$, M_2), $f_{l\vec{k}}$ is their nonequilibrium function of the distribution of holes with energy $E_{l\vec{k}}$, and n_ω is the refractive index of light at frequency ω. The remaining quantities are well known.

Since the matrix element of the momentum operator is determined by the Hamiltonian of the current carriers, which has the form [10]

$$\hat{H} = \hat{H}_0 + \sum_\alpha A_\alpha \sigma_\alpha, \qquad (2)$$

where relativistic small band parameters were not taken into account, $\sigma_\alpha (\alpha = x, y, z)$ are Pauli matrices. $\hat{H}_0 = A k_\perp^2 + B k_z^2$, $A_x = \Delta_2$, $A_y = 0$, $A_z = \beta k_z$, $2\Delta_2$ is spin-orbital splitting of the valence band at the point M (P) of the Brillouin zone).

The wave functions of holes in the subbands M_1 (and M_2) of the valence band are a superposition of states with the projection of the angular momentum on the axis $Z(m_z = \pm 3/2)$

$$\Psi_{M_1} = \sum_{m_z = \pm 3/2} C_{m_z}^{(l)} |m_z\rangle, \qquad (3)$$

where $C_{3/2}^{(1)} = C_{-3/2}^{(2)} = C_1 = \sqrt{(1+\eta)/2}$, $\eta = \beta k_z (\Delta_2^2 + \beta^2 k_z^2)^{-1/2}$. Here we must bear in mind that the choice of coefficients C_l ($l=1,2$) corresponds $\Delta > 0$, i.e. $C_1 \times C_2 = 2^{-1} \times \Delta_2 (\Delta_2^2 + \beta^2 k_z^2)^{-1/2}$ and contains Δ_2 not, where the index "2" should be attributed to the upper hole subband, and "1" to the lower one. Therefore, in order to make the transition from the point M to P the Briluyuen zone, we introduce the parameter $r = -\Delta_2 / |\Delta_2|$ in C_2, i.e. $C_2 = r\sqrt{(1-\eta)/2}$. Since for the lower valence band the spectrum is $E_1 \sim -\sqrt{\Delta_2^2 + \beta^2 k_z^2}$, therefore the signs C_1 and C_2 should be different (Note that the extremes of the conduction band and the valence band Te are located at the point M and P the Brillouin zone).

According to (2), the energy spectrum of holes in subbands M_1 and M_2 is described by the formula:

$$E_{M_{1,2}^\odot} = \lambda_v \pm \left(\Delta_2^2 + \beta^2 k_z^2\right)^{1/2}. \qquad (4)$$

Here $\lambda_v = A k_\perp^2 + B k_z^2$, $A = \hbar^2/(2m_\perp)$, $B = \hbar^2/(2m_\parallel)$, $m_\perp$ and $m_\parallel$ are the transverse and longitudinal effective masses of holes in the subbands M_1 and M_2, equal with the opposite sign, to the effective masses of electrons, $A = 0.363 \times 10^{-14}$ $eV \cdot cm^2$, $B = 0.326 \times 10^{-14}$ $eV \cdot cm^2$, $A_x = \Delta = 63.15 \times 10^{-3}$ eV, $\beta_V^2 = 0.6 \times 10^{-15}$ $eV^2 \cdot cm^2$ [10]. Then one of the subbands of the valence band has a "hump", the

depth of which is determined by the ratio $\varepsilon_{\min} = \Delta - \left(\dfrac{\beta_V^2}{4A} + \dfrac{\Delta^2 A}{\beta_V^2}\right) = -2.37$ meV to which the wave vector corresponds:

$$k_{z,\min} = \pm \frac{1}{\beta_y} \sqrt{\frac{\beta_V^4}{4A^2} - \Delta^2} = \pm 2.16 \cdot 10^6 \ cm^{-1}.$$

In fig. 1 it is shown the one-dimensional energy spectrum of holes in the valence zone of tellurium. We note here that if we increase the values of the transverse effective mass of holes to 16%, then the depth of the hump increases to 9%.

Then the matrix element of the momentum operator $\vec{p}$ has the form

$$(\vec{e} \cdot \vec{p})^{(l'l)} = \frac{1}{\hbar} \left\langle M_{l'} \left| \vec{e} \cdot \frac{\partial \hat{H}(\vec{k})}{\partial \vec{k}} \right| M_l \right\rangle =$$

$$= \frac{1}{\hbar} \left\langle M_{l'} \left| \sum_{\alpha=x,y,z} e_\alpha \cdot \frac{\partial A_1(\vec{k})}{\partial k_\alpha} \right| M_l \right\rangle + \qquad (5)$$

$$+ \frac{1}{\hbar} \left\langle M_{l'} \left| \sum_{\beta=x,y,z} e_\beta \cdot \frac{\partial}{\partial k_\beta} \sum_{\alpha=x,y,z} A_\alpha \hat{\sigma}_\alpha \right| M_l \right\rangle.$$

with the help of which, it is possible to classify optical transitions, where $\vec{e}$ is the light polarization vector.

Next, we consider one photon absorption of light and its linearly circular dichroism in tellurium. In a spherically symmetric approximation in the energy spectrum of current carriers, one photon absorption intensity nonlinear in intensity in semiconductors with a degenerate band structure was studied in [2], where it was shown that the absorption coefficient of light decreases with increasing intensity. However, this question for the *p-Te* remains open.

For one photon absorption of polarized radiation caused by intersubband optical transitions in the case when light propagates across to the main symmetry axis of tellurium, i.e. for case $\vec{e} = (0,0,e_z)$ (4) takes the form

$$\vec{e}\vec{p}_{21} = \frac{m_0}{\hbar} e_z r \frac{\beta_V \Delta_2}{\sqrt{\Delta_2^2 + \beta_V^2 k_z^2}} \qquad (6)$$

Then in a spherical approximation, i.e. at

$$E_{M_2', M_1'}(\vec{k}) = E_{M_2', M_1'}(k_\perp, k_z) = A_{2,1} k_z^2 + B_{2,1} k_\perp^2 \pm \Delta_2, \quad (7)$$

the coefficient of one photon absorption of light is

$$K_\parallel(\omega, T) = \frac{2e^2 \beta_V^2}{cn_\omega \hbar(A_2 - A_1)} \frac{1}{\hbar\omega} \sqrt{\frac{\hbar\omega - 2\Delta_2}{(A_2 - A_1)}} \exp\left(\frac{E_F}{k_B T}\right) \exp\left(\frac{(3A_1 - A_2)\Delta_2}{k_B T(A_2 - A_1)}\right) \exp\left(\frac{-A_1 \hbar\omega}{k_B T(A_2 - A_1)}\right), \qquad (8)$$

where we took into account that, from the energy conservation law $\delta\left(E_{3\vec{k}} - E_{1\vec{k}} - 2\hbar\omega\right)$, the wave vector of holes:

$$k_\omega = \sqrt{\frac{\hbar\omega - 2\Delta_2}{(A_2 - A_1)}}.$$

In the hump-like approximation (see formula (4)), we have

$$K_\parallel(\omega, T) = \frac{e^2}{cn_\omega \hbar} \frac{k_B T}{B} \frac{1}{k_z^{(\omega)}} \cdot e^{\frac{\hbar\omega - A\left(k_z^{(\omega)}\right)^2}{k_B T}} \cdot e^{\frac{E_F}{k_B T}}, \qquad (9)$$

$$E(k_z), \text{meV}$$
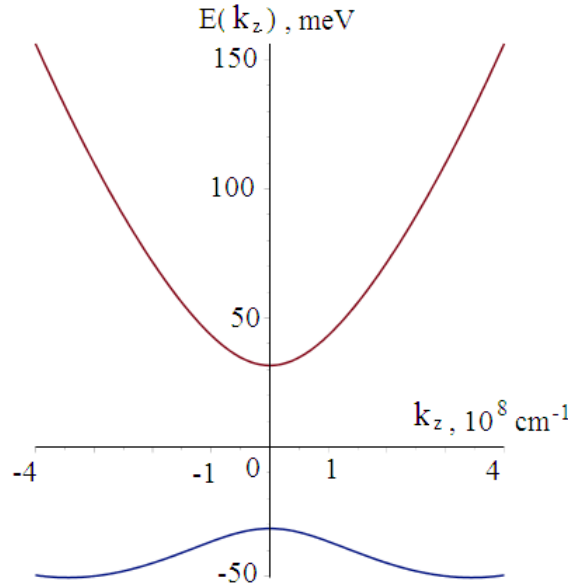
Figure 1. Energy spectrum of holes in the valence zone of tellurium

where $k_z^{(\omega)} = \dfrac{\Delta}{2\beta_V}\sqrt{\left(\dfrac{\hbar\omega}{\Delta}\right)^2 - 1}$, E_F is the chemical potential of holes, determined by the ratio of $e^{E_F\beta} = \dfrac{2\pi^2 p\beta\hbar^2}{3m_\perp}S$, p is the concentration of holes,

$$S = \int dk_z \left\{ \begin{array}{c} \exp\left[\dfrac{1}{k_B T}\left(\sqrt{\Delta_2^2 + \beta_V^2 k_z^2} - \dfrac{\hbar^2}{2m_\parallel}k_z^2\right)\right] + \\ + \exp\left[-\dfrac{1}{k_B T}\left(\sqrt{\Delta_2^2 + \beta_V^2 k_z^2} + \dfrac{\hbar^2}{2m_\parallel}k_z^2\right)\right] \end{array} \right\}. \quad (10)$$

The coefficient of one photon absorption of light in approximation (4) when light propagates across to the main axis of symmetry of tellurium, i.e. when $e_z = 0$, $e_x \neq 0$, $e_y \neq 0$ determined in a similar way.

Next, we will investigate the linear-circular dichroism of one photon absorption of light in p-Te taking into account the Rabi effect [10], which for an arbitrary light intensity I is determined by the probability of an intersubband optical transition

$$W^{(1)} = \dfrac{4\pi^2\alpha I}{n_\omega \hbar\omega b^2 k_{zc}}\sum_{\vec{k}} f(E_{1\vec{k}})(1 - e^{-\beta\hbar\omega})\dfrac{|e_z|^2 \delta(E_{2\vec{k}} - E_{1\vec{k}} - \hbar\omega)}{\varepsilon(1 + I\phi|e_z|^2/(\varepsilon I_S))^{1/2}} \quad (12)$$

where $I_S = \omega^2 T_1 T_2 I_0$, $I_0 = \dfrac{\hbar^3\omega^4 n_\omega}{8\pi\alpha b^2}$, $\varepsilon = (\Delta_2^2 + b^2 k_z^2)^{1/2}$, $f(E)$ is the distribution function of current carriers with energy E, is the thin structure parameter ($e^2/\hbar c$), n_ω is the refractive index of medium light at a frequency ω, T_i is the time of exit from the resonance region of current carriers in l [2] before the linear in the wave vector of the term in the effective Hamiltonian (see, for example, [11]), $\beta = 1/k_B T$, T is the temperature, k_B is the Boltzman constant, GaP [12]; $b = \beta_V$ and $\phi = \beta_V k_Z$

for tellurium. Then the probability of a one photon intersubband optical transition for linear polarization is as follows

$$W_{lin}^{(1)}/W_0^{(1)} = \xi_{lin}(I/I_S), \quad (12)$$

$$W_{circ}^{(1)}/W_0^{(1)} = \xi_{circ}(I/2I_S), \quad (13)$$

where $l = 1,2;$, $W_0^{(1)} = \dfrac{\alpha}{n_\omega B}\dfrac{I}{(\hbar\omega)^2}f(E_\omega)(1 - e^{-\beta\hbar\omega})\dfrac{b}{\phi_0}$,

$E_\omega = E_{1\vec{k}}(k_\perp = 0, k_z = k_{ZC})$, $\phi_0 = \phi(k_Z = k_{ZC})$,

$2\Delta = E_2(\vec{k} = 0) - E_1(\vec{k} = 0)$ is the energy gap between the subbands (the valence zone of tellurium and the conduction band of gallium phosphide) in the center of the Brillouin zone,

$$\xi_{lin}(x) = \dfrac{1}{4x}\left[2\sqrt{1+x} - \dfrac{1}{\sqrt{x}}\ln\left|\dfrac{\sqrt{1+x}+\sqrt{x}}{\sqrt{1+x}-\sqrt{x}}\right|\right] (x = I/I_S), \quad (14)$$

$$\xi_{circ}(y) = \dfrac{1}{4y}\left[1 + \dfrac{y-1}{\sqrt{y}}\arcsin\sqrt{\dfrac{y}{1+y}}\right] (y = x/2), \quad (15)$$

presented in (fig. 2). From fig it is seen that in the region of small light intensity, when the Rabi effect can be neglected, the probabilities of one photon optical transitions do not depend on the degree of polarization, but with increasing light intensity, linear-circular dichroism occurs even with one photon light absorption. According to the last relations, the factor of linear – circular dichroism $\eta = W_{circ}^{(1)}/W_{lin}^{(1)}$ within the limits of high intensity, that is $I \gg I_0$, does not depend on intensity and is equal to $\pi\sqrt{2}/4 \approx 1.1$ and in frequency $\Delta/\hbar$ one photon linear – circular dichroism in semiconductors with a "camel's back" zone structure of the p-Te and n-GaP type taking into account the Rabi effect for the corresponding optical transitions.

$$K_{\parallel,extr} = K_\parallel(\omega_{1,2}, T), \quad (16)$$
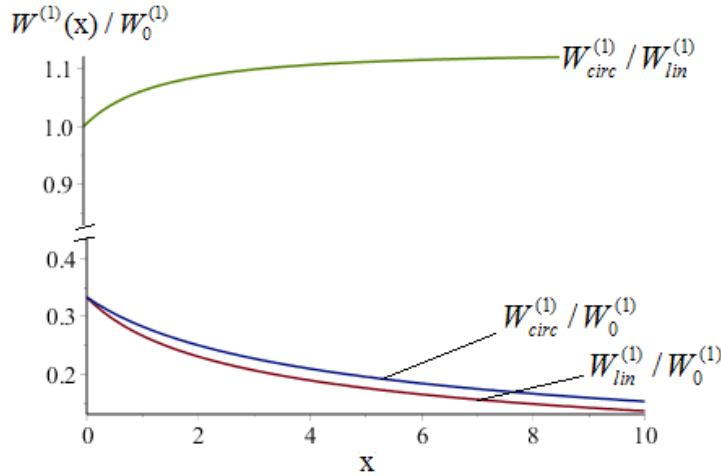
Figure 2. Dependence $W^{(1)} / W_0^{(1)}$ on the intensity of the exciting light depending on its degree of polarization in the p-Te

In conclusion, we note that the absorption coefficient of light $K_\parallel(\omega, T)$ at a fixed temperature with increasing frequency of the exciting light, satisfies the condition, passes through an extreme value defined by the expression $\hbar\omega > \Delta$, where ω_i are the roots of the next cubic equation

$$2\gamma x^3 - x^2 + \left(\frac{1}{\beta} - 2\gamma\right)x + 1 = 0,$$

Consider in more detail the "behavior" of $K_\parallel(\omega, T)$ in the experimentally interesting region of the frequency of illumination: $\hbar\omega - 2\Delta_2 < 2\Delta_2$. Then for large values $\varepsilon\left(\varepsilon\rangle\rangle\frac{m_0}{m_\parallel}\right)$ the

dependence $K_\parallel(\omega, T)$ has a maximum at a point $\omega^{(1)} = \frac{\Delta_2}{2\beta}\left[1 + \sqrt{1 + \beta^2}\right]$ and does not depend on the parameters ε and $m_\parallel$, and for the case of smaller values $\varepsilon\left(\varepsilon\langle\langle\frac{m_0}{m_\parallel}\right)$:

$\omega^{(2)} = \frac{\Delta_2}{2}\sqrt{1 - \frac{1}{2\gamma\beta}}$. As can be seen from the last relation, for the appearance of the maximum value in the spectral dependence $K_\parallel(\omega, T)$ in the case $\varepsilon\langle\langle\frac{m_0}{m_\parallel}$, the following condition for the temperature should be satisfied $T < \frac{\gamma\Delta_2}{k_B}$.

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Section 12. Philology

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LINGUISTIC ASPECTS OF THE USE OF PHRASEOLOGICAL UNITS WITH COLOR SEMANTICS "WHITE", "BLACK", "RED" IN THE ENGLISH, RUSSIAN, TATAR, TURKMEN LANGUAGES

Abstract. This article presents an analysis of phraseological units with the color semantics "White", "Black", "Red" in three structurally different languages, which makes it possible to represent the interpretation of the picture of the world in individual languages and use phraseological units with color semantics correctly. The focus is on identifying lexical meanings of phraseological units with color semantics "White", "Black", "Red".

Keywords: language group, a foreign language, linguistic culture, national culture, linguistic person, color, semantics, phraseological units.

The purpose of the article is to analyze the phraseological units with color semantics in the three structurally different languages such as English, Russian and belonging to one language group (Turkic) Tatar and Turkmen and to show the possibility of the use of phraseological units with color semantics in these languages in speech.

A comparison of English, Russian, Tatar and Turkmen can help to eliminate misunderstandings and facilitate getting and using knowledge of the foreign languages: English – by Tatar and Turkmen students; Russian – by Turkmen students.

Comparing various linguistic phenomena, we reveal some common features uniting linguistic cultures, we notice some specific traits, characterizing a given linguistic person, in order to gain a deeper understanding of the national culture.

"The lexical-semantic group in linguistics is defined as a set of words of one part of speech, united by a common sema at the level of lexical meaning" [8].

One of such groups is the lexical-semantic group of adjectives with the semantics of color.

Russian and foreign researchers in the field of linguistics (Baudouin de Courtenay, Grunina E. A., Zakiryanov K. Z., Kubryakova E. S., Maslova V. A., Yung I. A., German N. F., Marvin D. E., George B. Bryan) wrote that there are universal concepts through which mutual understanding between people is achieved.

Color plays an important role in understanding the world around us.

White color personifies purity, virtuousness, good intentions, joy, beauty. In English there are phraseological units "To be whiter than white", "Lily-white reputation", "White hands", "White lie", "A white wedding", "To mark with a white stone", "White-collars".

In Russian the expressions «Средь бела дня» means doing something wrong or bad openly, without hiding; «Белые мухи» refers to falling snow; «Белый свет» – the reality

surrounding us, life with all joys and sorrows; «Взять под белы руки» to show respect, honor; «Белая кость» – a person from high society, aristocracy [6].

Both in English and in Russian negative characteristics associated with white color were not failed to notice, such as pallor of the face, skin, soreness, rage, anger, fear, and horror "To turn white" – «побледнеть», «побелеть»; "To be/look white as sheet (ghost, death)" – очень сильно побледнеть (обычно от страха или волнения); "To be white-hot" – быть разъяренным, доведенным до «белого каления»;

In the Tatar language we also find sayings with similar meanings:

"Ак белән караны аера белмәү" – interpretation- One cannot distinguish white from black – white means something good, and black – something bad; "Ак нәрсә кер күтәрми" – interpretation – White things get dirty faster than others – someone always tries to dirty, slander, stipulate good things; "Акны кара дип әйтү" – interpretation – Call white black – someone changes the original meaning. "Аксөяк эш сөймәс" – interpretation– an aristocrat won't love the hard work which means "White Bone" [2].

In the Turkmen language, white has the meaning of something positive, beautiful.

"Ak gireni bilen aň girmez" – interpretation– No matter how hard you try to embellish yourself, but you won't become smart – to become "white" that is to become better. "Ak gün agardar, gara gün garaldar" – interpretation– White day will bleach, black day will blacken– white day is a happy, lucky day, bringing a good mood, a rainy day – a day that brought misfortune, grief [13].

White color in the English, Russian, Tatar and Turkmen phraseology, basically finds the same meaning and very often reflects everything positive.

A black colour is ambiguous one, it has a dual meaning.

In English such phraseological units as "Black dog"; "Black eye"; "A black sheep"; "To paint smth. in black colours", "To be in black" denote non-standard things, evil, unhappiness; "Black frost" is a biting frost denotes the extreme degree of something, "Black ice" means extremely slippery.

But phraseological units with black color can be positive "To be in the black" means to get profit, to be in a favorable financial position;

In the Russian language "Black (Rainy) Day" is a difficult time in the life of someone; "Keep in black body" means half-starving or to treat anyone strictly; "The black cat ran in between…" means the worsened relationship between people; "Black ingratitude" means to forget to thank for some good; "Black bone" means non-aristocratic origin.

In the Tatar language "Кара алтын – җир мае, аның белән ил байый"- interpretation – Black gold is the oil under the land, which is the wealth of the country.

"Кара болыт булып йөрү" – interpretation- Walk like a black cloud – means be offended, to sulk at someone.

Proverbs and sayings with black colour semantics carry both positive and negative. "Кара ипине җиксенсәң, кара көнгә калырсың" (җиксенү – ялку, өнәмәү) – interpretation- If you do not love black bread, poverty will come to you at lunch – The Proverb teaches us to respect the work of a grain grower, to love the bread.

In the Turkmen language black and white often makes a pair.

"Gara haly ak bolmaz, köne duşman dost" – interpretation- The black carpet will not become white, the old enemy will not become a friend.

"Gazan garasy gider, namys garasy gitmez" – interpretation -The blackness of the saucepan can be washed, but the blackness of soul is not. "Puly gara günüň üçin sakla" – interpretation- Save money for a black (rainy) day.

Red color symbolizes love, passion, devotion. It also symbolizes fire, rebellion, anarchy, struggle, revolution, blood, freedom, independence.

In the UK, red is a symbol of statehood, which is reflected by phraseological units: "The red, white and blue" which means colors of the British flag, denoting the British fleet and army; "Red book" – the name of the genealogy book or some official directories, " A red-letter day" – holiday, a memorable day [11].

The Slavs of the ancient Russia used the word "red" when they wanted to say "beautiful, joyful, good or pleasant". In the phraseological units where there is a red color, they have a positive meaning, for example, "Red Square" – beautiful square, "red days" – time of good luck, good life.

Red color can also express emotional states of a person, such as anxiety and extreme excitement.

In both English and Russian the expressions "To get / have a red face", "Red in the face", "Red as a beet as a lobster" means – confused, blush, turn purple with shame, embarrassment. "As red as fire (flame)" – flashed (on the face) – "blush like poppies color", " blush to the ears", "blush to the roots of the hair" – a person has a strong degree of embarrassment, shame.

Red color means health and beauty, courage and strength: "Red blood" is strong, brave.

In English, healthy appearance and beauty are associated with cherry berries or rose flowers "Red as a cherry (rose)", while in Russian, people speak of "being as healthy as blood with milk" and associate health with the red color of blood and the white color of milk.

In English, Russian, as well as in the Tatar and Turkmen languages, red is the color of the danger warning "To see the red light" (to see the red light of a traffic lights, semaphore, buoy), "Like a red rag (to a bull)" – something infuriating, anticipating of approaching danger, trouble, etc.

In the Tatar language the proverb "Кызыл кар яуганда" – interpretation- When there the red snow will fall-means something unreal, irrealizable, based on illusion;

"Алманың кызылына алданма" – interpretation – Do not reach for an apple just because it is red (red means good, ripe) that means you should not envy something with a beautiful look.

In the Turkmen language, red means "beautiful", "expensive", "golden".

Gyzyl dil- jan zähmeti, abraý är kuwwaty – interpretation – The eloquence is the fruit of labor, respect is the fruit of power – education and authority are achieved either through hard work or through human power. Adam eli gyzyl gül – Human hand is a red rose – all beautiful is created by the hands of people. Gyzym gyzylly halkam – interpretation -The daughter is a red (golden) earring. The proverb means that a daughter is as dearest for a mother, as gold is very precious for Turkmen people.

Analysis of factual material extracted from phraseological dictionaries of English, Russian, Tatar and Turkmen languages, showed that the phraseological units are quite actively used in the lexicon of representatives of different language cultures. Proverbs and sayings with the semantics of the color "white", "black", "red" are quite often found in all the represented languages.

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Section 13. Philosophy

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DEMOCRATIC FEATURES OF PEOPLE'S RECEPTION

Abstract. Democratic institutessuch aspeople's reception, mobile receptions functioning in Uzbekistan; websites like 'Government hour' ("Hukumat soati "), 'My view' ("Mening fikrim") have been analysed in the article.

Keywords: democracy, institutions, governance, reception, people's reception, mobile receptions, dialogue with the people, people's treatment, suggestions, right.

Modern democratic reforms held in our country are based on restoring equality of property forms, ensuring human rights and freedoms, according to the national interests and statehood traditions, reorganization of governing system, establishing relationship basing on equality and mutual interests with world community, building a socially just and law-based state, orienting strategically to bring up younger high spiritual generation.

That enables 'The Concept of further deepening democratic reforms and establishing civil society in the country' to establish governing institutes and their effective function, protect citizens' right and freedom, make all forms of property, take part in governing' [1, p. 4–5].

The strategic goal of the Republic of Uzbekistan is to alter the social life based on democratic values. On the first day his presidency, Sh. M. Mirziyoev announced his intention to continue democratic reforms. He states that 'building civil society, protecting citizens' liberty and initiative, expending their participate in social life are still main aspects of development of the political system of Uzbekistan' [1, p. 44].

The President says that'expansion people's participation in social life' as a priority of his activities and it is the focus of the ongoing reforms. This task was set by critical analysing social life of our country, estimating objectively achievements and he worked out a strategy for development. That is why, new stage of our national democratic development is connected with the name and creative activity of Sh. M. Mirziyoev. At the 8th Congress of the Liberal Democratic Party of Uzbekistan, on October 19, 2016, first he gave an explanation on what oriented our main politic activity. First of all, he focused on the judicial system and its problems waiting their solutions.

'What are people waiting to do today? Initially, it is the solutions made on time, impartial and legitimate.' To improve

this situation, Sh. M. Mirziyoev notices improvement of the situation by emerging a new relationship between the judicial system and the people. Servicing the judicial system, which is far from real life, interests of people, to people becomes the agenda. The head of state Sh. M. Mirziyoev says: 'Therefore, we'll make a system, according to it every governor (hokim), head of the department of Interior, public prosecutor reports to the people' [1, p. 53]. It reflects the aim transitioning to a new stage of national democratic development through the concept of the dialogue with public.

Sh. Mirziyoev says that developing of governing system and its effective functioning are one of the main issues. His enactment 'On Approval of the Concept of Administrative Reforms in the Republic of Uzbekistan'was adopted. In this Enactment sets following tasks discharging hinders to our progress in governingfora few decades, and enabling innovative development:

a) to improve institutional and organizational legal basisof the activities of executive authority;

b) toclarify the functions and duties of the executive body, to determine the frame of their responsibilities, to improve the coordination and interaction processes;

c) toreduce administrative interference in the economic sector and to expand market mechanisms of management;

d) toimproverelationship between the mechanisms of the vertical government system and the executive authorities;

e) to introduce modern forms of strategic planning, innovative ideas, developments and technologies into the government system;

f) to form effective public services, to introduce effective anti-corruption mechanisms in the executive body [2].

It is obvious that the Head of our state considers that the effective functioning of the system of governance is primar-

ily aimed at the interests of the people.Improving the institutional and institutional framework of governance is pointed at improving the performance of executive authorities in decree-making, with the interests of the people, and the whole socio-economic development of the territories.Without the development of the region, without answering people's need, it is impossible to assess activities of governance, because governing is the process tending to centralization, bureaucracy and deviation from the interests of the people.There is no system of absolute relief from these illusions, even in Germany, where the systematic discipline is deeply rooted, sometimes, reports of bureaucracy and corruption can be heard.

In China, even abusive and corrupt practices are banned by the death penalty, people doing that are found, the government do not deny to showthe death penalty. This cannot lead to the idea overcoming of absolute vanity and corruption and to the absolute exclusion of human life and governing. Therefore, training of cadres whose purpose is pure, transparent, and whose a vital position is to obey the law is the main purpose of any democratic state.

The principles such as'Human interests areabove all' and 'Public authorities should serve the people, not people to the authorities', which were adopted in the five future priority directions of the development of the Republic of Uzbekistan in 2017–2021, are aimed at raising democratic reforms in the country to a new level. So far, 36 laws, more than 130 decrees of the President of the Republic of Uzbekistan, more than 220 acts of the Cabinet of Ministers and other sub-laws norms have been adopted to reach that purpose. Among them, the important democratic ones are opening and functioning the virtual reception of the President of the Republic of Uzbekistan, people's reception, the virtual reception of the Cabinet of Ministers and websites of ministries and so on. The virtual reception of the President have received more than 2 million applications so far.

The first notion of 'democracy', which means 'people's power', is being used widely. It includes factors like freedom of thought, human rights and freedoms, the creation of non-governmental organizations, freedom of conscience, free choice of residence, liberty of working [3].

Interpretation of democracy as the people's power is very close to the characteristics of the people's reception. According to the new edition of the law 'On appeals of physical juridical persons' adopted on September 11, 2017, the system of testing has been formed. (http//www.pm.gov.uz) is set as the website, and 10–00 as the telephone number. The new edition of the law implies a more open, democratic approach. Citizen's personal cabinet is also available. There is no need to repeat citizen's personal information, his or her all appeals are put together.

According to the new version, in the virtual reception of the President, some modules such as 'Frequently asked ques-

tions', 'Online consultant', 'Reception tables and appeals to Ministries and heads of departments', 'People's receptions' addresses', 'Reports of persecution' have been created. In order to be appropriate of citizens' appeals with democratic principles, appeals of People's reception can be placed on the modules of virtual reception of the President.

Indeed, the formation of the people's reception as a democratic institution is a consistent process. At the same time, democratic features of People's reception are highly appreciated by international experts and leading research centres. 'There is no alternative of the virtual receptions the world', states the director of the Institute for Caucasus and Caspian studies M. Dornfeldt (Germany). It increases transparency, public confidence in government, and minimizes corruption [4].

Basing on the analysing of appeals sent to People's reception can be concluded that in the first years, people were complaining about their privacy and problems, and asked for interference from government officials, now they concern the country, regions, labour communities. For instance, according to 'Social opinion', 30.4 percent of the people complain about corruption in some systems, 28.1 percent about lack of well-qualified staff, 28.3 percent about careless of their own problems, 28.8 percent about improving laws on economic sphere, 52.6 percent about health service, 41 percent about educational system, especially schools, more than 60 percent about public utility service [5].

Appeals received at the People's reception are also close to these indicators.For instance, in the process of public reception of the Office of the President of the Republic of Uzbekistan on the protection of the rights of citizens, control over work with physical persons and legal entities in Namangan region (April 18–19, 2018) 2540 appeals were received. In those, problems of land allocation, law enforcement agencies, the restoration of civil rights and freedoms, water, gas and electricity were brought [6].

Till March, 2018, twenty-seven thousand and a hundred and sixty-nine appeals were received at People's reception in Khoresm. The appeals are mainly related to housing, increasing judicial system, subsidy, credit, entrepreneurship and utility services. 'Human life is full of a joy and anxiety,' says NasibaJumaniyozova, a resident of the Bayot neighbourhood in Yangiarik district. Sometimes there are some kind of problems that need to be address to government agencies to solve them.A few years ago, to solve these problems we had to run between administrative department, had to face with roam. Opening these people's reception, holding public receptions like this, the fair consideration of our petitions testify that, in our country, people's interests have become the most important issue' [7].

Mobile receptions held by People's reception are one of the forms of democracy. The diversity and quantity of

applications, especially the need to solve them contribute to function mobile receptions. For example, on April 1, 2018, on mobile reception held at Tashkent Institute of Railway Engineering, more than 2.000 applications were received by the Office of the President, General Prosecutor's Office, the Supreme Court, the Central Bank, the Ministry of Internal Affairs and Emergency Ministry, the Ministry of Higher and Secondary Specialized Education, the Ministry of Health and the Ministry of Finance, the Ministry of Justice and Labour, and 60% of which were resolved in the same place [8].

At the initiative of President Sh. M. Mirziyoev, the institute of the 'government hour' was found with the People's reception on 12th of July, 2017. Heads of state institutions, ministers report to deputies of the Oliy Majlis, hold open meetings with fractions of political parties, deputies and senators.

SinceApril, 2018, the portal 'My opinion' (*"Mening fikrim"*) has been launched, and every citizen can make suggestions and comments.

Above mentioned examples show that 2017 which is the year of 'Dialogue with the people and the human interest,' has begun to move towards a new level of democratic change in Uzbekistan. Today, new institutions of democracy, modern mechanisms of supporting for people's initiatives and ideas are being made. There is no obstacle to the people's concerns and thoughts. The main subject of this democracy is the people of Uzbekistan. Its guarantee is democracy and our law-obeying state. There is an opportunity for these democratic institutions to work more efficiently and to identify and research that is the task of science.

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MIRZO BEDIL`S VIEWS ABOUT HUMAN AND ITS ESSENCE

Abstract. This article analyzes the essence of man and his essence from a philosophical and religious point of view. A person's ability to know is infinite due to his intuition and intelligence. Understanding of a person through the mind, sense organs and thinking of a person. Man achieves perfection through knowledge and morality. Mirzo Bedil believed that he would achieve perfection as a result of physical, spiritual and intellectual development.

Keywords: Chor unsure, Nikot, Irfon, Sufism, "Jawhar-uz-zot", moral education, human, flora, plant, molecule, humanity, nature, religion, human essence, person.

Mirzo Abdulkadir Bedil, famous in the XVII-XVIII centuries, was one of the most prominent scientists in the history of the Indian philosophy and was well aware of the Muslim heritage. He wrote philosophical and religious views in his works such as "Chor unsur", "Irfon", "Nikot". In his work he wrote about the teachings of Sufism, Aristotle's social-philosophical and naturalist views with al-Kindi, Abu Nasr Farabi, Abu Rayhon Beruni, and the views of scholars and thinkers. In social philosophical aspects of his works, they were devoted to the idea of perfect humanity, moral education, and human perfection. Mirzo Bedil examined the human condition deeply, learned its purpose, dignity, self-actualization and attitude to others. There is a point in the philosophical, social ideology of the scientist that there is an impression that this thinker's close proximity to arches of sufism had a permanent impact on his philosophical outlook. It should be noted that Mirzo Bedil used the teachings of Sufism in the human and its essence. Comparing the Bedil's philosophy with the views of Farididdin Attar, this is also evident in the human question. Farididin Attor's "Jawhar-uz-zot" first describes the uniqueness of all the spiritual and material worlds, namely, the unity of the universe and the power of absolute Creation. Then, in this vicious circle, the role of man, the essence of human nature, the self-awareness of the Creator, the pain of suffering, the purification and self-consciousness of the soul; the body, the world, the soul, the transgression of the difference stage and joining in the true [1].

Mirzo Bedil, in his Irfan, argues that the origin of man is based on the theory of evolution, in which first human beings emerged from the formation of the flora and fauna and their accumulation. The evolution of the "four elements" consists first of all, the molecule, the second plant (plant), the third animal (the irresistible and the loose animal) and the fourth person (the willpower and creature).[2] He emphasizes that the human being is created in the highest status among all of the universe, and wants to be regarded as worthy of this honorable title, irrespective of his race or race. Human beings are miraculous, yet they are sources of mischief. Therefore, he draws attention to the need to take into account these two different manners. It also points to the fact that it is a creature capable of performing many things, that is, the splendor of the human being, the intelligence of speech, the speech, the mind, the intelligence, the other creatures, and the imperfect, careless, the poet tried to cover the moral virtues along with the noble morals and manners in man.

Bedil introduces the concept of "brilliance" absolutely in explaining the existence of human beings in his works Irfon, Chor unsur. The "absolute praise" refers to an absolute presence based on divine power. Mirzo Bedil is the greatest and most blessed man. The scientist considered the greatness of the human being as its important and conceivable essence. Fitrat's "Bedil" illustrates three important aspects of the essence of the person analyzed by Bedil. The first of them is that man has the highest, the most powerful power. When a person believes in himself and follows his conscience, he does everything he can to achieve the truth. In this, the intellectualist calls on man to recognize his own power and points to man's power.

According to nonsense, man admits his weakness because he does not know that such a great power is. When he is weak, all his troubles come to him, and he becomes a source of mistakes. A person's ignorance of his own power draws attention to the concept of the Bedouin as the cause of errors.

The second important aspect in the analysis of human nature is the example of the Bedouin interpretation. The flesh is ignorant of the fact that a person does not know that he is a blessed person. One of the reasons that deprives man of his strength, spiritual development is his imitation.

The companion is trying to explain that people are following the unconscious, blind, and obedient images of the

idols that prevent them from doing great things. He sees the true power of human beings in the pursuit of knowledge and enlightenment.

Bedouin shows that man has the greatest, the highest mind, the mind, the heart. The Bedouin understands that one of the reasons that unites imitation in human nature is misunderstanding of religion. Therefore, the intellectual was regarded as the third most important aspect of human nature's analysis: to misunderstand the essence of religion, and to misinterpret its religious views [3].

Bedil opposes the use of formal words and deceptions of God's words. It is necessary to explain the essence of religion, that is, trying to entice people with the fear of hell and deceiving them with paradise will gradually become a legend of the gods, and they will be able to understand the true meaning of the legends. As the Sufi masters say in the mosques, the teachings of God through the prophet, the word of truth, and the passing of time, are a fascinating myth. When a certain period of human experience is not able to comprehend the meaning of science, it begins to give these concepts a legitimate authority.

Thus, the Bedouin calls on man to abstain from following the imitation and religious beliefs by relying on his own power.

In addressing the essence of human nature, the intellectual is based on the historical necessity of the time. Because in the second half of the XVII century - the struggle for the throne in India in the first half of the XVIII century, and seeing disagreements, injustices, humiliation. Bedil encourages people to be kind, dignified, generous with their impressive thoughts.

The attitude towards the unbelieving people is condemned by their disagreement on the part of the nation, and the religion. He invites all to love people.

The problem of preserving a human being is becoming increasingly common throughout the world today. One of the best ways to deal with this problem is to create a sense of love for people, to love people, as Bedl said. Weapons and battles are a source of religious aggression not only for the lives of others, but also for everybody.

In the doctrine taught by humanity, the level of humanity is determined by the level of development of the spirit, hence, spiritual heights are inevitable for victory over cruelty, ignorance, low nature.

Here are some conclusions from the above-mentioned points of view:

First of all, it is important for a person to appear in Bedil's philosophy. The first thing that influences on the appearance of man is the Essential Spring (Divine Force) and the scientific evolution of nature. This interpretation of the material and spiritual world of man means that the spiritual world of man is in harmony with the Divine Power, the Absolute Being, the body with the material universe.

Secondly, these views of Mirza Bedil, who supported the united position of tasawwuf in man's appearance, are inextricably linked with the idea of Farididdin Attar.

Thirdly, Bedil pays special attention to some concepts of power, imitation and religion in analyzing the essence of man. The power of human beings is dominated by the spiritual perfection of man, as well as in the elevation of the elevated position. Slander and religious fanaticism lead to humiliation.

Fourthly, Mirzo Bedil is a philosopher, who promotes religious and secular views on the origin and essence of man.

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THE MAIN CRITERIA FOR ENSURING RELIGIOUS HARMONY, PEACE AND FRIENDSHIP IN UZBEKISTAN

Abstract. This article will discuss the main criteria and factors that ensure peace, harmony, tolerance and friendship in society. The value of such a passage is seen in its organizational, analytical and practical significance of the day of countries with a diverse religious and national organization.

Keywords. Religion, religious feelings, tolerance, secularism, Central Asia, UN, factor, development.

The end of the XX and the beginning of the XXI centuries is characterized by an unprecedented surge of religious feelings in all regions of the world, especially in countries with a predominantly Muslim population. The great ancestors of the peoples of Uzbekistan making an invaluable contribution to the development of science and culture, such as Biruni, Farabe, Ibn Sina (Avicenna), Timur, Ulugbek, Navoi and others today live in people's memory. The course of the new state to revive the forgotten, the exact forbidden in the years of national dependence on tsarist, and then – Bolshevik Russia, turned spirituality into an important factor.

From the first days of its independence, Uzbekistan took up these vital issues – achieving a reasonable balance between religiosity and secularism, religion and the state. The ethnic composition of the population, religious diversity, the atheistic Soviet past extremely actualized the problem of establishing the principle of secularism in society.

In Uzbekistan, the role of religion in society is increasing, its position in everyday life and in society is being strengthened, and religious education is developing. Uzbekistan is a multinational and multi-faith republic. 136 representatives of religious nations and ethnic groups live in the country, 16 religious denominations officially function. The characters are interfaith, national and civil accord, peace and friendship of peoples. This is the outer side of the matter. In fact, behind all this well-being and peace there is a certain social policy that ensures such a state, and a number of problems that require strengthening this state – peace, harmony and tolerance of citizens.

The head of Uzbekistan in his speech at the 72nd session of the UN General Assembly, held in New York, praised the significance of the Islamic religion in the world and came up with the initiative to adopt a special resolution "Education and Religious Tolerance." It should be noted that work is being done in this direction in Uzbekistan. The Imam Bukhari International Research Center was established in Samarkand, and the Center for Islamic Civilization in Tashkent. Today, Uzbekistan's principled approach "Enlightenment against ig-norance", which implies ensuring openness of knowledge for all, eliminating ignorance in matters of religion, can serve as an example for all (Шейх-уль-ислам Аллахшукюр Пашазаде: Шавкат Мирзиёев – достойный лидер, способный вести Узбекистан к еще более высоким вершинам *28.02.2018 http://xs.uz/index.php/homepage/sijosat/item/13481–1* (date of the application 01.03.2018)

One of the most important, if not decisive, criteria for ensuring tolerance in society in modern Uzbekistan is a reliance on secularism. The policy of secularism is the historical conquest of humanity, which allows for a balance between religious and secular life.

After the collapse of the Soviet political regime, the right to worship appeared. Adopted on December 8, 1992, the Constitution of independent Uzbekistan proclaimed freedom of conscience and religion (Article 31). The Constitution, the adoption of laws on freedom of conscience and religious organizations (1998, May 1) and a number of other legal acts made it possible to stabilize the situation, achieve civil unity, harmony and peace between believers and supporters of secular development.

In Uzbekistan, the separation of religion from the state, the restriction of its activities to the sphere of spirituality is not achieved smoothly, without contradictions. Secularism in society was established at the cost of the lives of many advanced people of the region. The process of separating secular authorities from religious ones was somewhat different. In Europe, they don't even talk about the need to separate religion from the state. Because, this question is practically removed from the agenda. However, in the Middle Ages, the best minds both in Europe and in the East became more and more deeply aware, the channel of dangerous obstacles on the path of universal progress became the dominance of religious consciousness, and were engaged in a constant search for solutions to this universal problem.

Today, the Christian and Islamic dialogue as a factor in the harmonization of ethnic and religious relations. These are problems of war and peace, ecology, social inequality,

ethno-confessional relations (conflicts), drug addiction, alcoholism, demography, globalism, charity and others that require the active interaction of all faiths in order to develop joint measures to stabilize society, prevent social and political and ethnic religious conflicts.

Dialogue between people of different political views, nationalities and religions is always conducted in order to achieve mutual understanding and establish socio-political, ethnic and religious harmony. The forms of political dialogue are: parliamentary debates, diplomatic negotiations, conciliation commissions, conferences, round tables, etc. Even the mutual recognition by participants of the dialogue of the right to disagreement is different views. Other problems serve as a necessary prerequisite for consensus, compromise.

However, dialogue should be understood not only as a form of exchange of views in order to achieve consensus, but also as a principle of social life, as a political tool, without which any community of people disastrously disintegrates. The absence or restriction of dialogue as a priority principle for the functioning of society and power characterizes their anti-democratic, totalitarian nature.

Interfaith dialogue is not just a dialogue between theologians of various faiths, where religious dogmas are discussed or a comparative analysis of various sources, interpretations and religious practices is conducted. Dialogue in the sphere of confessional relations is an important element of domestic and foreign public policy, having a specific strategy and tactics. The harmonization of interethnic relations in modern Russia largely depends on the harmonization of interfaith relations. One of the famous Western modern theologians G. Küng noted that there can be no peace between nations without peace between religions. And peace between religions cannot be without a dialogue between them. If national minorities could solve the problems of preserving and developing their national culture, language, and political sovereignty by secular, democratic means, then there would be less room for religion to solve the complex, and pressing issue of the national question.

Thus, the dialogue between Orthodoxy and Islam in the conditions of modern Russia goes beyond the purely confessional problem, all the more clearly gaining the importance of general political.

The actualization of such a dialogue is associated with fundamental changes in the political and spiritual life of nations throughout the entire post-Soviet space: first, the promotion of the religious factor plays the role of the determining (to a greater or lesser extent) political situation in the former Soviet republics. As is known, among the non-Slavic peoples of the USSR, the fusion of national and religious has always been perceived as the norm, therefore in the era of sovereignty and rapid awakening of national identity, the "traditional" confession (Islam) became the main factor of the spiritual and political unity of the nation.

Secondly, the actualization of the Orthodox-Islamic dialogue is associated with a clearly marked tendency to increase the influence of the religious factor, increasing its role in society. In the conditions of modern ideological pluralism, it is religion that possesses the greatest mobilizing power: religion is not only an intimate affair of everyone, but also an essential part of civilization. Therefore, the more people are concerned about the fate of their civilization, the more easily politicians manage to manipulate the properties of religion to unite and mobilize people in their own political interests.

The Muslim world today stands out as politically independent and rich, with which the most developed countries and international organizations are forced to reckon and have partnerships, and the Muslim Ummah formed under its auspices has become influential and attractive to all Muslims, including the Muslim communities of Uzbekistan.

Interethnic relations require interreligious dialogue as an essential component of the general cultural dialogue. And the problem of interreligious dialogue turns out to be unusually relevant not only in the sphere of purely interreligious relations, but it becomes a factor influencing the cultural, social, economic and political life of society.

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CULTURAL AND HUMANITARIAN DIMENSION OF CIVIL SOCIETY

Abstract. The Message of the President of Uzbekistan Sh. M. Mirziyoyev to Oliy Majlis notes that Uzbekistan will always be faithful to its principles in the sphere of international harmony and religious tolerance, strengthening the atmosphere of mutual respect, friendship and harmony between representatives of different nations and faiths. It is considered as the greatest wealth of the state and society. The resolution of the UN General Assembly on Education and Religious Tolerance (A/RES/73/128, 12.12.2018), adopted at the initiative of Uzbekistan, stresses that freedom of religion or belief, promoting interfaith and intercultural dialogue, mutual understanding and cooperation are necessary conditions ensuring peace, as well as the valuable contribution of adherents of all religions or beliefs to the development of mankind, ideas and concepts of civil society development.

In this context, we note that one of the urgent tasks of studying civil society remains finding answers to the questions: what is the role and influence of the mentality, traditions and culture of the population in shaping civil society; how do "civilizational, religious values" in the processes of democratization, the relationship between the people and the government, etc.

Keywords: civil society, cultural and religious values, Islam, Islam and democracy, justice.

The Message of the President of Uzbekistan Sh. M. Mirziyoyev to the Oliy Majlis and the resolution of the UN General Assembly on Education and Religious Tolerance adopted at the initiative of Uzbekistan emphasize that freedom of religion or belief, encouraging inter-religious and intercultural dialogue, mutual understanding and cooperation are necessary conditions for peace [1]. There is also noted the valuable contribution of scholars and practitioners of adherents of all religions or beliefs in the development of mankind, ideas of forming a civil society, promoting education, peace, human rights, tolerance and friendship.

In this context, we note that civil society has many dimensions, among which the cultural, humanitarian, religious and national dimensions stand out. Those. One of the urgent tasks of studying civil society is studying the issues of the role and influence of the mentality, traditions and culture of the population in the formation of civil society, the reflection of civilization values in democratization processes, the relationship between the people and the government, etc.

According to many analysts, in particular, according to R. Inglehart and K. Veltsel, the value orientation of society plays a key role in the emergence and development of democratic institutions. At the same time, the establishment of democracy largely depends on the deep-rooted value orientations of the people. According to their estimates, modernization in the socio-economic sphere, the assertion of the values of self-expression in the cultural sphere and democratization are components of a single fundamental process:

human development. According to them, "human development contributes to the strengthening of civil society, political freedoms, good governance, and therefore increases the likelihood of democracy in those countries where it does not exist yet, and gives it greater" responsiveness "to the interests of people there where the democratic system is already operating" [1].

In this context, it seems appropriate to point out a number of fundamental points related to the definition of the concepts "civilization", "cultural and religious values", etc. It should be particularly noted that researchers have long tried to explain the concept of "civilization" and "culture", their interconnection. Created types, concepts and theories on the problems of civilization and culture. However, a clear interpretation of these terms is still not present in modern science.

In general, it should be emphasized that the modern civilizational approach, based on the ideas of "cultural pluralism" and the need to abandon any hierarchy of cultures, introduces a number of clarifications to this concept, consistently moving away from the definition of mainly two civilizational types – Eastern and Western. This is due to the fact that if the European world in terms of civilization is a relative unity, then in the East there are several religious-cultural civilization regions – Islamic, Indo-Buddhist and Confucian. Moreover, despite the significant differences between these all regions in the political structure and value orientations of people, there are a number of similarities of these types [2].

The concepts of liberalism and democratic participation of the population in the affairs of the state were already present in the medieval Islamic world. In particular, Al-Farabi, discussing the features of the "virtuous city", stressed that "no one can stand at the head of a virtuous city, what happens, a person, since management depends on two things: first, by nature, he was ready for management, and secondly, from the position and abilities that have their willpower as their source" [2, 311–312].

According to him, the only person who can combine the twelve innate natural qualities can become such a person: be healthy; have analytical thinking; be able to state with complete clarity all that he thinks about; have a love of learning and learning; abstain from eating, drinking, and mating; love the truth and its champions; have a proud soul and cherish honor; to love the nature of justice and its champions, to be fair to their people and to others, to encourage justice, etc.

In addition, this person must meet six other conditions: be wise; to be knowledgeable, keeping in mind the laws, rules and customs; show ingenuity in what has not been preserved from its predecessors of the relevant law; to have insight and ingenuity, allowing him to learn at any time, both the existing state of affairs and future events, and in these actions he should aim at improving the well-being of the city. The leader of a virtuous city must also be able to direct people with his word to the execution of laws, have the bodily strength necessary to conduct military affairs, and know the art of war as a service art and as a governing art [2, 317–321]. In his work, he also gave recommendations on how to elect (appoint) the head of a virtuous city. Speaking in modern language, Al-Farabi considered the implementation of the principles of the rule of law, democracy, justice, the pursuit of knowledge, a healthy lifestyle, etc. as the most important tasks of ensuring the well-being of the residents of a virtuous city (or an ideal state). This, as we see, are inalienable properties and necessary conditions of civil society and the rule of law in their modern understanding.

A thousand years later, Mohammed Iqbal claimed that the early Islamic Caliphate was compatible with democracy, he had the makings of an economic and democratic organization of society. So Ahmad Moussalli argues that concepts in the Quran indicate some form of democracy: shura (consultation, election of leaders to represent the people and rule on behalf of the people), ijma (consent), al-herriya (freedom), al-hukkuk-shariyya (legal rights). He believed that the shura is a doctrine that implies the participation of the people in the management of the affairs of their government [3].

Lawyer L. Ali Khan argued that Islam upholds fundamental democratic principles: power is truth; justice and law are vital things; freedom of religion and the right to life, individual property, and also health cannot be violated; guarantee of privacy and privacy; presumption of innocence; deliberation and others. Islam believes that society consists of conscious individuals who have the freedom of choice and are responsible for both themselves and those around them [5].

In general, it can be noted that the modern "enlightened Islamic democracy" fully complies and recognizes the principles of democracy generally accepted in the modern world. At the same time, a comparative study of the constitutions of countries with a predominantly Muslim population shows that in Indonesia and Malaysia considerable experience has been gained in combining the values of Islam and the democratic path of development. Thus, adopted in the summer of 1945, the Constitution of Indonesia laid down five principles of the Indonesian model of developing national statehood, building a society of "justice and prosperity" proposed by Suharto (Pancha Sil): belief in one God; fair and civilized humanity; the unity of the country; democracy guided by sound consultation and representation policies; implementation of social justice for all people of Indonesia [3]. The basic law proclaims democracy and enshrines "religious pluralism." It is indicated that these ideas are based on the two pillars of Islam: "mufakat" (consensus) and "mashvarat" (consultations, prototype of parliamentarism, representative power) [6].

The Constitution of the Malay Federation declares that "Islam is the religion of the Federation; however, other religions may confess peace and harmony in any part of the Federation. In any state except states where the head of state is not the head of the Muslim religion in this state, in the manner and extent recognized and proclaimed by the state constitution of this state, as well as following this Constitution, all rights, privileges, prerogatives and powers belonging to him as head this religion, inviolable and can not detract. But in any acts, rituals or ceremonies for which the Council of Governors decides that they should apply to the Federation as a whole, each of the other rulers, by virtue of his position as head of the Muslim religion, delegates his authority to Yang di-Pertuan Agongu " [4].

Article 8 stresses that "all persons are equal before the law and enjoy equal protection of the law", article 11 – "everyone has the right to profess his religion". Those. proclaims the principles of the rule of law and "religious pluralism." Thus, the fourth Prime Minister of Malaysia, Mahathir Muhammad, who held his post from 1981 to 2003, based, in particular, on the provisions of the 11th ayat of Surah Ar-Riad of the Qur'an: "Truly, Allah does not change the position of people until they themselves change himself, "noted that" the early Muslims were oppressed just as we are now. But after their sincere and determined efforts to help themselves in accordance with the teachings of Islam, Allah helped them defeat their enemies and create a great and powerful Muslim civilization. And what have we done, especially considering the resources that He has endowed us with? "

According to his conviction, Islam was not revealed only for the 7th century AD. Islam has been revealed for all time. As times have changed, then Muslims also have to change by applying the teachings of Islam in the context of the modern world, which is radically different from that which existed in the 1st century Hijra. All that is required is the will to act. He emphasizes that if a person manages to change himself, Allah will help him, as stated in the holy Quran [4]. Through his life and work, he proved loyalty to enlightened Islam, freed from the extremes of interpretation of the Qur'an and the Sunnah.

He took a decisive course on the development of the country. His famous statement: "If I want to pray, I will go to Mecca, and if I want knowledge, I will go to Japan" – became the basis of the Malaysian public consciousness. Because of this, along with the acquisition of modern technology, strong economic growth and the achievement of a high standard of living, Malaysian society has managed to preserve its religious traditions and cultural foundations.

M. Muhammad believed that smart leaders of governments and countries should turn not to the formalism of liberal democracy, but to the common sense and the highest interests of their peoples, using mobilization methods of governing the country in necessary cases.

In conclusion, it should be noted that the researchers did not agree on a single concept of "civilization", "democratic, civil society", "culture" and today there are quite a few points of view regarding these terms. For example, there are about three hundred definitions of the concept of culture, and the same is true of the concept of "civilization". Each point of view, in its own way, in any aspect of the discussed problem of law. Still, every nation has its own culture, and researchers of a given nation evaluate civilization, following the laws of their culture.

At the same time, it can be argued that the universally accepted values of democracy, such as democracy, the rule of law, etc., are compatible with the values of Islam and other religions. In this regard, it should be emphasized that they differ from each nation and "civilization" and have forms peculiar only to them.

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Section 14. Chemistry

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GRAPHANALYTICAL METHOD FOR DETERMINING TECHNOLOGICAL PARAMETERS USING FOUR-COMPONENT SYSTEM Na_2CO_3-$NaHCO_3$-$NaCl$-H_2O

Abstract. The graphic-analytical technique of determination of parameters of receiving sodium sesquicarbonate with application of a horizontal and orthogonal projection of an isotherm of Na_2CO_3-$NaHCO_3$-$NaCl$-H_2O system at 30 and 100 °C.

Keywords: sodium sesquicarbonate, sodium carbonate, crystallization, system

Known methods for producing sesquicarbonate sodium, based on the mixing of powdered sodium carbonate and aqueous suspension of sodium bicarbonate [1]. The disadvantage of these methods is the presence in the synthesis products, in addition to sodium sesquicarbonate, $Na_2CO_3 \cdot H_2O$ and $NaHCO_3$ and, therefore, low content of the basic substance. At the same time, it was noted that polythermal crystallization from a saturated solution makes it possible to obtain a product with a content of 96–98 wt.% $Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$, and in [3] it was shown that it can be obtained in the system Na_2CO_3–$NaHCO_3$–$NaCl$–H_2O.

However, the authors did not take into account the effect of the composite components on the solubilities of each other [2]. In [3], the temperature and concentration limits of the existence of trona are shown in detail, but their application of the technology is not indicated.

The aim of the work is to develop a graph-analytical method for determining the technological parameters of obtaining trona using the solubility diagram of the Na_2CO_3–$NaHCO_3$–$NaCl$–H_2O system.

When creating a graph analytical method for determining the optimal parameters for the process of obtaining thrones at 30 and 100 °C, the isotherms of the Na_2CO_3–$NaHCO_3$–$NaCl$–H_2O system diagram given in [3; 4] were used. The technique is based on the rule of the connecting straight line and the lever [5].

To simplify graph analytical calculations, the concentration of the salt part in the diagram is expressed as a percentage, and water in grams per 100 g of the amount of salts. The composition of the salt residue is shown on the orthogonal projection, and the amount of water is shown on the horizontal projection (Fig). This diagram allows you to theoretically determine the optimal range of variation of the technological parameters of the process of obtaining trona from carbonate and sodium bicarbonate in the presence of sodium chloride. It can be seen from the diagram that the ratios of sodium carbonate and bicarbonate lie in the intervals of points located on the faces (sides) of sodium carbonates and bicarbonates 3, 4 (at 100 °C) and 5, 6 (at 30 °C), respectively. To determine the effect of adding sodium chloride on the process, we conduct a straight line from the HX angle to the side of carbonate and sodium bicarbonate with $NaHCO_3 : Na_2CO_3$ ratios from 0.235 to 0.15, which are located at points A and B. When adding sodium chloride, the salt composition of the system moves along straight lines ANX and VNH to the top of the NC. The amount of added sodium chloride was varied in quantities of 0.5; 1.0; 5.0; 15.0 and 30.0%. The composition of the salt part of the system in the figures is reflected in the figurative points A_1, A_2, A_3, A_4, A_5 and B_1, B_2, B_3, B_4, B_5 with the ratios of $NaHCO_3 : Na_2CO_3$ equal to 0.235 (A) and 0.15 (B).

To determine the amount of water on the horizontal projection of the system, we carry out an auxiliary curve corresponding to the water projections of lines A_1A_7 and B_1B_7. To construct the curve of the line on the water horizontal projection of the thrones on the curve of the 4'3'line, put the points A'_1 and B'_1, and on the curve of the 1'7' and 4'1' points A'_7 and B'_7 respectively. On the found point we draw the curves $A'_1A'_7$ and $B'_1B'_7$ with the simbate curves 3'7'.
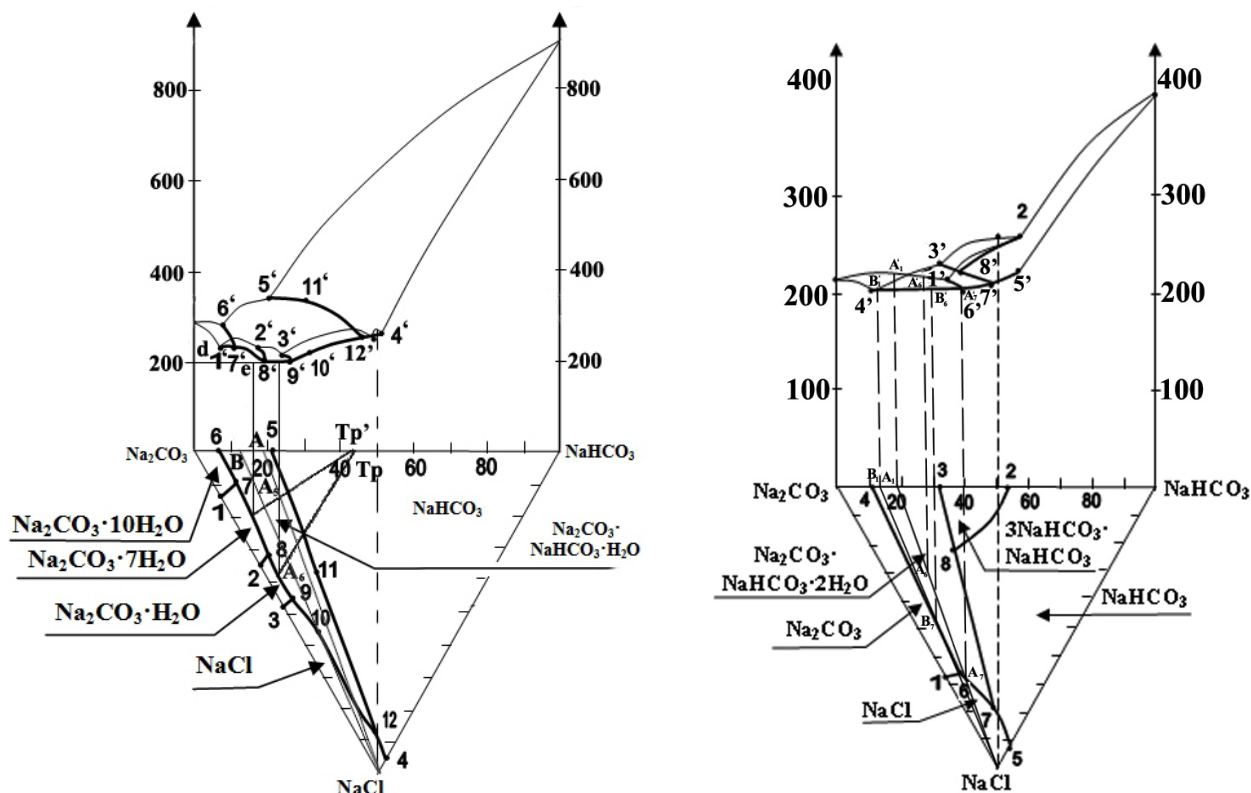
Figure. Graphical analysis of the production of trona on the horizontal and orthogonal projection of the isotherm of the four-component system Na_2CO_3-$NaHCO_3$-$NaCl$-H_2O at 30 and 100 °C

Table 1. – The chemical composition of the initial samples and the liquid phase after separation of the solid phase

№ experiences	Designations of figurative points in Fig.	The initial composition of the system, wt.%				The composition of the liquid phase at 30 °C, wt.%				Coefficients			Product yield,%
		a, NaCl	b, $NaHCO_3$	c, Na_2CO_3	d, H_2O	a_1, NaCl	b_1, $NaHCO_3$	c_1, Na_2CO_3	d_1, H_2O	x	y	z	
1.	A_1	0	6.09	25.96	67.95	0	1.740	27.33	70.930	0.13	0.728	0.38	79.3
2.	B_1	0	4.28	28.62	67.11	0	1.740	27.33	70.930	0.07	0.923	−14.29	60.8
3.	A_2	0.16	6.08	25.91	67.85	0.220	1.610	27.505	70.675	0.13	0.716	1.32	79.5
4.	B_2	0.16	4.25	28.48	67.11	0.292	1.674	27.189	70.845	0.07	0.921	−14.07	61.2
5.	A_3	0.32	6.07	25.87	67.74	0.368	1.510	27.534	70.588	0.14	0.711	1.62	85.7
6.	B_3	0.33	4.25	28.43	67.00	0.440	1.589	27.297	70.674	0.08	0.912	−13.39	70.0
7.	A_4	1.61	5.82	24.82	67.74	2.315	1.285	27.265	69.134	0.13	0.682	4.66	83.0
8.	B_4	1.66	4.09	27.37	66.89	2.744	1.387	26.765	69.104	0.08	0.888	−10.4	72.7
9.	A_5	4.85	5.23	22.28	67.64	7.310	0.881	24.280	67.529	0.13	0.676	6.06	92.4
10.	A_6	9.71	4.30	18.35	67.64	13.76	0.610	19.850	66.445	0.11	0.677	6.73	95.1

The intersection point of the found curves with perpendicular lines drawn from the figurative point shows the amount of water in the solid phase in grams per 100 g of the sum of salts with the formation of a saturated solution at 100°C. The resulting solution is purified from the insoluble part and cooled to 30 °C, as a result of which the throne

precipitates and a saturated solution is formed. If the initial and final composition of the system component is known, the material balance of the process can be calculated. When the composition of the system and the solid phase is known, the composition of the liquid phase can be determined from the connecting line. Therefore, from the point Tr. and a given

composition of the system at 100 °C, for example, from point A_5, we draw a crystallization line to the intersection with the saturation line of the thrones and $Na_2CO_3 \cdot 7H_2O$ (curves 7–8 at 30 °C). The intersections of the lines show the salt composition of the saturated solution at point e. The intersection of el perpendicular with the horizontal projections of 7'–8' at point 1 indicates the amount of water in saturated solutions in grams per 100 g of the total salt. As a result of using the above methodology, the composition of saturated solutions at 100 and 30 °C is determined, which allows you to perform a material calculation of the process using the formula:

(a, NaCl + b, NaHCO$_3$ + c, Na$_2$CO$_3$ + d, H$_2$O) = x (37.1 NaHCO$_3$+46.50 Na$_2$CO$_3$+15.93 H$_2$O)+y(a1, NaCl+b1, NaHCO$_3$+c1, Na$_2$CO$_3$+d1, H$_2$O) + z H$_2$O

where *a, b, c, d* and *a1, b1, c1, d1* are the contents of NaCl, NaHCO$_3$, Na$_2$CO$_3$, H$_2$O, respectively, in saturated solutions at 100 and 30 °C. The effect of the content of NaHCO$_3$: Na$_2$CO$_3$ and sodium chloride in the system on the product yield was also determined. From the results of the calculation (Table)

it can be seen that with an increase in the ratio of NaHCO$_3$: : Na$_2$CO$_3$, the yield of the product increases by 10–15%. With an increase in the content of sodium chloride from 0 to 9.71%, the product yield increases from 79.3 to 95.1 and from 60.8 to 72.7%, respectively, with NaHCO$_3$: Na$_2$CO$_3$ = 0.234 and 0.15. It also follows from table that when NaHCO$_3$: Na$_2$CO$_3$ = 0.234, the values of *z* are positive, and at 0.15 they are negative. A positive sign means that for given compositions of salt systems, the water content is greater, and a negative sign is the amount of missing water.

Thus, in order to achieve more than 90% yield of the product, the process must be conducted with sodium chloride content of more than 2%, and the ratio of NaHCO$_3$: Na$_2$CO$_3$ must be maintained in the intervals of 0.200–0.280. The obtained information allows you to pre-select the intervals of variation of technological parameters. The real optimal values of the parameters are determined by specific experimental data, taking into account the techno-analytical and physic-chemical parameters of intermediate and final products.

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TAKING PURE CELLULOSE FROM TOMATO STEM-*(SOLÁNUM LYCOPÉRSICUM)*

Abstract. In the following article it is searched for taking hemi cellulose from the tomato stem, and the optical functions of chemical reproducing fresh cellulose`s fiber instruction which is taken from the tomato stem.

Keywords: Cellulose, Hemicelluloses, less cellulose, optical properties.

Introduction

Research aimed onchemical processing of various plants and producing pulp suitable for paper production are carried out in the leading research centers and higher educational institutions of the world, in particular in STFI Institute (Stockholm, Sweden), Madrid Technical University (Spain), Hamburg University (Germany), Tvendensky University (Netherlands), Dresden Technical University (Germany), Berlin Technical University (Germany), Moscow State University (Russia) [1; 2]. As a result of the researches, conducted in the world, on obtaining composite polymeric materials achived a number ofscientific results, including: the new technology of improvement of cellulosequality (Codra Cell, Sweden) has been introduced; technology of transformation ofcellulose from the difficult period of synthesis on the simplified stage (Stockholm, Sweden) has been developed; optimum parametres have been created at obtaining cellulose from various woods and annual plants (Dresden, Germany); introduced into manufacture soda process of obtaining cellulose from wheat straw with cooking in 3% of alkali solution (NaOH) at a temperature of 150 (French Pulp paper research, France). Scientific researches are being carried out worldwide in the field of obtaining composition polymeric materials on the basis of cellulose, in particular in following priority directions: an intensification of manufacture systems for several times; process management with high precision due to preliminary determination of the factors that influence during the synthesis of products; obtaining cellulose with high molecular weight and its derivatives under the influence of various parameters; modernization of system by correction of various parameters and factors.

Uzbekistan has a very large source of raw materials (guzapaya and rice straw, straw, hemp, etc.) to obtain paper from annual plants [3].

Nowadays, as the demand for paper and paper products is rising, it has called us to obtain other types of paper products. For this purpose, a series of investigations have been carried out.

2. Materials and methods

For obtaining pure cellulose we measured 5gr of hemicellulose in the analytical weighning and reproduced that. At the result, pure cellulose was taken. We took each hemicellulose and boiled it in the water, alkaline, and nitric acid for 5 hours in 1:40 module. After boiling, all of them was washed in the alkaline and treated in 3% hydrogen. Hemicelluloses which were taken from the tomato stem retreated and obtained pure cellulose (Table 1).

Table 1.– Physical and physical-chemical nominations of tomato stem hemicelluloses

Raw material	Chemical treatment condition	Length of 10 fibers, mm	Capacity mass gr/l	The water soak degree of the model,%
1	*2*	*34*	*5*	*6*
Tomato leaf cellulose	hemicelluloses NaOH, 5%, H_2O_2 3%, 7% HNO_3, 100 °C, 6 hours	0.66–0.87	350	166.1

1	2	34	5	6
Tomato brunch cellulose	hemicelluloses NaOH, 5%, 7% HNO_3, H_2O_2 3% 100 °C, 6 hours	0.82–0.97	400	169.0
Tomato body cellulose	hemicelluloses NaOH, 5%, 7% HNO_3, H_2O_2 3% 100 °C, 6 hours	1.27	440	175.6
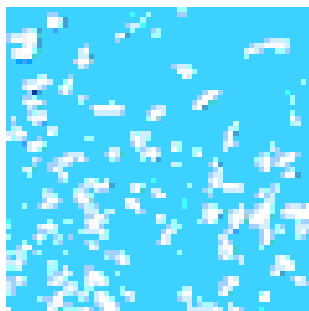
Hemicelluloses fibers of tomato leaf
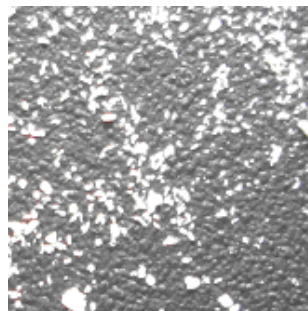
Pure cellulose fibers of tomato leaf
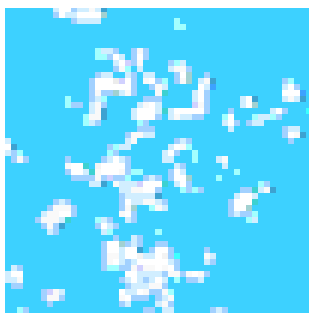
Hemicelluloses fibers of tomato brunches
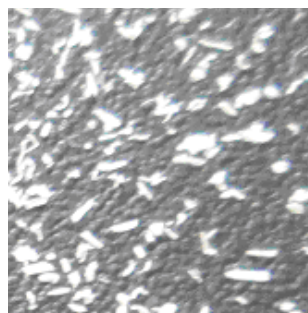
Pure cellulose fibers of tomato brunches
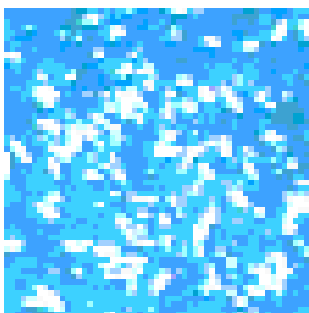
Hemicelluloses fibers of tomato stem's body
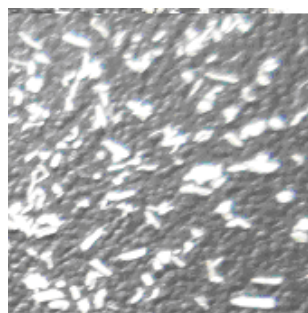
Pure cellulose fibers of tomato stem's body
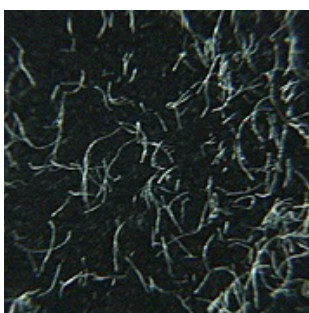
a)
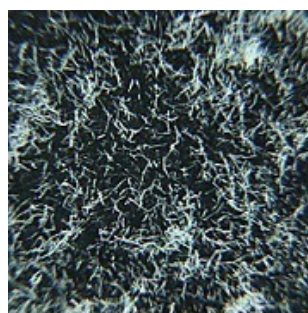
b)

Figure 1. The appearance of hemicelluloses of tomato stem and cotton

In the next step, cellulose part was filtered, washed by yielding water till the neutral condition and boiled again for 6 hours in 5% nitrate acid. Cellulose separated from the liquid and washed till neutral condition. It was boiled in 3% hydrogen peroxide for 60 minutes. It was left in the room temperature for completing reaction. Whitened cellulose was filtered, washed till neutral condition and dried in the room temperature. It is well known that after chemical re-treating the functions of cellulose fibers are changed. We characterized these changes by the characters of capacity mass and water soak degree. In the 3.7 schedule there are given following physical-chemical functions: water soak degree ash quantity, optical nominations and polymer degree. If the soak degree of hemicelluloses which are taken from tomato stem, brunch, and leaf are from 14 about 30%, pure cellulose's water soak degree is higher: from 66 75%. Dimension of fibers- pure cellulose smaller: from 0, 57 0,92mm. Capacity mass of pure cellulose is heavier than hemicelluloses: about 10–15% heavier. The reason is that during the procedure of reproducing hemicelluloses the fiber's dimension is shortened, and condense becomes higher.

General appearance of cellulose fibers which are obtained from tomato stem is given in the 1st pictures: Cellulose fibers of tomato stem differs from the external appearance of the cellulose fibers of cotton wool (Figure 1).

3. Results and discussion

The fibers from the tomato stem are sticky, inaccessible. The reason of that is considered as the fibers were made smaller in the laboratory. The device has an opportunity to access the cellulose fibers. However, in the laboratory we do not have this kind of chance. Though, the difference between the structures of pure cellulose and hemicelluloses can be seen in the pictures. The length and width are close to each other. This is because of the hydrogen's power, namely, the fibers are not separated well from each other.

We have learnt some physical-chemical functions of pure cellulose and the quantity of hemicelluloses which are obtained from tomato leaf, brunch and body. The degree of polymerizing, the quantity of ash and capability for soaking water are also learned. 60% pure cellulose is taken from the hemicelluloses of tomato leaf. More than 10%pure cellulose is obtained from the brunch and body of tomato. The reason of that is considered as the quantity of cellulose of tomato brunch and body is rough. There is a difference in the quantity of ash too. Ash of tomato leaf is more than another part with 1.0–1.5%. Soaking degree of cellulose obtained from all part of tomato is about 13–15%, degree of polymerizing 310–320 too. Tomato stem's cellulose is compared with another products' cellulose in water soaking. The result is in the (Table 2).

Table 2.– Comparison of soaking water of tomato body's cellulose and whitened cotton, Samarakand paper, wheat satalk, cotton (taken from the factory in Yangiyul) cellulose

№	The name of cellulose and paper	Quantity of water soaking,%
1.	Cellulose of tomato stem's body	13,0
2.	Whitened cotton wool	3,1
3.	Samarkand (from the mulberry bark) paper	7,0
4.	Wheat stalk paper	14,2
5.	Cotton cellulose (Yangiyul factory)	19,0

4. Conclusion

Whitened cotton wool, Samarkand paper, wheat stalk and Yangiyul cotton cellulose are compared. The result characterized well the structure of the models. The reason is technology. Yangiyul cotton's cellulose soaked more water with 19%. Capability of soaking water of whitened cotton cellulose is almost the same,13–14%. The reason is that the structure of cellulose fibers are nearly the same.

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Section 15. Economics

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SOLUTION TO DEVELOP INNOVATIVE START-UP ENTERPRISE IN VIETNAM

Abstract. Innovative start-up plays an important role for the nation economy, especially for the developing countries. In Vietnam, the start-up of innovation has become an important content in the nation economic development strategy, is concerned and developed by the govement, with the aim of creating a favorable environment for promoting and supporting the process of formation and development of the startup type. These are enterprises that can be able to apply new technologies, ideas, have innovative business models, take risks to bring new products and services to the market, accepted by the market. This paper focuses on clarifying the activity and policy Vietnam's innovation. Thereby to propose the solution for supporting and promoting to develope of innovative start-up enterprise in accordance with the conditions and circumstances of Vietnam.

Keywords: innovation, innovative startup.

1. Research overview

Until now, innovative start-up has attracted the attention of many researchers in the world. A number of studies have focused on the success of innovative start-up at the countries, such as Dan Senor and Saul Singer (2011), that have studied innovative start-up at Israel, a small country in the Middle East, has established for nearly 70 years in difficult geographical and political conditions, no natural resources and the population of only 8 million, but has achieved more than 50 times growth in 60 years; There are a number of researches from the organizations, individuals mentioned the factors affecting innovation, innovative start-up in Vietnam, such as Tech in Asia, IDG Ventures, CBInsights, The Global Entrepreneurship Network (GEN), etc.

In Vietnam, there have been a number of research organizations related to innovative start-up, such as National Agency for Technology Entrepreneurship and Commercialization Development (NATEC, 2017), National Agency for Science and Technology Information (2018), National Economics University (2016), … and typical individuals that researched and operated in the start-up and have been published annually by Forbes Magazine (https://forbesvietnam.com.vn).

Thus, the above studies have contributed positively to the start-up activities in Vietnam, given the concept of entrepreneurship innovation, innovative start-up, the factors affecting innovative start-up and given reasoning to success of nations based on innovation. However, the above studies have not really clarified the real situation of innovative start-up enterprise, as well as the lack of synchronous support and promotion solutions for development of innovative start-up enterprise in the conditions of Vietnam.

2. Research method

In order to information for research purpose, the authors have collected secondary data through researchs published about innovation, innovative start-up enterprises. In particular, the authors have inherited the results of the enterprise innovation survey, including 7.641 enterprises belonging to 44 provinces/cities of Vietnam that published 2018 by the National Agency for Science and Technology Information.

To clarify secondary data, the authors conducted in-depth interviews with a number of experts, entrepreneurs, managers's Viettnam in the field of science and technology, start-up, innovative start-up. The information obtained is one of the important bases to offer solutions to promote for the development of Vietnam's innovative start-up activities in the context of the fourth industrial revolution.

3. Research results

Firstly, about innovation in enterprises

The survey results of 7,641 enterprises of the National Agency for Science and Technology Information (2018) show that, the higher the rate of innovation enterprises, the lower the ratio of using state capital. On average, in the group of enterprises with the ratio of state capital below 10%, the rate of innovation enterprises is about 84.6%; in the group of enterprises with capital ratio of 20% – 50%, the rate of innovation enterprises is about 76.3%; in the group of enterprises with a ratio of 75% or more of state capital, the rate of innovation enterprises is about 73.1%.

In terms of enterprise size. In Vietnam, small and medium enterprises are divided based on the Decree No. 39/2018 / ND-CP dated March 11, 2018 of the Government. Accordingly, small enterprises in the fields of agriculture, forestry, fisheries and industry and construction sectors have the average number of employees participating in social insurance in ≤ 100 people and the total revenue of the year is năm 50 billion VND or total capital of ≤ 20 billion; small businesses in the field of trade and services have the average number of employees participating in social insurance ≤ 50 people and the total revenue of ≤ 100 billion VND in the year or total capital of ≤ 50 billion VND. Medium enterprises in the fields of agriculture, forestry, fisheries and industry and construction sectors have the average number of employees participating in social insurance in the year ≤200 and the total revenue of the year is VND200 billion or total capital of tỷ 100 billion. And medium enterprises in the field of trade and services have the average number of employees participating in social insurance in ≤ 100 people and total revenue of ≤ 300 billion VND or total capital of vốn 100 billion VND. According to the survey results, 7,641 enterprises, including 4,929 small enterprises, 820 medium enterprises and 1,892 large enterprises of the National Agency for Science and Technology Information(2018) show that:

– Percentage of small enterprises with net revenue of VND20 billion or more, up to 60.8% is an innovative start-up enterprise, this rate in enterprises with revenue of VND10 to 20 billion is 58.3%, and among enterprises with revenue below 10 billion VND is 53.6%. It can be seen that, in small enterprises, the higher the group of enterprise with net revenue, the more innovation enterprises are. Of the 2882 small enterprises that

having innovativion, the number of enterprises with turnover of VND20 billion or more accounted for the majority (60.6%); enterprises with turnover of 10 to 20 billion VND accounted for 19.3%; The remaining businesses have revenue of less than 10 billion VND, accounting for 20.1%.

– Percentage of enterprises having net revenue of less than VND200 billion has 62.4% of innovation enterprises, this rate in enterprises with turnover of VND200 to 300 billion is 67.5% (the highest rate) and in businesses with revenue of VND300 billion or more is 66.7%. Thus, in medium enterprises, the higher the group of enterprises with net revenue, the higher the rate of innovation enterprises. Among 525 enterprises that have innovated, the number of enterprises with revenue below 200 billion VND accounted for the majority (61.0%); enterprises with revenue of VND200–300 billion, accounting for 15.4%; The remaining businesses have revenue of 300 billion or more accounted for 23.6%.

– Percentage of large enterprises with net revenue of less than VND300 billion has 64.4% of innovation enterprises, this rate in enterprises with revenue from VND300 to 400 billion is 71.1% and in businesses with revenue of VND400 billion or more is 71.7%. In large enterprises, thus, the higher the group of businesses with net revenue, the higher the rate of innovation enterprises. Among large enterprises having innovation, the number of enterprises with turnover less than 300 billion VND accounts for more than 1/3 (36.4%); enterprises with revenue of VND300–400 billion, accounting for 10.2%; the remaining businesses with revenues of 400 billion or more accounted for more than half (53.4%).

Thus, the research results show that, the higher the group of enterprises with net revenue, the higher the rate of innovation enterprises; At the same time, the percentage of enterprises having innovation is inversely proportional to the percentage innovatvion enterprises that using state capital.

Secondly, about Vietnam's innovative star-up activities.

The creative entrepreneurship has been development in recent years, these activities cannot be without the initiatives and active support of the Government. In the United States, with seven startup ecosystems among the world's top 20 ecosystems, the US Government is not only important in establishing Silicon Valley but also continues to fund many of the basic research in the region. In the UK, several positive steps have been taken to establish and nurture an entrepreneurial ecosystem. Since 2010, it began with the establishment of Tech City in London to offer tax incentives for both businessmen and investors, by 2015, the number of creative startups in London amounted to 608.110. In France, there are currently about 9.400 startups while venture capital investments increase to more than 2.2 billion euros in 2016, second only to UK in startups in Europe. The French government is investing

to attract young businesses to France and encourage investment in the necessary places. One of the goals of this direction is to create an environment that attracts startup founders, encouraging the establishment of technology incubation. In China, nearly $320 billion has been spent to provide venture capital for start-up businesses. In 2015, the Government announced the launch of a $6.5 billion investment fund to directly support the start-up ecosystem.

So far, Vietnam has about 3,000 startups. According to the statistics of Topica Founder Institute (TFI, 2017), Vietnam has received 92 investment deals with the total capital of 291 million USD, nearly doubling the number of deals and nearly 50% of the total investment capital compared to 2016 (50 deals with 205 million USD). Despite the relatively strong growth, the investment capital for innovative star-up in Vietnam being very modest compared to the region and the world, accounting for a small percentage, less than 5% compared to the region Southeast Asia (Tech in Asia, 2017). Currently, Vietnam has 40 investment funds for start-up innovation (by the end of 2017) with the participation of large corporations, organizations promoting business and individual investors, there have been nearly 50 common work area for the innovation, focusing mainly in 3 big cities, as Hanoi, Ho Chi Minh, Da Nang. Currently, there are about 30 business incubators and 10 organizations promoting business, increasing 10 technology incubations and 3 organizations promoting business (compared to 2016). Typical as: Business Incubators at Hoa Lac high technology; Ho Chi Minh City Hitech Business Incubator; Da Nang incubation; Youth Support Center; Hanoi Business Information technology Innovation Incubator, etc.

In order to develop the system of innovative start-up, the Vietnam's Government from central to local level have issued many policies to support and promote start-up innovation activities. Some typical policies such as:

– Decision No. 844/2016 / QD-TTg on supporting the development of innovativation ecosystems to 2025. Accordingly to 2025, Vietnam will support the development of 2,000 innovative start-up projects; supporting the development of 600 innovative start-up enterprises; 100 enterprises participated in the project called for investment capital from venture capitalists, mergers and acquisitions, with an estimated total value of VND2,000 billion.

– Decision No. 1667 / QD-TTg dated 30/10/2017 on approving the project "Supporting students to start-up until 2025". Accordingly to 2025: continue to promote propaganda and education to raise awareness students with knowledge and skills about innovative start-up; strengthening facilities for centers to support start-up students in universities, institutes, colleges and intermediate schools; 100% of universities, institutes, universities, 70% of colleges and intermediate

schools have at least 05 ideas and start-up projects of students who are supported with investment from the source fit or connect with businesses, venture capital funds.

– Decision No. 939 / QD-TTg dated June 30, 2017 on approving the project "Supporting women to innovative start-up in the period of 2017–2025". The objective of the project is to raise the awareness of women on the policies of the Party and the State on innovative start-up, promoting the realization of business ideas, contributing to the implementation of national goals on enterprise development and the National Strategy on gender equality. To 2025, 90% of the association's specialized officials at all levels will participate in implementing the project on raising awareness, methods to support women in starting a business and developing their business; 70% of women members are disseminated and raise awareness about jobs and start-ups; support 20,000 women to start businesses and start a business; coordinating and supporting the establishment of 1,200 cooperatives / cooperatives managed by women; 100,000 enterprises of newly established women are consulted and supported to develop businesses.

– Foreign technology search and transfer program to 2020 issued under Decision No. 1069 / QD-TTg dated July 4, 2014 of the Prime Minister, establishing the network of global experts to search advanced technologies, transfer and application in Vietnam. The focus of the program is to find source technologies, advanced technologies for creating new technology products and services that contribute to improving productivity, quality, value-added products and goods of the business Vietnam. The National Technology Innovation Fund was established under the Prime Minister's Decision No. 1342/QD-TTg of August 5, 2011, the fund has a chartered capital of VND1,000 billion from the state budget, focusing on preferential loans, loan interest support, guarantee for loans, capital support for organizations, individuals and enterprises to innovate start-up, research, transfer and perfect technology.

– Some Vietnam's provinces and cities have also issued policies suitable to their local practices, such as: Decision No. 4665 / QD-UBND dated September 5, 2018 on support projects start a business in Hanoi city until 2020; Decision No. 4181 / QD-UBND promulgated the program to support small and medium enterprises to innovate, improve competitiveness and international integration in the period of 2016–2020 in Ho Chi Minh City; Decision No. 3380 / QD-UBND promulgating the plan to support innovation innovation of Ba Ria-Vung Tau province in the period of 2016–2020; Decision No. 9098 / QD-UBND promulgating the Da Nang start-up development program; Plan No. 147/ KH-UBND on supporting the ecosystem of creative start-up in Thua Thien Hue in the period of 2016–2018; Plan No. 9239/KH-UBND on supporting start-up innovation in Dak Lak province until 2025, etc.

Moreover, based on the status of the innovation and innovative start-up activities at the sectors and localities, the Ministry of Science and Technology (2017) has made guiding, suggestions plans to implement support projects ecosystem of national innovation. For example, it is necessary for industries and localities to have a level of ecosystem at level 1: focus on promoting basic training on entrepreneurship innovation, towards students at universities and colleges; alumni have gone to school and staff at research institutes; There should be a mechanism and arrangement of human resources to advise and support legal and administrative procedures for innovative start-up enterprises, especially in matters of business registration and dissolution procedures enterprise; Investment in facilities is a place where components of innovative innovation startups meet, connect, and organize events. If possible, can be build a co-working space, or a focus area for start-up support services.

Thirdly, evaluate Vietnam's innovative start-up activities

Vietnam's innovative start-up activities have initially brought positive impacts on economic and social development through creating favorable legal corridors. Policies and measures to support innovative start-up are all derived from the needs of businesses and society. On that basis, the Vietnam's Government planned programs, projects and projects to promote appropriate creative start-up activities based on the approach of national innovation system. Therefore, the policies that have been formed not only help businesses see the factors that are related and interact with each other in the system but also see the relationship between enterprises, the relationship between producers. export, users, education and training systems, government, research organizations deploy in forming new ideas, conducting research and development activities and launching products to market, accepted by the market.

According to the 2018 Global Entrepreneurship Report by Amway Group in collaboration with Munchen University, Germany's Gesellschaft fuer Konsumfors company made in March 2018, showing that Vietnam is leading the way In the world for entrepreneurship morale, 99% of Vietnamese people are willing to sacrifice their free time to implement their own business ideas.This is a big number compared to the world. However, in recent years, the innovation activities in Vietnam have been movement, especially the creation of innovative ideas in the community is not high, the quality of human resources is still limited. Along with that, it has not promoted the best scientific and technological capacity for creative start-up activities; Inadequacies in funding, attracting investment capital for creative startups have not really been improve.

Box 1: Restrictions in Vietnam's innovative start-up activities

Vietnam's entrepreneurial ecosystem has not really developed its potential and has not achieved as the expectations. The reasons for this situation because of the low quality of human resources for creative start-up, there is no adequate statistics on the subjects of the national creative startup ecosystem; Financial policies, investment policies to support start-up businesses have not promoted many effects, especially policies to support creative startups having not motivation the attraction involved by investors, scientists, businesses. Activities of commercializing research results to form innovative start-up businesses, especially in universities are limited.

Source: Synthesis from the National Scientific Conference on Innovative start-up Ecosystems, Hanoi, 2018

4. Conclusions and recommendations

To develop the innovative start-up enterprise adaping with the objectives of the Vietnam's Economic and Social Development Strategy, Vietnam's Science and Technology Development Strategy; at the same time, on the basis of flexibly applying the experiences of the number of countries around the world about start-up businesses, combined with the trend of international cooperation in science and technology in the context of the forth industrial revolution, in the future, Vietnam needs:

Firstly, supporting innovative start-up enterprises must ensure fairness and objectivity, consistent with market rules and not create unequal competition. In order to achieve this, there must be full awareness and appreciation of the role of small and medium-sized enterprises, especially small and medium-sized enterprises, which innovative start-up for the development of the economy. Gradually improve the institutional environment, create favorable conditions for businesses to access and use preferential policies of the state in production and business activities. Moreover, the support for innovative start-up businesses must ensure the role of small and medium enterprises, ensure business freedom, property ownership, and enhance commune responsibility association of business. Therefore, the Government needs to ensure the stability of policies, improve the business environment in the direction of convenience, safety, ensuring equal rights for businesses, regardless of type and economic sectors in access to resources and support policies towards simplifying administrative procedures, especially administrative procedures to enjoy incentives.

Secondly, identify feasible resources to improve the process of implementing policies to support innovative start-up enterprises. Policy making to support start-up businesses, guiding to enterprises is important but not enough if in the process of implementing policies not possible to identify appropriate resources. Therefore, in the coming time, it is necessary to review these resources, especially finance, capital structure for innovation from th government support, capital from start-up, from venture capital funds, credit in-

stitutions and other capital sources. Moreover, in order to effectively implement policies to support innovative start-up businesses, it is necessary to review the sources of support for start-up businesses, helping start-up businesses remove difficulties towels, stimulating the creation of creative ideas, supporting the process of conducting research and technology development with fiting market demand. In addition, it is necessary to strengthen inspection of programs, projects to support enterprises, including start-up innovation enterprises to have timely assessments and adjusttments to the situation of implementation and efficiency of policies to help innovative start-up businesses.

Thirdly, stimulating, motivating the formation of ideas through entrepreneurship and innovation competitions in universities. The idea of starting a business can be formed through training programs, through entrepreneurship competitions, through the passion of students, faculty, scientists in the school. This activity has had a strong and widespread development in recent years. Therefore, the promotion and promotion of annual start-up competitions in universities/colleges towards improving quality, efficiency and high cohesion to the market, attracting investors is necessary to create many creative ideas, potentially commercialized. Innovative start-up competitions should be organized according to appropriate interactions, associated with the process of innovative start-up. The objective of organizing innovative start-up competitions is not only to exploit the results of scientific research and intellectual property of students, lecturers and scientists in universities/colleges but also promotes the process of connecting startup teams across the country to call for attract investment. Moreover, it is necessary to pilot the implementation of a human resource search program for innovative start-up businesses such as the program connecting students to internships at start-up businesses; connect, support funds and transfer from research institutes and universities to work at start-up businesses. At the same time, attracting good students and scientists from overseas Vietnam to participate in activities to support innovative start-up.

Fourthly, promote the connection of Vietnam's start-up networks with the venture capital funds the region and the world, need partly support funding for innovative start-up enterprises to take part in attend training courses at the organization that promotes reputable business abroad (Singapore, USA, Finland, UK and other countries). Continue to promote the cooperation and link between the Ministry of Science and Technology with international organizations (Uber Exchange, USA; N15, Korea; venture capital funds and other partners) to strengthen Introducing Vietnam's entrepreneurial ecosystem with international partners to attract resources, especially capital to support for innovative start-up. Moreover, the Min-

istry of Science and Technology should continue to improve the quality of annual organized activities regional links to develop innovative entrepreneurial ecosystems in Vietnam's four economic regions and joint conferences on building innovative entrepreneurial ecosystems. These activities contribute to creating opportunities for localities to link and exchange experiences about creative entrepreneurship. At the same time, promoting comparative advantages, entrepreneurial potentials, local strengths to partners, domestic and foreign investors. Actively connecting between Vietnam's networks of start-up, investment with start-up networks in the world. Along with that is to build training programs, organize start-up business exchange programs for Vietnamese enterprises to have opportunities to exchange, learn, attract investment and access international markets; At the same time, support businesses and international investors to learn about Vietnam market, support them to set up businesses, develop products. In addition, the state should support establishment of a focal point to represent Vietnam's innovation in entrepreneurial ecosystems in the world.

Fifthly, promote the commercialization of research results to form innovative start-up enterprises, especially in universities and research institutes. In order to do this well, it is necessary to first review and evaluate research results that have the potential to commercialize. In order to form start-up innovation enterprises based on the results of scientific research and technological development, inventions and utility solutions, the Government/State needs to evaluate and then build build databases, or banks of research results from organizations, universities/research institutes. This is a difficult and requires a large budget, if not well done, the research results can be distorted, even faked. Therefore, it is necessary to develop criteria for evaluating and selecting research results with potential for commercialization as a basis for forming innovative start-up enterprises. This is a force capable of rapid development of economic and social values. In order for this activity to be effective, it is necessary to link innovation activities with scientific studies of research institutes, universities, inventions, creative ideas of students, citizen. At the same time, it is necessary to build centers / organizations to support startups for students in regions/ universities and training institutions, to form start-up support funds for students from socialization funding.

In addition, it is necessary to support start-up businesses to access, find information, investigate and survey the market of output products; Supporting the reception of incentives from the state in the early stages of innovative entrepreneurship, especially financial support has important implications for the success of startups. In start-ups, the state often participates in the initial stage to provide financial support through non-refundable grants for research, technology completion

and hiring experts. Therefore, it is necessary to create favorable conditions for innovative start-up businesses to access and enjoy incentives not only at the initial stage but at all stages of the startup process.

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THE BUSINESS SYSTEM OF MANAGEMENT OF INNOVATION RESOURCES AS AN ECONOMIC CATEGORY OF THE INSTITUTIONAL COMPONENT OF THE AGRARIAN SECTOR

Abstract. The necessity in the transition of agrarian sector of economy on innovative model of development of the application of the theoretical foundations of institutionalism in the institutional system of innovation, formulated the inseparable connection of institutional support "of the Business system of management of innovation resources" General technological process of production of high-tech products in accordance with the law of interaction.

Keywords: business system, innovation, institution innovation resources, intellectual product, competition, conceptual category

Business management system of innovation resources as an economic category of institutional system includes a significant list of current strategic and creative tasks that need to be addressed in the creation of technology demanding products and business. In particular, that is development of business ideas, market research, information collection and processing, promotion and advertising technology demanding products and services. And then a whole range of issues – like steps to success: business management and staff, overcoming competition, working with partners, negotiation, pricing, financial activity, business planning, legal and regulatory foundations of business monitoring and so on [1, 95]. It should be noted that activization of businesses in the production development on the basis of innovation requires, first of all, creation of competitive market environment. Competition as market institute, on the one hand, determines efficient functioning of other institutes, on the other hand, helps economic agents to react correctly to market signals when choosing innovative development strategy. Growing competition in conditions of innovative economy stimulates investments in scientific, re-search and scientific-engineering studies, innovations use, improves intellectual products quality and leads to lower costs.

Competition development of is the most important factor in shaping the innovation behavior of innovation generators and agricultural businesses on the market: changing competitive relations necessitates the development and implementation of innovative products by innovation process' subjects: finding new research methods, new ways of implementing innovative ideas, new incentive mechanisms for transition to innovative changes.

Scientific institutions of NAAS, universities and research institutions of the Ministry of Agrarian Policy and Food of Ukraine from year to year receive around 700–900 protection documents for creation of new products, technologies, plant and animal breeds, which usage in agricultural production allow production of 50 million tonnes and eventually 70–80 million tonnes of grain, 10–15 million tonnes of oil-seeds, almost double production of livestock industry, to ensure the image of Ukraine as the breadbasket not only in Europe but in the world, the leader of oil exports, barley and corn [6, 321].

When using in production objects of intellectual property, the latter have a unique feature: if they are used more intensively, they not just reproduce, but can accumulate material resources, increase efficiency of natural resources use. In fact, the transformation of scientific knowledge into innovation and the latest into high-tech products occurs in conditions of effective functioning of business-management system for innovation resources, cooperation of all innovation process institutes. It follows the belief that reserves lie in all phases of the innovation cycle, from generating knowledge – creating innovation – forming the basis for an innovative resource to be included in the manufacturing of technology demanding products.

However, until now innovative resources are not widely applied in the agricultural production of Ukraine. In 2013, with 57 thousand units of existing agricultural organizations NAAS signed contracts for innovations implementation in production with 1420 agricultural organization. If in future the boosting of the creation and application of competitive innovation will not be activized, economic growth and agro-industrial production remain uncertain [10, c. 15].

One way of solving this problem is to create a viable institutional configuration of business systems development of innovative resources that combines different types of institutions (subsystems), developing effective relations between institutes (subsystems) with different functional properties, which has each one of the institutions (subsystems). The experience of highly efficient foreign and domestic business groups, operating on the market of technology demanding products, shows that profit and results in significant new business development is mainly achieved by the additional use of more efficient or additional innovative resources, and for that business management innovation resources should include number of these institutional structures (subsystems): "Marketing innovation"; "Research and development"; "Maintenance and transformation of resources"; "Production"; "Management" with methodological tools development (large set of consulting and training services).

Institute (subsystem) "Marketing innovation" directs its activity to:

– study the requests and needs of consumers in innovation, paying market segments of scientific production, the formation of inter-connected internal and external flows;

– testing methods of innovative resources transfer of research groups on the basis of market mechanisms to create scientifically demanding production;

– institutions' capability estimation (franchising, engineering structures for the production of high-tech goods and services on contractual basis, the intellectual property rights transfer for usage in science-demanding sphere);

– assistance to organizing scientific and production corporative formations on a contractual or proprietary basis for manufacturing of high-tech products.

Institute (subsystem) "Marketing of innovations" summarizes and monitors:

– state of filling science demanding market with innovations, its solvency innovative segments of the market orientation of resources and their structure;

– information flow, direction of innovation strategy [2];

– subjects that form and implement technological resources, facilities and technical consulting services;

– sales shaping by agents of high-tech products, volumes and pricing palette.

Institute (subsystem "Research and development") is aimed at creating competitive innovation, obtaining added value from their development.

Institute (subsystem "Maintenance and transformation of resources") includes institutions that provide resources for production. It defines the resources, revenues from outside, suppliers organizational structure and the amount of involvement of its own resources.

Institute (subsystem "Production") directs organizational units, operating in production field, to involvement of optimal process parameters to convert resources involved in high-tech products, programmable quality of high-tech product and maximum efficiency at minimum cost.

Institute (subsystem "Management") – provides optimal functioning of business system based on:

– definition of the sales market;

– clarification of conditions of different investing methods and optimal decision making;

– study of conditions and possibilities of attracting foreign investments;

– creation of optimal conditions for innovations management brought about by the formation of innovative business projects with defined parameters and business results, cash flows (revenues and expenses) [5];

– reliability justification of technological level of production base;

– avoiding technological dependence.

These unbreakable connections of institutional provision "Business-systems management of innovation resources" define constant movement and elements' change of the overall production process of science-demanding production in accordance with the law of interaction.

And in these precise relations one element of the process stimulates the growth of another. The functioning of such connection creates conditions, when institute "Marketing", having information about the market's state, development trends, knowing about ideas of institute "Research

and development", enables the company to design science-demanding products and services that will be accepted by consumers [4, p. 24].

Meanwhile, institute "Marketing" predicts profitable market segments. Such information – big find for "Maintenance and transformation of resources" institute. In order to become even more effective, institute "Marketing" urges institute "Management" to address issues of optimal production organization in terms of its sustainable operation under conditions of limited resources, causes institute "Research and development" to search for creative innovative solutions for the production of science-demanding products.

Usage of business-management innovation resources when a competent institution provides innovation support, tends to achieve multiplier effect of added value, linked to so-called mutual reinforcement loop of production processes.

Precisely increasing added value with simultaneously increasing investments in scientifically demanding production is stimulated by effective management of innovative, investment and material flows of innovation process in scientifically demanding production and development of financially healthy market segments.

To ensure successful operation of innovation resources' management business-system in agricultural production, formal and informal institutions are shaped with transferring to them wide range of functions, in particular: designing, testing and distribution of knowledge and skills; intellectual property protection, patent law; innovation process organization; providing certain level of production stability; risk management; conflicts resolving and cooperation strengthening, etc.

Conceptual categories of institutional theory in economics, institutional structure (a set of formal and informal institutions) of innovation activity in agricultural production, the current state of institutional support for innovation in agricultural production of Ukraine were reviewed. The reasons that influenced preserving of inefficient institutions' structure of science and innovative branch activity were revealed. The necessity to make agricultural sector function on the basis of innovative model of institutionalism's theoretical achievements application in shaping the institutional system of innovation activity, unbreakable links of institutional support for "innovation resources' management business-system" of general technological process of scientifically demanding products according to interaction law.

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FEATURES OF PUBLIC-PRIVATE PARTNERSHIP PROJECTS FINANCING

Abstract. The article deals with the features of public-private partnership projects financing based on innovative tools, which include infrastructure bonds and mezzanine loan. The article provides the characteristic of each type of innovative tools.

Keywords: public-private partnership, financing, infrastructure bonds, mezzanine loan.

Introduction

2017–2021 Action Strategy on five priority areas of Republic of Uzbekistan development is aimed at continuing institutional and structural reforms in order to reduce the state's presence in the economy, further strengthen the protection of rights and the priority role of private property, and stimulate the development of small business and private entrepreneurship.

Nowadays, the participation of the private sector in projects based on public-private partnership (PPP) is the priority direction of the development of the private sector. PPP may be defined as a type of joint activity of government agencies and business organizations in the form of integration of public and private interests and competencies. On the one hand, such integration allows for more effective realization of entrepreneurial potential, considering expansion of the investment process and profit increase. On the other hand, by means of the above integration, the government may solve general economic and social problems, considering the successful development and operation of production facilities and social infrastructure.

Global experience shows that PPP is the most effective form of realization of investment projects related to infrastructure development, design, reconstruction, construction of highways or operation of capital construction facilities, as well as the construction of socially significant facilities [2]. However, the formation and development of a public-private partnership require the adoption of PPT Law Republic of Uzbekistan, which will allow the development of the regulatory framework for the implementation of PPP projects.

Currently, there is no methodology for PPP projects implementation in Uzbekistan. In addition, mechanisms of financial planning and structuring of PPP projects are underdeveloped. These factors, in addition to the absence of a special regulatory framework, hinder the development of PPP in Uzbekistan. Due to insufficient project quality analysis, a large number of projects may result in situations involving high financial risk and the ineffective commercial value of investments, as well as complicated legal consequences. In this regard, the main purpose of this article is to develop new innovative instruments for financing PPP partnership projects, taking into account the peculiarities of their implementation in the Republic of Uzbekistan.

Literature review

Some basics of the PPP concept were laid in "the General Theory of Employment, Interest and Money" by J. M. Keynes, where the focus is on the problems of the state's economic policy, which should contribute to the fastest growth of national income through monetary policy and budget policy, the promotion of private investment and consumer expenses [6].

The government in the framework of PPP not only invests considerable sums in new projects, but also accepts part of the risk. The main purpose of the government is to create general economic conditions that determine the development of innovative activity. The government should eliminate systemic deficiencies that hinder the development of innovations, as well as develop various type of incentives for the development of the activities of economic entities in innovative areas [7].

The analysis of literary sources also shows that the term "public-private partnership" is applied based on a clear definition of the leading role of the government, taking into account the mentality and the leading role of governmental agencies. In addition, it is emphasized that it is the government that is the initiator of many PPP projects. The subject of a public-private partnership is always state property or a service provided by the authorities to economic entities [2].

Despite the undoubted advantages of PPP, certain factors, such as financing, constrain the successful implementation of PPP. There are various sources of funding for PPP projects. However, some of them can be used only at a certain stage of the project, while others are the basis for starting of work. Russian researcher N. E. Gerasimova proposes to use life cycle contracts (the term "Design–Build–Finance–Maintain" is used in some European countries) for PPP projects financing [3].

Russian scientists I.V Moiseeva and S.A. Kochetkova analyze the mechanisms of financing of PPP projects in their research [8]. They note that in practice there are a sufficient number of financial mechanisms, through which PPP is carried out. Financial mechanisms differ depending on funding sources. The main sources are funds from budgets of different

levels, funds from state enterprises and institutions, funds from the private sector and etc.

In foreign practice, there are the following sources of funding for the purposes of PPP projects implementation [10]:

- Private equity;
- Public contracts;
- Co-financing;
- Government debt obligations and provision of various benefits by the government.

We agree with position of Russian researcher M. A. Shulgina, who notes that for successful implementation of PPP projects, it is necessary to carefully select sources of financing, to conduct a detailed financial analysis of both the company providing the funds and their own ability to meet their obligations, as well as effectively combine various types and directions of financing at each stage of implementation [11].

It is worth noting the publications of Uzbek researcher U. I. Jumaniyozov, who investigated the features of corporate governance in the implementation of PPP projects in construction [12].

It is important to note that currently in Uzbekistan there are only separate attempts to implement PPP projects, therefore questions on PPP financing have not been raised yet. In the light of the above, we attempted to equip future researchers and practitioners with modern tools for financing such projects. At the same time, it should be noted that PPP is not developed in Uzbekistan and there is not enough experience in PPP. Consequently, there are only a few separate publications on PPP. To some extent, this research intends to fill the existing gap.

Research Methodology

Currently, large-scale reforms are implemented in Uzbekistan. These reforms require the mobilization of significant financial resources, including funds of the state budget. At the same time, as global experience shows, by means of PPP it is possible to attract private sector funds to finance infrastructure projects.

However, Uzbekistan does not have sufficient experience in implementing PPP projects, although private healthcare is widely developed, in addition, there are private construction, private schools, kindergartens etc. Recently, the President of the Republic of Uzbekistan signed the resolution of "On priority measures to create the legal and institutional basis for the development of Public-Private Partnership" [1], which is the foundation for the development of the legislative-regulatory framework of public-private partnership in Uzbekistan.

Another important problem is the absence of a formed PPP market in Uzbekistan. In various industries, the supply of projects is quantitatively and qualitatively quite limited. This is because in the absence of current legislation, government authorities are responsible for organizing a tender. Thus, there is a problem of financial support for the activities of ministries and departments, as well as local authorities for the preparation of PPP projects.

In our opinion, another constraint to the development of public-private partnerships is the lack of financial resources. Despite the fact that there is a practice of supporting PPP projects by a number of commercial banks, nevertheless, this problem in Uzbekistan has not yet been resolved.

In modern conditions, long-term financing of PPP projects by commercial banks is not so widely supported due to their insufficient liquidity. At the same time, the number of investors, who looks for alternative investment opportunities increases. This is due to macroeconomic uncertainty, the instability of stock market indices and the declining creditworthiness of financial institutions. The confidence of foreign investors in Uzbekistan cannot be called positive for a number of reasons that go beyond the scope of the problem we are considering within this research.

Today, one of the additional sources of financing public-private partnership projects could be the funds of individuals. This requires an increase in income of the population.

PPP tools from extrabudgetary sources can attract funding in capital-intensive long-term projects. In such a situation, it becomes necessary to develop mechanisms for guaranteeing and ensuring public-private partnership projects against the risks associated with the state's fulfillment of its obligations. After creating such tools, it will be possible to attract funds from international financial institutions, as well as funds from private investors from Uzbekistan.

Financing of PPP projects has its own mechanisms and tools, which determine the specifics of this area. PPP provides an opportunity to finance projects from different sources and to combine own and borrowed funds.

The main risk lies in the possibility of the government or local authorities failing to fulfill their obligations in the long term. After all, a public-private partnership is, above all, a long-term relationship, respectively, in order to dispel all possible investor concerns, the state must create favorable conditions and provide reliable guarantees.

In addition, currently, the constraining factor for the development of public-private partnership at the level of regions, cities, and districts is the lack of financial resources. It is important to note that most of the regions and districts of Uzbekistan are subsidized.

Under these conditions, public-private partnership projects can be viewed as one of the important areas that can support the implementation of the goals defined in the Action Strategy initiated by President of the Republic of Uzbekistan

Sh. M. Mirziyoev. The search for new sources of financing for PPP projects, including funds from private investors, becomes relevant when solving a number of issues, in particular, social ones, will be carried out not at the expense of budget funds, but by attracting private business resources based on PPP projects.

For successful implementation of PPP projects, it is necessary to carefully select the sources of financing, conducting a detailed financial analysis of both the company providing the funds and their own ability to meet their obligations, as well as effectively combining different types and directions of funding at each stage of implementation.

Depending on the specified sources in PPP-projects, financing schemes are determined, the most prevalent of which are government funds and loan [8].

As a result, the following financing mechanisms are formed:

- Loan (borrowing);
- Mixed (attraction of own funds of two or more partners);
- Hybrid (combination of own and borrowed funds).

The implementation of projects in the framework of PPP requires appropriate financial support and compliance with the basic principles of its financial mechanism. Important principles for financing PPP projects include redistribution of financing risks between government and commercial structures; additional involvement of economic resources in the country's economy; use of financial resources of the non-state sector of the economy while maintaining by governmental authorities their functions and powers.

The sources of financing for the implementation of projects in the framework of PPP currently include the following:

- Government subsidies. This type of financing is used when the government needs to demonstrate real support, as well as attract the attention of the investment community. This form of financing is used with a high level of general expenses and the expected profitability is not sufficient to adequately maintain loan and equity capital;
- Commercial Lending. Commercial loans are provided by commercial banks. When granting a loan, the ability of the PPP project to produce the necessary positive cash flow for timely servicing of debt obligations is taken into account;
- Project bonds. This type of financing of PPP projects is of limited use, as currently the securities market is not sufficiently developed in Uzbekistan. At the same time, one should recognize the merit of this method. The positive side of this tool is that the cost of issuing bonds may be lower than a bank loan. On the other hand, the capital market for such bonds may be very limited, which in turn will create difficulties for large projects in mobilizing the necessary capital.
- Share capital. This type is considered one of the promising sources of financing of the PPP project and is provided by investors from their own funds as a combination of issuing shares and subordinated debt.

It should be noted that a public-private partnership implies participation in financing and sharing the risks of both parties to the contract. To date, the range of instruments for financing projects of public-private partnerships is quite wide. The main place among all other instruments is project financing.

Project financing is executed in the form of "limited recourse" loans, which are issued by a specially created target project company. This company has the right to carry out construction and operation of the facility within the project. One of the main positive aspects of project financing is that the obligations of the project company are not reflected in the balance of the grantor or shareholders and, therefore, do not affect their investment attractiveness [2].

The effectiveness of project financing is as follows:

- Provision of the favorable weighted average cost of capital compared to net financing from own funds;
- A possibility of using a more transparent risk sharing mechanism;
- Creation of incentives for improving the quality of work of all project participants and effective risk management.

Project financing schemes implemented on the basis of PPP have their own characteristics. This is, first of all, the presence of the project company, which creates cash flow, which is the basis for a settlement with creditors and shareholders, as well as the use of a complex system of financial instruments and contracts.

As with any commercial organization, funding sources can be divided into internal and external. Internal sources include the profits and the funds generated from it in the form of depreciation, insurance claims, land plots provided. fixed assets, etc.

External sources of funding for a PPP project depend on the composition and size of the funds raised, the focus of the project, the volume of upcoming work and costs, and other factors.

Part of the funds is included in the equity capital of the project company. This may be equity; founders' funds; government subsidies; funds allocated under the state targeted programs, etc.

The remaining sources of financing are attracted in the form of borrowed bank loans, the main of which are: loans provided by non-bank organizations (for example, pawnshops,

credit unions, etc.); bond issues; government loans; commercial loans; leasing, etc.

Special attention should be given to the effective form of attracting sources of financing, such as leasing, which is rarely used in Uzbekistan and still not sufficiently developed.

Currently, along with the above types of financing of PPP projects, they have begun to use innovative tools to raise funds for the PPP project. These include new innovative financial instruments: infrastructure bonds. mezzanine financing, junk bonds, etc. [9]

The following figure shows a scheme for financing PPP projects based on innovative financial instruments. (Fig. 1)

Now we give a description of each type of the above innovative financial instruments. Interest in the development of public-private partnership is currently growing in Uzbekistan, so it is important to determine the sources of funding for projects in this area.

One of the main mechanisms for attracting investments for the successful development of public-private partnerships is the financing of infrastructure projects through the issuance and placement of infrastructure bonds, when the issue of bonds is carried out under the guarantee of the state.

Infrastructure bonds will allow private capital to participate in mutually beneficial projects with the state, reducing the burden of the latter on the cost of building and maintaining public infrastructure to lift restrictions on economic growth in the country.

Infrastructure bonds are bonds issued by a special project company (SPV — special purpose vehicle) in order to raise funds to finance the creation or reconstruction of infrastructure facilities (roads, railways, air terminals, power lines, etc.), fulfillment of obligations for which provided in the amount and manner prescribed by law.

Figure 1. A scheme for a PPP project financing using innovative tools

It is important to note the undoubted advantages of issuing and placing infrastructure bonds. This type of bonds has certain advantages, including the following:

- Attracting non-state financing for investments in objects of state importance;
- Reduction of government spending on the maintenance (operation) of infrastructure facilities;
- Sharing of project risks between the state and private investors;
- Ensuring cost-effective management of project implementation by transferring management functions to a private investor;

The attraction of modern, high-performance technologies in infrastructure development.

All infrastructure bonds can be divided into two groups: general coverage bonds and bonds secured by project revenues. The second type of bonds deserves special attention, since they are issued based on income from the projects being implemented.

The state can resort to the issue and placement of infrastructure bonds when it is interested in private investment while retaining ownership of the object. Among the advantages of issuing and placing infrastructure bonds, it is important to note its versatility: it can be used in most sectors of the economy, it can be used to develop railway and underground transport, to build engineering and utility infrastructure, energy, telecommunications, healthcare, education, culture, tourism, and sport.

Another type of innovative instruments for raising funds for a PPP project is a mezzanine loan. Mezzanine is a kind of symbiosis of debt financing and equity financing. As you know, debt is the cheapest money, and equity is the most expensive money. Mezzanine financing occupies an intermediate position: the financial resource provided is more expensive than debt money, but cheaper than its own.

A mezzanine loan is an unsecured loan, in other words, loan provided without collateral or having a deeply subordinated security structure. The latter is characterized by the fact that the lien right has on the property of the third turn, but without the right of recourse against the borrower. Such a loan is granted for a period of at least 3–5 years with the repayment of the loan body at the end of the term. The essence and meaning of the mezzanine is to allow companies — project initiators to make large investments, while not possessing significant capital. Mezzanine lenders, combining both the lender and the investor, usually prefer borrowers with strong growth potential. At the same time, the investor bears increased risks in comparison with conventional bank financing and, accordingly, expects a higher return on his investments. From the point of view of financing conditions, the mezzanine is a hybrid between debt financing and direct investments, and its use may allow optimizing the conditions for parallel receipt of a bank loan for a specific project [4].

In conclusion, it should be noted that at present in many countries, public-private partnership is an important tool contributing to economic development. Successful implementation of the Action Strategy for the five priority directions of development of Uzbekistan in the coming years will depend to a certain extent on the search and implementation of new mechanisms ensuring the stable economic development of the country. One of these tools is PPP. However, the development of PPP in our country largely depends on the adoption of the Law "On Public-Private Partnership", as well as on the choice of appropriate methods of financing projects in this area. In our opinion, the effectiveness of PPP projects is crucially dependent on the use of innovative tools offered by us, such as the issuance and placement of infrastructure bonds and mezzanine credit.

Conclusion

1. Financing of PPP projects have their own characteristics. First of all, the funds of the state budget can be used, however, in modern conditions, when the budget is limited it is required to find innovative sources of financing for PPP projects. In recent years, innovative financing instruments have become widespread in foreign countries, including infrastructure bonds, mezzanine bonds and junk bonds.

2. In connection with the implementation in Uzbekistan of structural reforms identified by the Action Strategy in the five priority areas of the country's development for the period 2017–2021, public-private partnership will be widely developed. Implementation of PPP projects will require significant financial resources, sources of which may be innovative tools. However, this will require changes in the Law of the Republic of Uzbekistan "On Securities". In addition, it is important to change the thinking style of local investors so that they believe in the legitimacy of innovative tools.

3. The formation and development of a public-private partnership in Uzbekistan depend on the adoption of relevant regulatory acts governing both such activities directly and issues relating to the development of forms of co-financing investment projects from the state budget, private investments, venture capital funds, direct investment foreign investment, issuance of infrastructure bonds, etc.

4. In order for a PPP to become a real instrument that contributes to the economic development of a country, it is necessary to adopt an appropriate Law, which should define the legal framework of a public-private partnership. It is also required to pay special attention to the issue of redistribution of property rights in the process of implementing a joint project, since the subject of PPP is state property. Taking into account that PPP projects are mainly of an infrastructural nature, the complete transfer of ownership rights to private business can lead to social and political tensions in society. Therefore, it is recommended to transfer the limited powers, such as the right to control the use of assets, the right to income, the right to control, as well as the right to change the capital value of the objects of the agreements and the right to transfer certain property rights to others etc.

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