SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

Proceedings of the International Conference

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Part 1: Participants’ reports in English

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这些会议文集结合了会议的材料 – 研究论文和科学工作者的论文报告。 它考察了职业化人格的技术和社会学问题。一些文章涉及人格职业化研究问题的理论和方法论方法和原则。
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创新平台在教育结构项目活动中的作用
THE ROLE OF INNOVATIVE PLATFORMS IN THE PROJECT ACTIVITIES OF EDUCATIONAL STRUCTURES

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Orel State University named after I.S. Turgenev

注解。 在地区创建创新平台的重点是改善整个地区的教育体系，改进教育过程的机制和有效性，改进教育技术，同时考虑到正在实施的教育计划和项目的具体情况。

关键词：创新平台，项目活动，教育体系

Annotation. *The creation of innovative platforms in the regions is focused on improving the regional educational system as a whole, improving the mechanisms and effectiveness of the educational process, improving educational technologies, taking into account the specifics of the educational programs and projects being implemented.*

Keywords: *innovation platform, project activity, education system*

The modern concept of the project approach in the field of education is the idea of creating, developing, modernizing educational structures, methods of the educational process, as well as educational technologies. Innovative platforms are one of the modern tools responsible for the sustainable development of education.

An innovation platform represents a certain status of an educational organization(s), regardless of their organizational and legal form, type, departmental affiliation [1].

The purpose of creating an educational innovation platform (EIP): state financial support for the implementation of innovative projects and programs that are essential for ensuring the modernization and development of the education system,

taking into account the main directions of socio-economic development, as well as the implementation of priority areas of state policy in the field of education [2].

The educational innovation platform (Figure 1) is the center of the innovation and project space of the educational system.

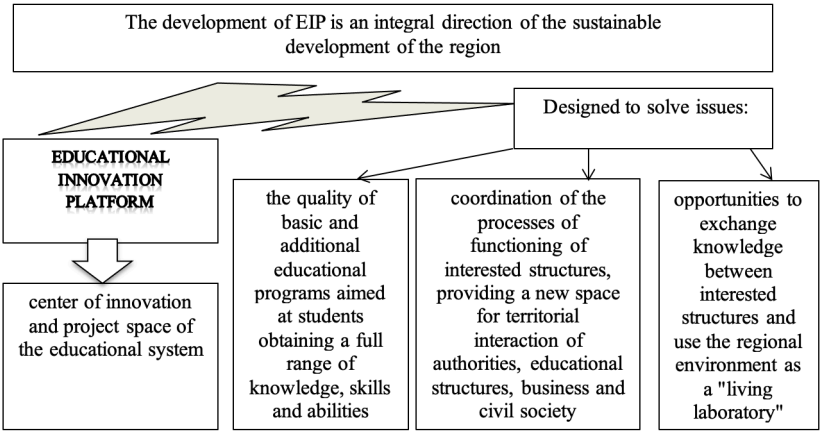

Figure 1. *Educational innovation platform as the center of the innovation and project space of the educational system*

The structural composition of the EIP elements as a tool for implementing the Sustainable Development Goals on the example of the Orel region is shown in Figure 2.

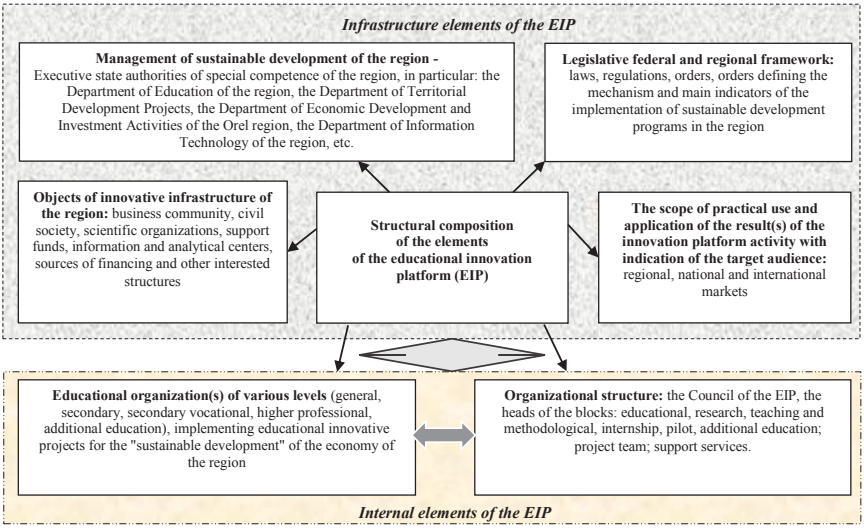

Figure 2. *Structural composition of elements EIP as a tool for the implementation of sustainable development goals on the example of the Orel region*

The main directions of the EIP project activities are shown in Figure 3.

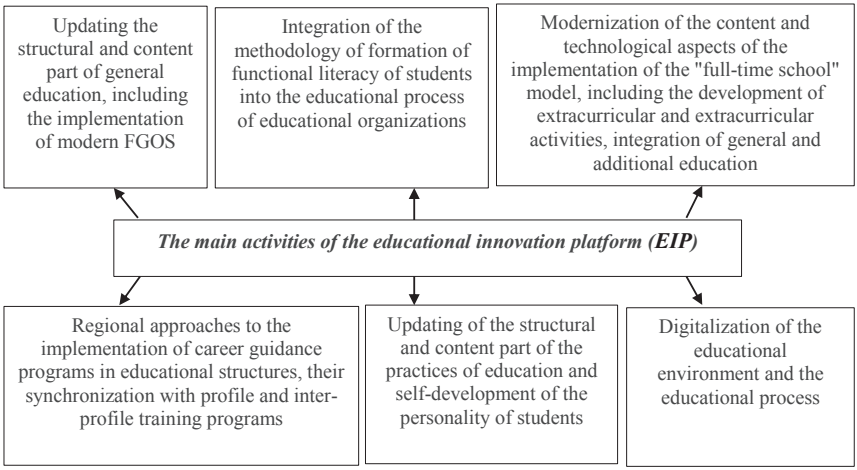

Figure 3. *Directions of EIP project activities*

Among the activities within the framework of the EIP, special mention should be made of projects for the development, testing and (or) introduction of new profiles, methods, mechanisms, educational institutions, other collaborations, etc.

Also of interest are projects to improve the educational and methodological, scientific and pedagogical, organizational, legal, financial and economic, personnel, material and technical support of the education system through the creation of favorable conditions, individual educational trajectories, the introduction of modern technologies, adaptive models, etc. (Figure 4).

The concept of project management in the education system makes it possible to coordinate the activities of educational structures responsible for the development and implementation of pilot projects, as well as optimize the resource base, guided by innovative development programs. At the same time, the project approach focuses educational structures on the selection of projects, optimization of project portfolios, as well as the elaboration of their content and implementation.

In order to increase the effectiveness of project management of innovative development of regional educational structures, it is recommended to implement it comprehensively: from the standpoint of consistency, functionality, process approach.

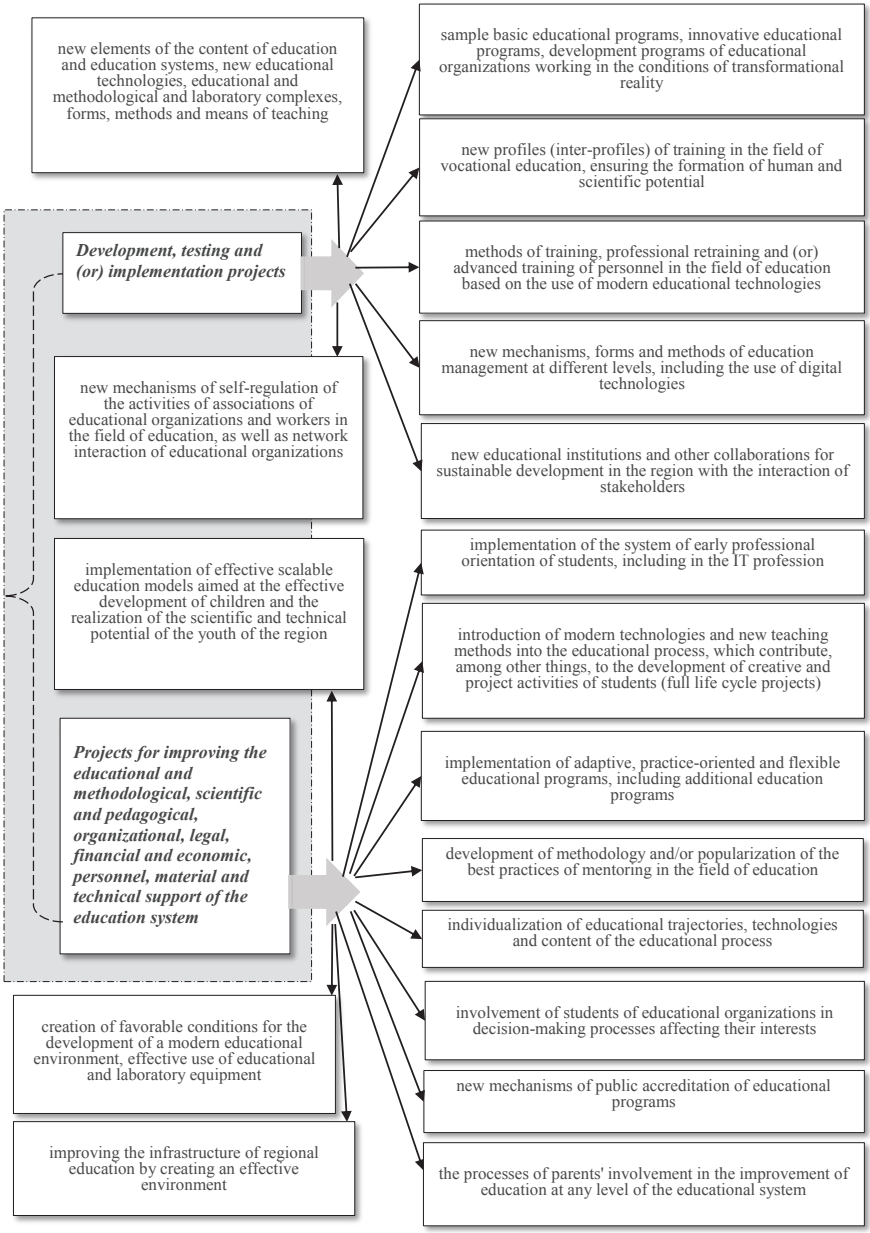

Figure 4. *EIP projects and activities*

In order to increase the effectiveness of project management of innovative development of regional educational structures, it is recommended to implement it comprehensively: from the standpoint of consistency, functionality, process approach.

The above allows us to note that project management is an integrated process of making and implementing management decisions, accompanied by the definition of innovative goals, the formation of organizational structures, planning project activities and monitoring the progress of their implementation, aimed at translating innovative ideas into real practice within the established time, budget and resource constraints.

The modern concept of the project approach is the idea of creating, developing, and changing an educational innovation platform. In a broader context, the project approach includes a system approach, system methodology, system design, reflecting the real process of integrating knowledge and activities, science and social practice in the project culture.

The project approach makes it possible to achieve high efficiency in the management of educational innovation platforms in terms of performance, optimization of time and costs for the performance of individual works, stages, programs and projects in general. During the implementation of the project, feedback is valid. The results obtained are compared with the plan, deviations are evaluated, on the basis of which innovative development programs are adjusted.

The use of a project-based approach in the management of educational innovation sites avoids such common problems as freezing of facilities, financial constraints, allocation of resources according to the roadmap, disunity in actions, risk and uncertainty in the project completion dates.

The main advantage of the project approach is that the project management methodology is universal and can be applied to projects of various directions regardless of their subject area: educational, research, methodological, educational, etc.

Thus, innovative platforms are focused on providing conditions for effective design aimed at modernizing the education system, and providing affordable, as well as high-quality education that meets modern socio-economic and professional requirements [3].

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“中蒙俄”轴新架构：未来物流
NEW ARCHITECTURE ALONG THE "CHINA-MONGOLIA-RUSSIA" AXIS: LOGISTICS OF THE FUTURE

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抽象的。 本文考察了俄罗斯与蒙古和中国的经济合作，给出了与这些国家的贸易量。 作者分析了亚洲公路网沿线国际公路运输的政府间协议。 它还确定了创建“中蒙俄”经济走廊的可能风险和前景。

关键词：经济走廊、中国、蒙古、俄罗斯、货运、运输合作、Covid-19。

Abstract. *This article examines the economic cooperation of Russia with Mongolia and China, the volume of trade with these countries is given. The authors analyze the intergovernmental agreement on international road transport along the Asian Highway network. It also identifies possible risks and prospects for creating an economic corridor "China-Mongolia-Russia".*

Keywords: *economic corridor, China, Mongolia, Russia, trucking, transport cooperation, Covid-19.*

The growing cooperation in the field of joint transit and the creation of logistics corridors between Russia, China and Mongolia is gaining new momentum. This is confirmed by a number of next steps in the modern construction of a new global infrastructure. First, in the XXI century, the East is increasingly striving to set the pace of social development, to form trends and tendencies, thereby becoming a new economic center. Secondly, the Mongolian and Chinese directions are a priority in the foreign policy of the Russian Federation due to many years of friendly and favorable relations for all parties, including economic ones. Thirdly, Russia, China and Mongolia are connected by numerous projects (energy, mining, as well as transport and infrastructure) [1].

Russian-Chinese cooperation is also strengthened by trade between these countries. Let us consider in more detail the structure of Russia's exports to China in 2020 (see Fig. 1). Despite the widespread introduction of mass restrictions and lockdowns due to the spread of a new type of coronavirus infection, although trade

volumes have fallen, they still remain quite impressive. The largest export item to China is mineral fuels - 29.1 billion US dollars, accounting for 59% of the total. The volume of ore supplies increased by 0.7 billion US dollars compared to 2019 [3]. At the same time, other product groups remain practically at the same level.

Energy cooperation with China is a priority at this stage. In 2021, the construction of the "Soyuz Vostok" gas pipeline from Russia to China, passing through the territory of Mongolia, is underway. The gas pipeline will be a continuation of the "Power of Siberia-2". At the same time, the issue of gas supplies to Mongolia remains unresolved, it is likely that this project may remain only a transit project for the country. This fact confirms Russia's great interest in energy cooperation with China.

Consider the structure of Russian imports from China in 2020 (see Fig. 1). The two largest items over the past 3 years (2018-2020) remain electrical machinery and equipment and nuclear reactors, accounting for 27% and 24% in the total import structure in 2020. Thus, more than half of Russian imports from China are precisely engineering products. It should be noted that the value of total imports in 2020 compared to 2019 remained approximately the same - 54.1 against 54.9 billion US dollars, respectively [4].

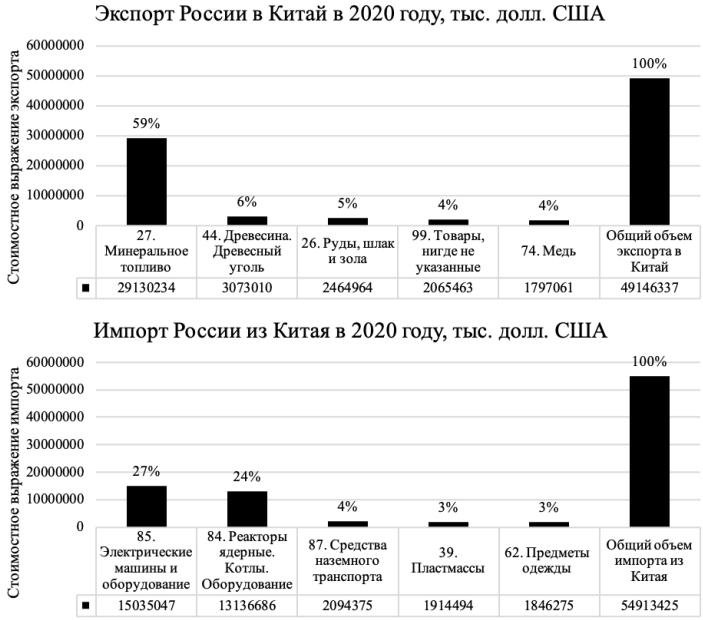

Figure 1. *Russian-chinese trade*

Source: compiled by the authors based on data [2]

Consider the volume of trade between Russia and Mongolia for 2020 (see Fig. 2). In this case, the coronavirus pandemic has significantly affected exports. Thus, export volumes in 2020 decreased by 349.8 million US dollars compared to 2019. The largest item of Russian export to Mongolia, as well as to China, remains mineral fuel. However, in 2020 there was also a sharp reduction in the supply of products from ferrous metals, cereals and ferrous metals directly. At the same time, it should be noted that the reduction in the total volume of exports occurred mainly due to a decrease in the volume of supplies of mineral raw materials [3].

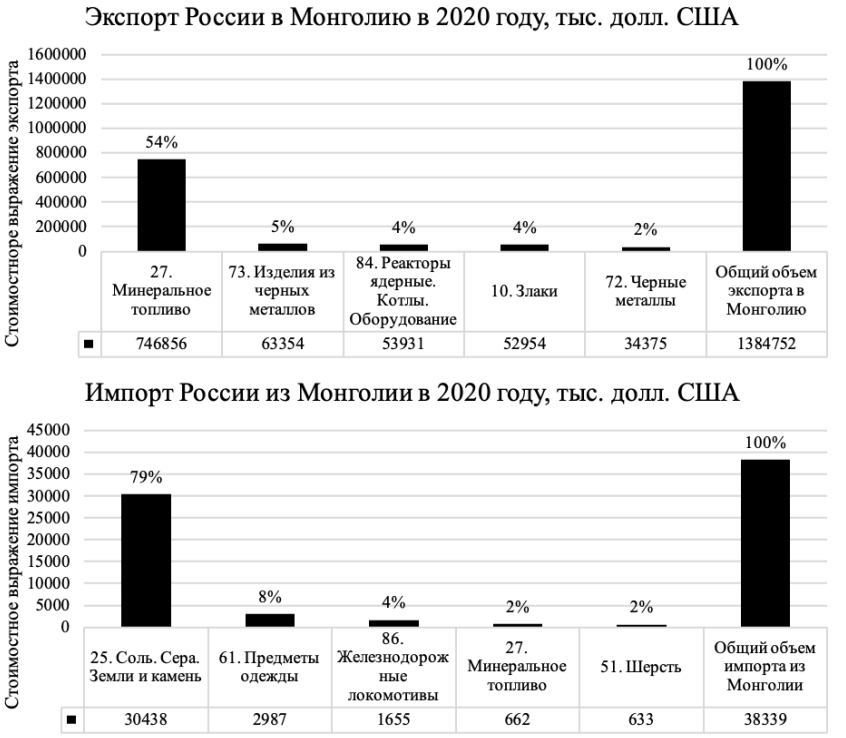

Figure 2. *Russian-Mongolian trade*
Source: compiled by the authors based on data [2]

When considering the dynamics of Russia's imports from Mongolia in absolute terms, it can be seen that the volume of trade in many of the presented commodity groups has increased significantly. The total volume of imports for 2020 compared to 2019 increased from 33.6 to 38.3 million US dollars [4]. So, for example, out of 4.7 million US dollars of the total decrease in Russian imports from Mongolia,

4.3 million US dollars accounted for salt, sulfur, earth and stone, and only 415 thousand US dollars as a cumulative effect of an increase in all other items .

Thus, the authors put forward a hypothesis that bilateral relations between Russia and China have the greatest impact on building a dialogue with Mongolia, including the creation and development of transport corridors and logistics hubs.

Mongolia can act as a link between Russia and China. This statement is confirmed geographically by the fact that the length of the Russian-Mongolian border is 3.5 thousand kilometers, covering the territories of 4 administrative units: Tyva, Buryatia, the Republic of Altai and Zabaykalsky Krai. The listed regions have access to the European part of Russia[1], where about 70%[2] of the total population lives, which means that economic activity is higher there. At the same time, although the length of the Russian-Chinese border is 4.2 thousand kilometers, most of it is located in the Far East.

Consider the cooperation between Russia, Mongolia and China in retrospect. In 1947, the construction of the Trans-Mongolian Highway began. Then, in 1956, a route leading to China was launched. This railway connects Ulan-Ude, Ulaanbaatar and Beijing, its total length at the moment is 2.2 thousand kilometers.

In December 2016, an intergovernmental agreement was signed on international road transport along the Asian Highway network between the governments of China, Mongolia and the Russian Federation [6].

In accordance with the intergovernmental agreement, road transport is carried out along the following routes through the relevant checkpoints of the state borders:

– AH 4 – Asian Highway 4 – the transport corridor connecting Russia and China through Mongolia also has an exit to Pakistan, the total length is 6 thousand kilometers: Novosibirsk - Barnaul - Gorno-Altaisk - Tashanta (Russian Federation)/Ulanbaishint (Mongolia) - Kobdo - Yarantai (Mongolia)/Takeshikan (China) - Urumqi - Kashi - Honkiraf [8].

– AH 3 – Asian Highway 3 – transport corridor covering Russia, Mongolia, Myanmar, Laos and Thailand, the total length is 7.3 thousand kilometers: Ulan-Ude - Kyakhta (Russian Federation)/Altanbulag (Mongolia) - Darkhan - Ulaanbaatar - Sainshand - Zamyn-Uud (Mongolia)/Erlian (China) - Outer Beijing - Tianjin [9].

The Intergovernmental Agreement on International Road Transport along the Asian Highway Network makes it possible to transport goods subject to the legislation of the country through which transit is carried out. At the same time, carriers undertake to pay fees and charges for the use of the motorway in the state of their stay [6].

[1]The Trans-Siberian Railway passes through the territory of Buryatia and Zabaykalsky Krai. Connects Moscow with the East Siberian and Far Eastern regions.

[2]According to the Rosstat estimate of the population as of January 1, 2021 [15].

The agreement is valid, and it is aimed at reducing time and financial costs [7]. One of the most important goals of the agreement is the desire to minimize transshipments, since the weight and dimensions of the transport must comply with the requirements of the legislation of the state through which the transportation is carried out.

The tripartite agreement significantly reduces the level of bureaucracy, thereby reducing transaction costs: in China, Mongolia and Russia, the procedure for issuing visas to transporters should be simplified in accordance with the agreement.

Thus, in view of the relevance of the issue of trilateral cooperation between the Russian Federation, Mongolia and the People's Republic of China, as well as the urgent need, in August 2016, the "China-Mongolia-Russia" international motor rally was launched. This rally acted as a demonstration of a potential road transport connection.

The following goals of the international motor rally were identified:

- establishing the possibilities of international auto communication;
- expansion of international cooperation of countries;
- strengthening economic ties;
- elimination of administrative barriers during transportation;
- study of the state of road and roadside infrastructure;
- increase in cargo turnover with China and Mongolia [5].

The creation of this economic corridor was the result of a trilateral meeting in June 2016 at the SCO summit. The corridor contributes to the development of the infrastructure of the adjacent territories.

At this stage, the Far East is populated quite unevenly due to the climatic factor, as well as the location of industrial zones. Russia's cooperation with China and Mongolia regarding the development of the economic corridor will lead to the consolidation of economic activity. Thus, China can increasingly develop the Far Eastern regions of Russia, which is generally quite positive for the local population due to the fact that the territories will constantly develop. However, in this case, there is a risk of Russia's economic dependence on China.

The economic corridor "China-Mongolia-Russia" includes 32 projects:

- 13 projects in the field of transport infrastructure;
- 4 projects are aimed at trade cooperation;
- 3 environmental projects;
- 3 scientific and technical projects;
- 3 projects in the field of humanitarian cooperation;
- 2 projects in the field of industry;
- 1 project in the field of modernization of checkpoints;
- 1 energy project;
- 1 agricultural project;

- 1 project in the field of medicine and healthcare [10].

As of 2022, the economic corridor has already been successfully developing for 5.5 years. During this time, the countries managed to create a joint working group and hold regular meetings at the expert level [11]. Now, within the framework of the program, the project of modernization of the central railway corridor remains a priority.

In general, China, Mongolia and Russia are striving to maintain and develop economic relations despite the spread of a new type of coronavirus infection. The effects of Covid-19 remain significant for the global economy, with the previously listed countries managing to work within the framework of the project to create an economic

Thus, we can come to the following conclusions:

1. Despite the fact that the spread of the coronavirus infection negatively affected the forecast indicators of the economy, Russia, China and Mongolia managed to keep their foreign trade indicators at a level comparable to the pre-crisis period.

2. Russia will continue to increase gas exports to the East, as the construction of the Soyuz Vostok gas pipeline leading to China through the territory of Mongolia is currently underway. It is also possible to create a branch to Mongolia, which will increase gas supplies to this country.

3. China, Mongolia and Russia have been working effectively on the economic corridor for 5 years. For this reason, 32 projects that are designated within the framework of cooperation will be continuously developed and possibly replenished with new ones.

4. Since cooperation between Russia and China is quite effective at this stage, there is a risk of entering into a co-dependent relationship.

5. If China manages to fully implement its "Belt and Road Initiative", all economic activity will gradually shift from West to East. Thus, the role of the United States will eventually weaken. After the withdrawal of US troops from Afghanistan, which could not help speeding up geopolitical risks, all countries are obliged to build a new policy of interaction in the context of a balance of interests of all actors, which should bring the Russian Federation, China and Mongolia even closer in solving the problems of ensuring sustainable development and leveling the threats of global instability. and crisis phenomena of a country, regional and global character. And also overcoming the Ukrainian crisis will require the deepest convergence of technologies and logistical capabilities.

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中国与美国“技术差距”的斗争
CHINA'S FIGHT AGAINST THE USA 'TECHNOLOGY GAP'

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注解。 这篇文章讨论了当前中美贸易冲突后果的话题——“技术差距”。 由于这些国家是全球经济市场的巨人，它们的互动对全球贸易具有重要意义。 但在贸易冲突的过程中，中国被迫以新的方式发展国内经济来摆脱困境。 本文将讨论处理“技术差距”的后果和方法。

关键词：冲突、潜力、中国、美国、安全、“技术差距”、预算、贸易冲突。

Annotation. *The article deals with the current topic of the consequences of the USA and China trade conflict -the "technology gap". Since these countries are giants in the global economic market, their interaction is of great importance for global trade. But in the course of the trade conflict, China is forced to get out of its predicament with new means of developing its domestic economy. This article will discuss the consequences and methods of dealing with the "technological gap".*

Keywords: *conflict, potential, China, United States, security, "technology gap", budget, trade conflict.*

Innovative opportunities of the economy China's new five-year plan

Following the Fifth Plenum of the 19th Central Committee of the Communist Party of China, the Chinese authorities set their sights on long-term national development. 2021-2025 will be the XIV five-year plan. This five-year plan will be indicative in the history of the Middle Kingdom: the PRC will reach a new level of economic development, the national level in the future. The country's EAP will exceed 100 trillion yuan and, in the long run, China will completely get rid of poverty.

General Secretary of the CPC Central Committee Xi Jinping said that China's economy has a reliable potential to maintain stable development for the long term. The 14th five-year plan is based on the new Chinese concept of "double circula-

tion". This concept consists of two contours of the Chinese economic system: internal and external. At the same time, the Chinese authorities focus on "internal circulation", that is, relying on their own strength and the domestic market. Having learned about the new concept of the Middle Kingdom, there was talk in the West that in the near future China is ready to leave the path of expanding openness to the outside world. But Beijing immediately officially declared that this would not happen.

October 30 manager of the State Statistical Office of the People's Republic of China explained: "We will continue to implement measures to expand the openness of the PRC. The inflow of foreign capital to our country will constantly increase. Let's turn to the scheme to understand the priority areas for the implementation of the XIV five-year plan of the PRC.

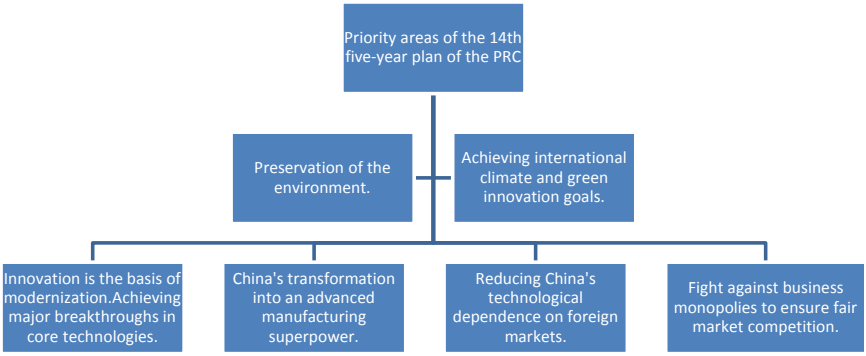

Figure 1. *«The scheme of priority directions of the 14th five-year plan»*

The social sphere of life in the Middle Kingdom is also being modernized year after year. From 2016 to 2020, China has established the world's largest social security system. The goal of social transformation is global - to eradicate poverty and achieve a middle-income level of society. To consider the successes in the development of the social sphere, let us turn to scheme № 2.

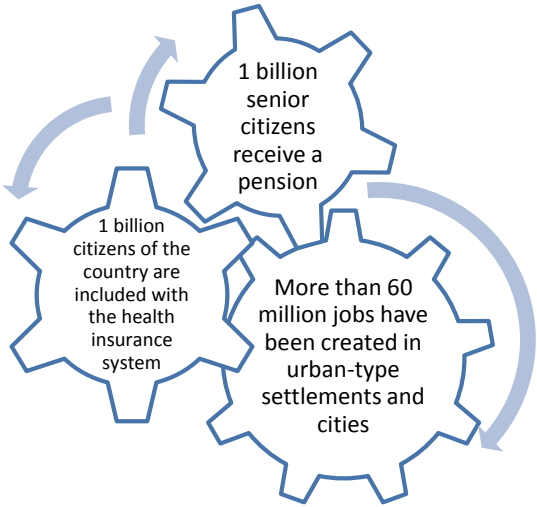

Figure 2.

Development of technological relations China and the United States

In the era of the industrial revolution, scientific, technological and innovative capabilities are the main factors for strengthening the economic power of states. That is why the key task for the PRC is to "Reduce technological dependence". In light of the trade conflict that began in 2018 between China and the United States, the global economic situationaradically changed course in a matter of years. In fact, today China is mainly focused on gaining technological independence in light of the growing US policy of a "technological gap" with China. Such a confrontation has negative consequences for the entire global economy.

Today, only a few evidences of the unfolding technological war have been revealed to observers: export restrictions, increased duties, and control over investment by the PRC. This is only part of the impact of the "technological divide". One of the most striking examples of the technological conflict between the United States and China is the situation around Huawei. In 2019, President Donald Trump banned the using of this company's equipment, making it a national threat to US security. By doing so, he put the Chinese Company Huawei in a difficult position. The US accusation of stealing information of national significance led to the fact that Australia, Great Britain and Japan also became wary of Huawei, after which they refused to work with this operator. The company lost the ability to work with OC Android, Google services.

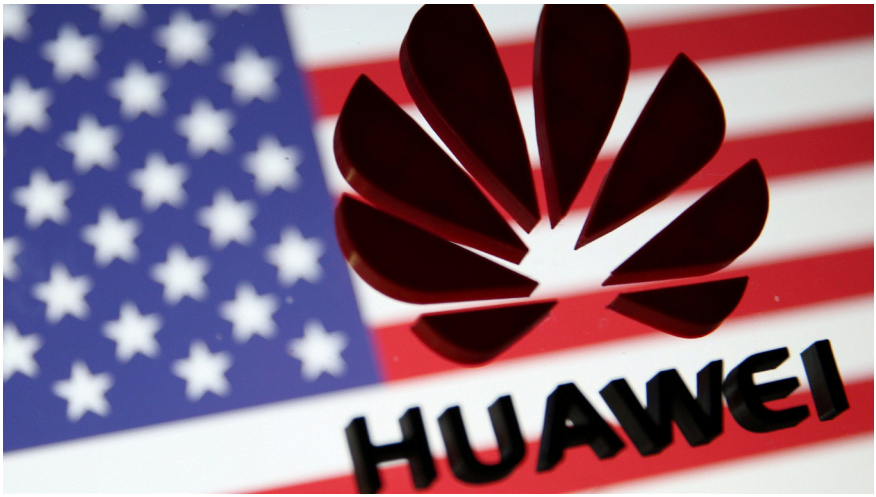

Figure 3.

In our 2022, the company has already experienced many difficulties, and today Huawei's profit increased by 9% at the beginning of the year. Hu Houkun, vice chairman of the company, said that in the next few years, Huawei will become a leader in the global technology market. So the company will only be stronger, because the most difficult times are already over.

Due to the lack of access to foreign advanced technologies and equipment, the growth of China's economic development may slow down in the future. But China has found a solution to this problem by increasing budget funding for research and development activities. Until the end of the five-year plan, China will increase its R & D investment by 7 % annually. The Chinese government is clearly aware of and committed to "creating new growth points." The field of science and technology is a strategic resource for national development. Embracing new technologies is a direct path to China's successful independence in the field of information and technology. The United States, through the introduction of sanctions and restrictions, only created conditions for the rapid development of the Chinese economy.

Strategy for solving the "technology gap"

A strategic solution to the problem of restrictions and prohibitions forces us to accelerate the development of the economy. Without receiving technology and equipment, the PRC, in order to avoid a decline in the pace of economic development, solved the problem radically. The Chinese authorities have allocated a budget for the development of technologies within the state, which in the near future will completely change the global technology system in the world.

During the fifth plenary session, indicators for the development of such industries as 5G communications, biomedicine and the development of the third generation of semiconductors were consolidated. USA restrictions on second-generation semiconductors have forced the Chinese computer technology industry to mark a new start for the development of third-generation chips. Already in October 2020, China created Nanjing University of Integrated Circuits, whose main task was to ensure national technological independence in the production of the latest generation of chips. The University of China is already conducting research in the development of artificial intelligence, integrated circuits and quantum computers, according to the direction for 2022, up to 30 thousand students are studying at the university.

Conclusion

Analyzing the situation of the USA and China trade conflict, in terms of the "technological gap", the PRC's desire for independence in the field of technology and information is noticeable. Innovative development of the country contributes to the expansion of economic and technological potential and the eventual completion of socialist modernization. China's strength lies in its ability to adapt to any conditions of external influence. By adopting new sanctions against China, the United States only forces China to develop, grow and improve for its own benefit.

By 2035, China plans to complete urbanization, industrialization and modernization in the agricultural sector. By 2050, according to scientists China will achieve carbon neutrality, which will dramatically change the environmental situation in the world. Earlier, by 2025, according to the results of the five-year plan, China will stop the growth of greenhouse gases, and will rapidly begin to reduce them.

China is making incredible progress in all areas within and outside the country. This is precisely the idea of "internal circulation". China will concentrate its forces mainly within the state, and in 30 or 50 years it will gain full independence, becoming a superpower.

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俄罗斯联邦的离岸监管
THE OFFSHORE REGULATION IN RUSSIAN FEDERATION

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抽象的。 考虑了在形成新的市场关系和对外经济活动自由化的条件下发展俄罗斯经济中的离岸关系问题。 分析了该领域监管立法的发展。 发现不足之处，制定改进方向。

关键词：对外经济活动自由化，离岸，监管立法，打击洗钱。

Abstract. *The problems of the development of offshore relations in the Russian economy in the conditions of the formation of new market relations and the liberalization of foreign economic activity are considered. The development of regulating regulatory legislation in this area is analyzed. Shortcomings are revealed and directions for its improvement are formulated.*

Keywords: *liberalization of foreign economic activity, offshore, regulatory legislation, combating money laundering.*

Russia's entry into the path of market reforms necessarily caused the formation of a regime of economic openness. One of the most important among them was the formation of institutions that developed and promoted the relations of the world offshore environment in the Russian economy, starting from the late period of the planned economy of the USSR. The development of legal regulation of offshore operations gives an idea of the key factors that determined the vector of change in the institutional environment of the entire national economy. Characteristics of the main regulations, thanks to which Russian private capital began entering the international market, is given in Table 1.

Table 1.

Regulations governing the creation of offshore companies by residents of the Russian Federation abroad and in Russia

Name of the normative act	Establishing a rule of action
1. Decree of the Council of Ministers of the USSR No. 412 “On the development of the economic activities of Soviet organizations abroad” dated 18.05.1989. (“Collection of Decrees of the Government of the USSR of 1989, No. 24)	The procedure for the creation of foreign enterprises by non-state enterprises has been determined, including: 1) obtaining the consent of the Ministry of Foreign Economic Relations of the USSR; 2) taking into account the recommendations of the MFA of USSR; 3) registration of an enterprise established abroad in a special register in the Ministry of Finance of the USSR .
2. Law of the RSFSR 1488-1 dated 26.06.1991 "On investment activities in the RSFSR", ("Gazette of CPD and SS of the RSFSR", 18.07.1991, art. 1005).	Article 4 of the Law declared the right to carry out investment activities abroad in accordance with the Law itself and the legislation of foreign states, including international agreements.
3. Law of the Russian Federation dated 09.10.1992 No. 3615-1 “On currency regulation and currency control” ("Gazette of CPD and SS of the RSFSR" dated November 12, 1992, No. 45, art. 2542).	The definition of current currency transactions and related to the movement of capital is given. For residents, a procedure has been introduced for carrying out operations on the movement of capital. This meant extending it to setting up offshore company ventures abroad.
4. Decree of the President of the RSFSR No. 213 “On the liberalization of foreign economic activity on the territory of the RSFSR”, 15.11.1991	Beginning of registration of enterprises abroad by residents of the Russian Federation.
5. Adoption of the Decree of the Supreme Soviet of the USSR No. 106-1 “On the creation of free enterprise zones” on 14.07.1990, as well as the adoption of the Resolution of the Supreme Soviet of the RSFSR of the same name No. 165-1 dated 13.09.1991	The beginning of the "offshorization" of Russia: the emergence in 1990-96. of free economic zones: "Yantar" (Kaliningrad Oblast), "Nakhodka" (Primorsky Krai), Ingushetia, Kalmykia, Buryatia, Altai.

The Law "On Foreign Investments in the RSFSR" in 1991 for the first time introduced a national regime for foreign investors: standard legal definitions of foreign investments and FDI, regulations governing the acquisition of shares in the authorized capital of commercial organizations exceeding 10% by foreign investors, as well as the procedure for investing in fixed capital branches of foreign companies established on the territory of the Russian Federation, standards for leasing equipment with a customs value of 1 million rubles. Later, the new edition of the law “On Foreign Investments in the Russian Federation” No. 160-FZ took into account the lessons of the 1998 financial crisis.

The Decree of the President of the Russian Federation "On the liberalization of foreign economic activity" on the territory of the RSFSR (November 1992) allowed all legal entities registered in the Russian Federation, regardless of their form of ownership, to carry out foreign economic activity without special registration. Restrictions were removed for individuals and legal entities to participate in foreign trade operations and conduct foreign exchange transactions through authorized banks. The sale of foreign currency to legal entities registered in Russia was allowed only for the purpose of importing goods and services, and to foreign investors for the transfer of profits and dividends abroad. Commercial banks received the right to open foreign currency accounts and conduct foreign exchange transactions on the basis of licenses.

During 1992, the market exchange rate of the ruble was introduced in the Russian Federation on the basis of trading on the MICEX, including its partial convertibility for current transactions. This differed from the Western European experience of the gradual introduction of the external convertibility of the national currency only with the final restoration of the national economy. The result had a negative impact on the balance sheet of international investment. The falling exchange rate of the ruble led to the fact that in the early 1990s, 500 largest Russian enterprises (with a total estimate of $200 billion) were sold for $7.2 billion [3]. It is believed that foreign participation was present in almost all major privatization transactions. Liberalization, at this stage, meant a quantitative easing by the state regulator of the parameters of the activities of already existing subjects of foreign trade activity, which before liberalization, as assumed by default, operated under severe restrictions. The state was only aware of the need to master its new role as a regulator, but to search for the goals of its foreign economic policy.

It can be concluded that the totality of these normative acts has become part of the policy of eliminating the state monopoly on foreign economic activity. However, there was no awareness of the need to manage and control the spontaneously developing offshore sector in order to solve domestic economic problems.

Since that time, companies on foreign economic platforms have been faced with the need to independently solve institutional problems for efficient business conduct: choosing the status of companies, various legal regimes of jurisdictions, taking into account the peculiarities of foreign exchange settlements and customs clearance of documents.

Opportunities for companies entering international markets have been expanded by such an important legal institution as international Double Taxation Treaties (DTTs), which, together with other conditions, make it possible to significantly reduce the tax burden of companies. Many of them were concluded in the Soviet period, but acquired a special relevance and a new breath in the 1990s. The Russian Federation supplemented the previous agreements with new ones, in

particular with the USA and China [1, 2]. The Russian Federation also has DTTs with countries commonly referred to as facades or "white offshores". They apply national preferential taxation regimes for certain types of income: Switzerland, the Netherlands, Ireland and others.

Since the beginning of the 1990s, the offshore policy of Western countries has changed significantly under the influence of the United States in the direction of strengthening control over offshore activities. The Money Laundering Control Act 1988 introduced a de facto ban on cash withdrawals. This excluded the transfer of cash to bank accounts, since such an operation itself was recognized as a link in the chain of laundering criminal capital.

The decisive moment of the anti-offshore strategy and its expansion outside the United States was the adoption of the Patriot Act after the September 11, 2001 terrorist attack, and then the introduction of the Foreign Account Tax Compliance Act (FATCA) in 2010.

Financial institutions around the world were now required to disclose information about the accounts of private American taxpayers and companies in which Americans directly or indirectly control more than 10%. Under the threat of paying 30% on any transactions in US dollars or closing accounts with US financial institutions, all financial institutions are required to enter into agreements with the US Internal Revenue Service from 2014. In fact, FATCA has become the main mechanism aimed at preventing tax evasion on income received by US citizens and residents outside the country.

But the time when Western countries had a monopoly on the world market of offshore services has passed. By the mid-1990s, Western countries controlled only 55 offshore centers, while the remaining 45 centers were located in the territories of developing countries and transitional economies, which accumulated an increasing part of supranational capital.

This policy reinforces the monopolization of financial markets and the dictates of US multinational companies.

It should be noted here that the size of the US state budget deficit and, accordingly, the public debt are such that foreign partners cannot reduce their funding without the risk of their own losses. According to US statistical services, the share of financing of US Treasury bills among foreign holders through the largest offshore companies, the Cayman Islands, Belgium and Luxembourg, Hong Kong, and others, has grown from 8% in 2006 to 19%.

The competition of black lists reflected the struggle of various circles of Western countries for the priorities of offshore centers controlled by one or another developed country.

Under the pressure of anti-offshore initiatives that began to be developed by the US authorities and international financial organizations, as well as the results

of the 1998 crisis that shook the Russian financial system, the Russian authorities headed for tightening currency, customs and banking controls. The wave of capital flight from Russia before and after the August 1998 crisis made it urgent to counteract the flow of offshore capital. According to the Bank of Russia, about $15 billion was withdrawn through banks registered in offshore zones only in the first quarter of 1999. But the measures introduced were only in the nature of containment measures (Table 2). The main one was the introduction of the requirement for banks to increase the required reserves for transactions with offshore companies: for acceptance credits, for the purchase of securities, for guarantee transactions, for correspondent transactions, for leasing transactions with offshore companies.

Table 2.

National measures of the Russian Federation to counteract offshore capital circulation

1. An amendment to the federal law "On currency regulation and currency control" was adopted on December 29, 1998, according to which ruble settlements between residents and non-residents are classified as currency transactions.	Introduction of restrictions on ruble export operations; liquidation of offshore business equal to 20% of foreign trade turnover, going according to shady schemes plus fictitious contracts for non-return of foreign exchange earnings from exports.
2. Order of Bank of Russia No. 500-U dated February 12, 1999 “On Strengthening Foreign Exchange Control by Authorized Banks over the Legality of Foreign Exchange Transactions by Their Clients and on the Procedure for Applying Enforcement Measures to Authorized Banks for Violations of Foreign Exchange Legislation”	1. A procedure has been established for the provision by banks of information on foreign exchange transactions of clients that have signs of a shady outflow of capital. 2. A list of countries and territories classified as classical and non-classical offshore companies has been established, transactions with counterparties of which are subject to mandatory notification.
3. Order of the Bank of Russia dated March 22, 1999 No. 519-U on the order for the importer, in the event of an advance payment, to transfer an equivalent amount to a deposit in an authorized bank.	Refund of the deposit is allowed after the presentation of the CCD. A barrier is being created against capital flight under fictitious import commodity contracts.
4. Order of the Bank of Russia dated July 13, 1999 No. 606-U. requires authorized banks to create reserves for operations with residents of offshore zones	Reducing the efficiency of offshore schemes of banks to reduce tax payments through the transfer of funds for the purchase of a promissory note of an offshore company

5. Order of the Bank of Russia dated August 26, 1999 No. 634-U. Introduction of a ban on the opening of "Loro" type accounts by authorized banks in the currency of the Russian Federation. That is, a ban on banks opening ruble accounts in Russian banks for residents of offshore zones	Liquidation of the industry of offshore operations for pumping capital abroad for newcomers to this business. But the Decree does not apply to already opened correspondent relations with offshore banks.
6. Order of the Bank of Russia dated December 30, 1999 3 721-U "On the purchase of foreign currency by resident legal entities for the performance of work, the provision of services or the transfer of the results of intellectual activity"	Permission to purchase foreign currency under import contracts is issued only after the submission of the EEC Conclusion to the bank. It aims to prevent the export of capital under contracts with artificial prices.
7. Adoption of the Federal Law by the State Duma on July 13, 2001 "On counteracting the legalization (laundering) of proceeds from crime"	1. The criminalization of actions for laundering proceeds from crime, including through banks, has been introduced. 2. The Financial Monitoring Committee is vested with the rights to combat the legalization of criminal capital. 3. Banks undertake to introduce internal control in order to identify transactions with signs of legalization of criminal capital.
8. Article 40 of the Tax Code of the Russian Federation, introduced in 1999, establishes the right of the tax authorities to verify the correctness of applying transaction prices in the following cases: 1) on transactions between related parties 2) on commodity exchange (barter) transactions 3) when making foreign trade transactions. 4) if prices deviate by more than 20% from the price level from the price level applied by the company for identical goods	Regulation of the principles of price determination for taxation purposes. It is directed against the main element of offshore capital withdrawal schemes - transfer pricing.
9. Federal Law No. 374-FZ "On Controlled Foreign Companies"	Obligation for owners of foreign companies - residents of the Russian Federation - to report information about the company if it owns more than 10%.
10. May 2016. Russia joined the automatic exchange of financial information	It became possible to automatically learn about foreign assets of residents and income, compare them with the tax return, if necessary, charge additional taxes and impose fines.

As a result, under the influence of a complex of internal and external factors, after 1999, the basis of anti-offshore legislation began to take shape, the absence of which did not prevent the use of offshore schemes for the withdrawal of capital at all. But it should be noted that the policy of the Russian financial authorities was more often opportunistic in nature, allowing them to patch up some gaps in the current capital flight, but had strategic goals and was inconsistent (Table 3).

Table 3.

Examples of inconsistency in the suppression of negative manifestations in offshore activities

1. FL "On counteracting the legalization (laundering) of proceeds from crime and the financing of terrorism" No. 115-FZ dated August 7, 2001	The money received as a result of criminal acts, provided for in Articles 193,194, 198, 199 of the Criminal Code of the Russian Federation, that is, income received from the non-return of foreign exchange earnings from exports, evasion of customs payments, tax evasion and insurance contributions to off-budget funds.
2. Ratification of the Strasbourg Convention on Laundering, Search, Seizure and Confiscation of the Proceeds of Crime on May 28, 2001 .	Article 20 has been withdrawn from the scope of this convention, providing for the confiscation of all assets of a person accused of receiving corruption proceeds, including assets, registered family members and affiliates
3. Federal Law "On the Introduction of Amendments and Additions to the Law of the Russian Federation on Currency Regulation and Currency Control" No. 72-FZ dated 31.5. 2001	1. Allowing individuals to purchase shares of foreign companies and open accounts without the permission of the Central Bank of the Russian Federation in foreign banks of OECD countries. 2. Simplification for legal entities of the procedure for paying income to non-residents. 3. Attracting loans for a period of more than 180 days from the licensing procedure becomes a notification.
4. Federal Law "On currency regulation and currency control", as amended in 2003	Excessive liberalization of the currency regime
5. Innovations in the Tax Code on pricing (1.01.2012 г.): restriction on the use of preferential tax rates of 5%; taking measures to identify "empty" holdings; withdrawal from preferential taxation of real estate transactions through offshore companies;	These innovations were not supported by the tightening of sanctions in the Tax Code.

6. Article 122.1 establishes control over the transactions of international companies. The goal is to prevent transfer pricing.	A measure in the form of a 20% penalty on unpaid tax does not stop. For comparison - in the USA up to 150% of the amount of unpaid tax

Russia could not exert effective political and financial pressure on offshore jurisdictions to disclose information about national residents like Western countries. There is also a fairly wide range of legal entities and individuals who are not interested in the publicity of their offshore activities. This determines possible directions for improving the regulation of offshore relations from the point of view of the interests of the development of the Russian economy.

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考虑到肩关节的活动性作为提高艺术体操接球质量的一种方式
TAKING INTO ACCOUNT THE MOBILITY OF THE SHOULDER JOINT AS A WAY TO IMPROVE THE QUALITY OF BALL CATCHING IN RHYTHMIC GYMNASTICS

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抽象的。 艺术体操中技术复杂的动作，以及滚球、圈转盘、球杆磨和丝带蛇，包括需要给予高度关注的投掷元素。 本文介绍了一项研究的结果，该研究考虑尝试优化艺术体操运动员的技术训练过程，以提高接球质量，其中一种方法是发展肩关节的灵活性 .

关键词：肩关节，投掷动作，接球，专家评估，运动学特征，艺术体操比赛规则。

Abstract. *Technically complex actions in rhythmic gymnastics, along with ball rolls, hoop turntables, club mills and ribbon snakes, include throwing elements that need to be given great attention. This article presents the results of a study that considers an attempt to optimize the process of technical training of athletes involved in rhythmic gymnastics in order to improve the quality of catching the ball, where one of the ways is to develop the mobility of the shoulder joint.*

Keywords: *shoulder joint, throwing actions, catching the ball, expert assessment, kinematic characteristics, rhythmic gymnastics competition rules.*

In this Olympic cycle, the technical set of complexity of competitive programs with the ball increases, as a rule, due to ball rolls, throws and catching of the object. Throwing elements are the most complex structural group of apparatus exercises,

which is confirmed by the low stability and reliability of their performance in competitions [3]. According to the current rules, throws and catches belong to the fundamental group, that is, they must be performed in each exercise. At the same time, complicated catching is of great value, associated with the risk of losing the object and, as a result, a decrease in marks for difficulty and performance [1]. A significant increase in the number of throwing elements leads to a complication of the conditions for catching them and is characterized by a continuous increase in technical skill, the difficulty of competitive combinations and an increase in the competitiveness of gymnasts [2]. Analyzing the video materials of international competitions in order to identify actual methods of catching an object, where the belt of the upper limbs is directly involved, it was found that in order to increase the complexity and originality of competitive programs, as well as to improve the quality of catching the ball, it is necessary to develop the mobility of the shoulder joint.

To study the features of the means and methods used in the training process to improve the quality of catching the ball, a survey of specialists was conducted. The survey found that:

- coaches point out the relevance of improving the quality of throwing elements, in particular catching the apparatus, as this is an important component at the present stage of the development of competitive programs in rhythmic gymnastics. At the same time, the development of mobility of the shoulder joint is most necessary in an exercise with a ball - 55%, least of all - with a rope, 6% of respondents think so;

- in this regard, there is a need to pay attention to the mobility of the shoulder girdle, according to experts, since this is one of the factors that determine the success of catching an object - 100%.

- the most used means in the development of the shoulder joint, according to trainers, are twists with rubber - 30% and with a rope - 25%.

- mainly affects the development of mobility of the shoulder joint extensibility of ligaments, tendons and muscles (58%), the next factor is the shape of the articular surfaces - 14% and sex - 12%, then the structure of the exercises performed - 10% and age - 8%.

- according to experts, the mobility of the shoulder joint changes with age due to the influence of several factors, such as: a decrease in the elasticity and extensibility of the musculoskeletal apparatus (35%), changes in the articular cartilage (35%), non-use of the articular surface area (30%). All this confirms the need to pay due attention to this issue.

The results of the survey revealed the need to find more effective and efficient ways and methods to improve the quality of catching objects based on the development of shoulder joint mobility. Thus, on the one hand, there is a desire to im-

prove the catching of objects, in particular, catching an object in interaction with the shoulder joint, and on the other hand, the degree of influence of natural data on the quality of catching the ball, as well as the biomechanical features of throwing elements with the ball in artistic gymnastics.

In this regard, a correlation analysis was carried out, aimed at concretizing the methods that determine the technique for performing throwing actions with the ball.

Thus, various degrees of interrelation between physical qualities, results of expert evaluation and kinematic characteristics of throwing actions were revealed. For the analysis, on the basis of pedagogical observation, the most frequently performed ball catching by highly qualified female athletes were selected for analysis: catching the ball behind the head, catching the ball behind the back, catching the ball in one hand in a back flip, catching the ball between in one hand going into the back wave, catching the ball after rebounding hands behind. Using the method of non-contact analysis of the video sequence of movements, the Kinovea licensed program was used to study the kinematics of movements by individual segments of the body. Such indicators were determined as: reaction time and speed of catching (t, s); shoulder joint angle (∠°); the technique of performing the listed elements was evaluated with the help of an expert assessment, deductions in points were applied according to the developed evaluation criteria. The study involved 12 highly qualified sportswomen from Lesgaft National State University of Physical Education, Sport and Health.

In the course of the correlation analysis of physical indicators and the results of an expert assessment, it was revealed that the level of development of physical indicators as the mobility of the shoulder girdle when performing the control exercise №1 - bridge and №3 - the "ring" balance affects the quality of the control exercise №1 - catching the ball behind the head (r=0.80; r=40). This is explained by the fact that when performing this catch, the gymnast must have equal mobility of the right and left shoulder joints, which directly develops when performing such exercises as the bridge and the "ring" balance. When performing control exercise № 5 - catching the ball after rebounding with hands from behind - the strongest relationship was established with the physical indicator of flexibility during the control exercise № 5 - back flip (r = 0.60) - due to the competent implementation of the "exit" phase in the back flip and preservation of the "physiological square" (table 1).

As a result of the correlation analysis, it was revealed that control exercises № 1,2 and 5 have the greatest connection with physical qualities. Based on the data obtained, it was found that the level of development of physical indicators correlates with the quality of catching objects.

Table 1.

The relationship between physical qualities and the results of an expert assessment of the quality of the execution of options for catching the ball (n=12, points)

Expert assessment	Physical qualities				
	bridge	**leg-split**	**balance "ring"**	**forward-flip**	**back-flip**
	mobility of the shoulder girdle, lumbar spine	**mobility of the hip joint**	**coordination abilities, mobility of the shoulder joint**	**mobility of the shoulder girdle, lumbar spine**	**mobility of the shoulder girdle, lumbar spine**
1	**0.80**	-0.04	**0.40**	0.16	0.07
2	0.79	0.42	0.22	0.38	0.04
3	0.34	0.08	0.18	0.08	-0.03
4	0.70	0.02	0.24	0.20	0.53
5	-0.02	0.44	-0.02	0.27	**0.60**

Note: control exercises: 1- catching the ball behind the head, 2- catching the ball behind the back, 3- catching the ball in one hand in a back flip, 4. - catching the ball in one hand going into the back wave, 5. - catching the ball after rebounding with hands from behind; tcr. = 0,5 (p>0,05).

The results of the correlation analysis of the kinematic characteristics of the mobility of the shoulder girdle when catching the ball and expert evaluation showed that the quality of catching the ball in one hand in a back flip, catching the ball in one hand going into the reverse wave and catching the ball after rebounding with the hands from behind depends on the angle of abduction of the hands (r=-0.68). The closer this indicator is to 90˚, the better the gymnast can perform these types of catching the ball. This is due to the fact that the gymnast must be able to control the position of body parts in space (table 2).

Table 2.

The relationship between the results of expert evaluation of the quality of the execution of options for catching the ball and kinematic characteristics (n=12)

Kinematic characteristics	Expert assessment (points)				
	1.	**2.**	**3.**	**4.**	**5.**
angle of abduction at the shoulder joint, ˚	-0.17	-0.15	**-0.68**	**-0.57**	**0.68**
reaction time from throwing to catching the ball (s)	**-0.78**	0.14	0.25	0.31	0.19
amplitude reproduction speed in the shoulder joint while catching the ball (cm/s)	0.39	0.11	0.21	0.35	-0.06

Note: 1- catching the ball behind the head, 2- catching the ball behind the back, 3- catching the ball in one hand in a back flip, 4. - catching the ball in one hand going into the back wave, 5. - catching the ball after rebounding with hands from behind; tcr. = 0,5 (p>0,05).

When analyzing the relationship of control exercise № 1 (catching the ball behind the head) with the kinematic characteristic, the strongest connection was established with characteristic № 2 - the reaction time from the moment the ball was thrown to catching it. This is explained by the fact that the gymnast must accurately distribute her actions at a strictly specified time when catching the apparatus and in a timely manner move her hands to a given amplitude, otherwise the lack of coordination of actions will lead to the loss of the ball.

Considering the relationship between the kinematic characteristics of the execution of options for catching the ball and physical qualities, various levels of relationship were identified (table 3). To a greater extent, the mobility of the shoulder girdle is determined by the degree of abduction of the arms when catching the ball behind the head ($0.58 \geq r \geq 0.65$) and catching the ball after rebounding with the hands from behind ($r=0.68$). When catching the ball behind the back, on the contrary, it is important to first take the hands back and up as much as possible and at the right time to lower the hands, pressing the ball to the back, and with insufficient mobility of the shoulder girdle, the athlete will not be able to reproduce catching the ball, which will lead to large technical errors ($r=-0.53$).

When catching the ball in one hand on a back flip and catching the ball in one hand going into the back wave, it is important to lower the hand evenly (arm abduction speed) 0.3-0.5 m/s (arm abduction speed) 0.3-0.5 m/s (slightly holding the arm at 45-90˚ (without acceleration)) to receive the ball in the palm ($0.58 \geq r \geq 0.63$) and only a high level of mobility of the shoulder joint will allow you to correctly reproduce the amplitude of arm movement.

A timely reaction from the moment of throwing the ball to the moment of catching the ball in one hand, going into the reverse wave, ensures high-quality catching, since it is important to reproduce the desired range of motion with your hand in time and tilt back. Thus, the high level of mobility of the shoulder girdle, the lumbar spine allows you to technically correctly catch the ball, which is mandatory and is estimated according to the FIG 2022-2024 rules at 0.4 points.

Table 3.

The relationship between the kinematic characteristics of the execution of options for catching the ball and physical qualities (n=12)

Control exercise	Physical indicators (points)					
	kine-matic charac-teristics	bridge	leg-split	balance "ring"	forward-flip	back-flip
		mobility of the shoul-der girdle, lumbar spine	mobil-ity of the hip joint	coordina-tion abilities, mobility of the shoulder joint	mobility of the shoul-der girdle, lumbar spine	mobility of the shoul-der girdle, lumbar spine
catching the ball behind the head	1	**0.65**	-0.36	-0.41	0.30	**0.58**
	2	0.16	-0.26	-0.15	-0.23	-0.46
	3	0.26	-0.44	0.00	-0.24	-0.49
catching the ball behind the back	1	0.41	-0.35	-0.15	-0.21	**-0.53**
	2	0.12	-0.23	-0.01	-0.11	-0.15
	3	-0.35	0.31	0.05	0.21	0.38
catching the ball in one hand in a back flip	1	-0.31	0.03	-0.41	-0.35	0.28
	2	0.32	**-0.77**	0.34	0.42	-0.48
	3	0.16	-0.44	0.07	-0.32	**0.58**
catching the ball in one hand leaving in the oppo-site wave	1	0.49	0.12	0.14	-0.03	-0.15
	2	0.15	-0.42	-0.01	**0.54**	**0.58**
	3	**0.63**	-0.33	0.19	-0.26	-0.38
catch-ing the ball after bouncing with hands from be-hind	1	**0.68**	0.15	0.18	-0.12	0.16
	2	0.22	**-0.57**	-0.08	0.45	-0.48
	3	0.48	-0.41	0.16	0.32	-0.28

Note: 1- hand deflection angle, in degrees, 2- reaction time, 3- speed. tcr. = 0,40 ($p<0,05$)

Thus, one of the ways to improve the quality of catching the ball in rhythmic gymnastics is to develop the mobility of the shoulder joint, thereby ensuring physical readiness for catching the ball. It is necessary to correct the technique for improving catching the ball, which would allow to perform catches at a qualitative level in difficult conditions, assessed according to the FIG 2022-2024 rules. First of all, it should include complexes of means that ensure physical readiness for their implementation, namely, complexes of means aimed at developing the mobility of the shoulder girdle, strengthening the muscles and ligaments of the shoulder joint, which ultimately will allow the gymnast to perform complex ball catches with high quality and increase the technical complexity of the competitive programs.

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重度烧伤患儿毒血症期血流动力学与治疗的相关性
CORRELATIONS OF HEMODYNAMICS AND TREATMENT DURING THE PERIOD OF TOXEMIA IN SEVERELY BURNED CHILDREN

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抽象的。 2-3A度烧伤毒血症期间输注2359.2±413.8 ml/天，面积55.1±14.4%，3 B-4.8±3.5%，IF 86.3±15.7个单位有下降趋势 CO、增加 TPVR、MVP、呼吸频率 (-0.8)。 在较年轻的年龄组中，同一方向的相关性不那么明显。 揭示了氨基酸对血流动力学影响的超动力取向。 第 3 组儿童以 7.5±3.9 ml/天的剂量给予 Cytoflavin 对 OBT、MVP、MBP、CO 有中度刺激作用。在 3 岁以下儿童中显示出相同的方向，但不太显着 随着 Cytoflavin 2 毫升/天的引入。

关键词： 毒血症 血流动力学 重度烧伤患儿治疗

Abstract. *With infusion of 2359.2±413.8 ml/day during the period of burn toxemia caused by burns of 2-3A degree with an area of 55.1±14.4%, 3 B - 4.8±3.5%, IF 86.3±15.7 units marked the tendency to decrease CO, increase TPVR, MVP, respiratory rate (-0.8). Correlations of the same direction in the younger age groups were much less pronounced. The hyperdynamic orientation of the effect of amino acids on hemodynamics was revealed. Administration of Cytoflavin at a dose of 7.5±3.9 ml/day to children of the 3rd group had a moderately stimulating effect on OBT, MVP, MBP, CO. The same direction, but less significant, was revealed in children under 3 years of age with the introduction of Cytoflavin 2 ml/day.*

Keywords: *toxemia, hemodynamics, treatment of severely burned children*

Relevance

Unlike an adult patient, the nature and severity of burns in children primarily depend on their age: the younger the age, the more severe the burn with the same area of damage. Burns that occupy an area of more than 1/3 of the body surface are life-threatening for the child. Mortality among children with body burns has recently decreased to 1.86%; it remained relatively high in children under 3 years old - 6.8%. To combat toxemia, the authors recommend continuous parenteral administration of protein preparations, salts, and glucose. On the 14-21st day, sepsis often develops [1-3]. Due to insufficient knowledge of the effect of treatment on age-related hemodynamic reactions during burn toxemia, we tried to study and identify the possible effects of drug therapy on hemodynamic parameters in children at different age periods.

Purpose of the work

To study and evaluate the age-specific correlations of intensive care and hemodynamic parameters in severe burn toxemia in children.

Material and research methods

The severity of the burn was assessed by calculating the surface area of the damaged skin and using the Frank index. The severity of damage to the skin surface was assessed by the area of the burn 2-3A degree, 3B degree, by IF (tab. 1). The main feature that determined the allocation of this group was the duration of intensive care in the intensive care unit (ICU) from 11 to 20 days, due to the severity of the burn disease. The relationship between the dynamics of the studied parameters heart rate (HR), stroke volume (IV), cardiac output (CO), total peripheral vascular resistance (TPVR), estimation of autonomic tone (EAT), myocardium oxygen demand (TNMO), - breathing rate (BR), oxygen saturation (OS) with the volume of intravenous daily fluid administration, kilocalories (glucose), the frequency of administration of painkillers (including sedatives), anti-inflammatory, vasodilating, antibiotics, heparin, vasopressor (dopamine), vitamin C, the amount of injected cytoflavin in ml/day, amino acids in ml/day, proteins in ml/day were determined by the method of pair correlations. The studies were carried out with 100% physiological need provided by enteral administration throughout the entire period of the study of burn toxemia. Intensive care from the moment of admission was aimed at recovery from burn shock, adequate pain relief, timely correction of deviations in homeostasis parameters under the control of clinical, functional and biochemical parameters and intravenous administration of crystalloids, volemic and other solutions under the control of hemodynamics, diuresis volume.

Table 1.

Characteristics of patients

Groups by age	Age in months	Height, cm	Weight, kg	2-3 A	3 B	IF, units	n/d in hospital	n/d in ICU
1	14.2±4.6 months	79.7 ±5.7	10.1 ±1.9	24.8 ±7.4	9±2.8	48.4 ±11.28	41.6 ±10.2	12.8 ±1.3
2	4.0±0.1 years	103.5 ±8.3	16.6 ±2.4	47.9 ±17.1	18.1 ±12.2	85.1 ±28.7	49.9 ±16.9	13.1 ±1.9
3	15±2 years	-	-	55.1 ±14.4	4.8 ±3.5	86.3 ±15.7	38±12	12.7 ±1.1

Results and discussion

Table 2.

The volume of intensive care by age in children

	Up to 3 years	3.1-7 years old	over 7.1 years old
Groups	1	2	3
kilocalories	169.1±39.1	140.4±16.8	215.4±29.5
intravenous fluids	802.1±76.5	1364.4±230.6	2359.2±413.8
number of types of solutions	4.0±0.4	4.6±0.3	5.0±0.4
painkillers	7.7±1.0	8.0±0.5	9.6±1.4
anti-inflammatory	6.5±0.6	7.5±0.7	8.2±0.9
A/B	3.3±0.8	2.7±0.5	2.6±0.6
anticoagulants	3.5±0.5	3.5±0.5	3.7±0.4
amino acids	124.3±39.0	236.7±42.3	467.3±117.1
Fat emulsions	0.0	4.8±7.6	8.2±13.4
Vitamin C	2.1±0.4	2.1±0.3	2.8±0.7
cytoflavin	2.1±1.4	0.8±0.7	7.5±3.9
vasodilating	3.5±0.5	4.7±0.7	3.5±1.0
dopamine	0.2±0.2	0.5±0.2	0.3±0.1
proteins	12.0±12.0	56.8±29.7	29.4±22.2

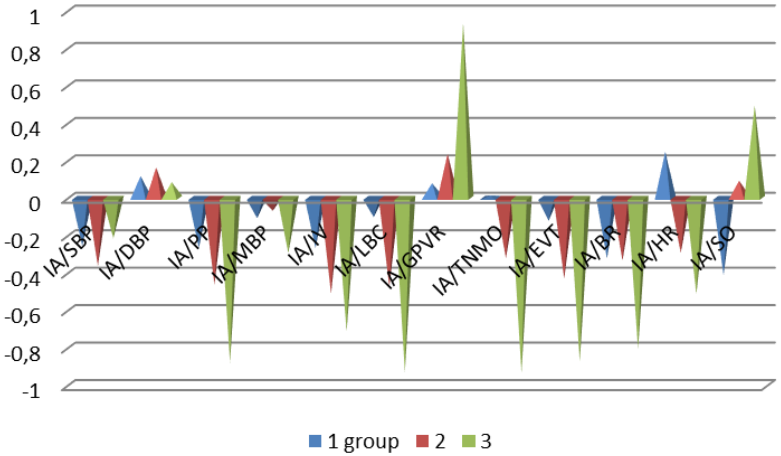

Figure 1. *Correlations of intravenous infusion therapy and hemodynamic parameters*

As shown in fig. 1, an inverse strong correlation was found between the daily volume of infusion and SV (-0.71), the volume of intravenous infusion therapy and PBP (-0.88), as well as CO (-0.93) and positive with TPVR (0.93). With an increase in infusion volume, there was a high risk of a decrease in CO, an increase in TPVR, a decrease in the degree of hypersympathotonic reaction, MVP, and respiratory rate (-0.8). The identified features most likely indicate the stress-protective effect of infusion therapy in children older than 7 years (fig. 1). At the same time, correlations of the same direction in the younger age groups were much less pronounced.

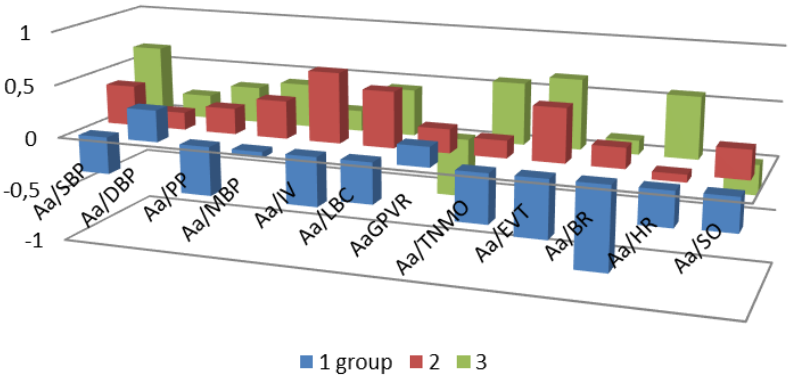

Figure 2. *Correlations between the number of amino acids and hemodynamics*

Amino acids were included in the composition of the parenteral administration of the liquid. In group 3, a tendency was found to form direct correlations between the number of introduced amino acids and MBP (0.65), amino acids and MVP (0.57), OBT (0.64), HR (0.56), inverse correlation of amino acids with TPVR (-0.54). That is, in children of group 3, amino acids caused effects that stimulate sympathetic activity, a tendency to increase MVP, MBP, causing a tendency to decrease TPVR (-0.55). That is, a hyperdynamic orientation of the effect of amino acids on hemodynamics was revealed (fig. 2). The same picture, but somewhat less pronounced, was observed in children aged 3.1-7 years (Group 2). An opposite direction of compensatory reactions was found in children under 3 years of age (Group 1). Thus, there was a trend of feedback between the number of amino acids and OBT (-0.54), BR (-0.77). The latter suggests a positive effect on sympathetic tone and respiratory rate, the latter, possibly, is associated with the effect of compensating for the energy-deficient state of amino acids in infants with severe burns.

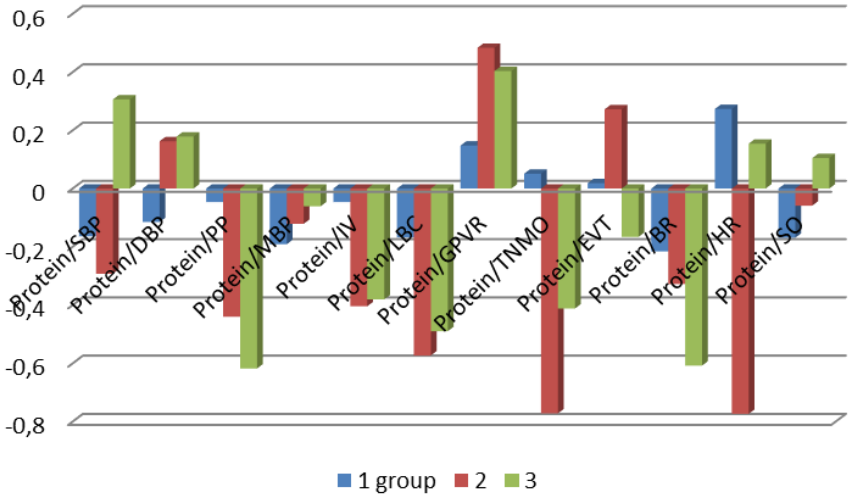

Figure 3. *Correlations of protein solutions and hemodynamic parameters*

In group 1, the correlation between the amount of administered proteins and hemodynamic parameters was insignificant due to the low volume of albumin transfusion, which averaged about 12 ml/day. Draws attention to the most pronounced compensatory reactions in children of the 2nd group to the introduction of proteins (fig. 3) on average 56.8 ml/day. Thus, an inverse correlation was found between the amount of administered proteins and PBP (-0.44), CO (-0.57), MVP

(-0.77), HR (-0.77) in children of the 2nd group. In group 3, with the introduction of an average of 29.4 ml per day, the feedback of the amount of proteins and PBP (-0.61), with BR (-0.6), increased, but turned out to be weaker with MVP (-0.44) and disappeared with HR(0.15).

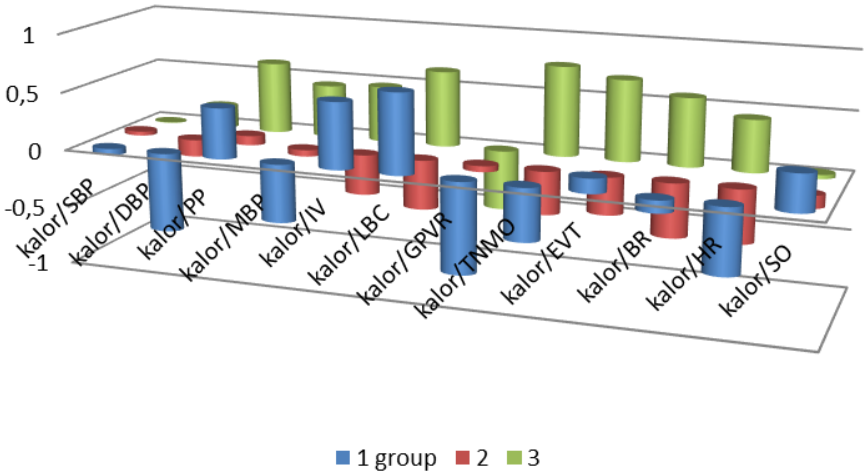

Figure 4. *Correlations of kilocalories and hemodynamics*

Part of the infusion therapy was the introduction of hypertonic (10%, 20%) glucose solutions, taking into account the energy value of the drug (fig. 4). In group 1, there was a strong inverse correlation between kcal and DBP, TPVR, and less significant with MBP, MVP, as well as a direct relationship with SV, CO. That is, in the 1st group, the injected solutions caused a hyperdynamic orientation of the restructuring of hemodynamic parameters during the period of severe toxemia in infants. In group 3, a stimulating effect on MVP was revealed.

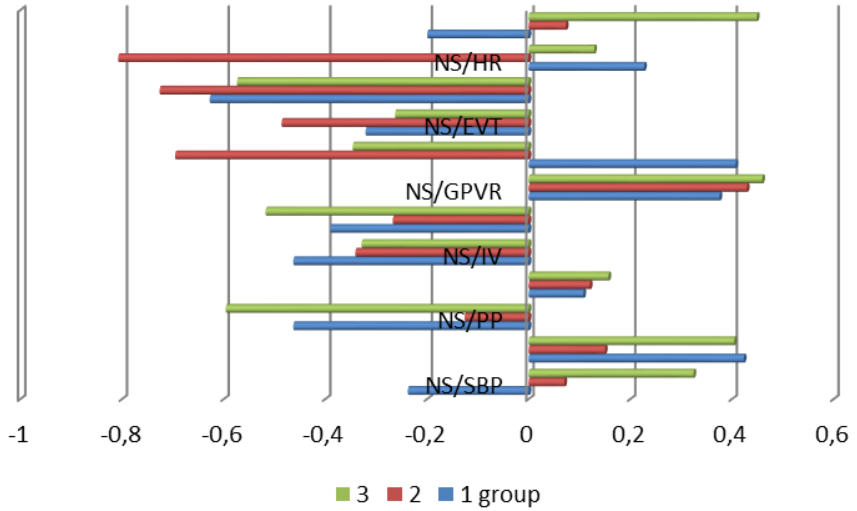

Figure 5. *Correlations between the number of types of solutions and hemodynamics*

A strong inverse relationship between the number of types of solutions and HR, BR and MVP was found in group 2 (fig.5).

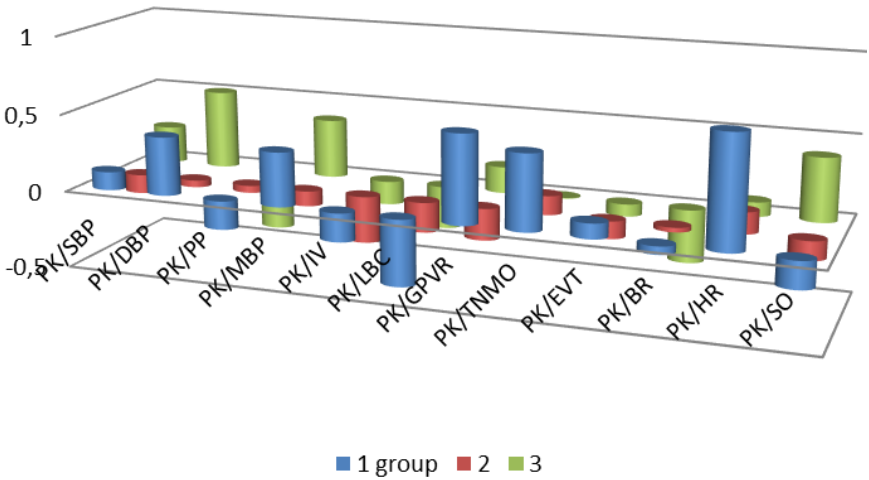

Figure 6. *Correlations of anesthesia and hemodynamics*

Significantly significant correlations between the multiplicity of pain relief and hemodynamic parameters have not been identified (fig.6.)

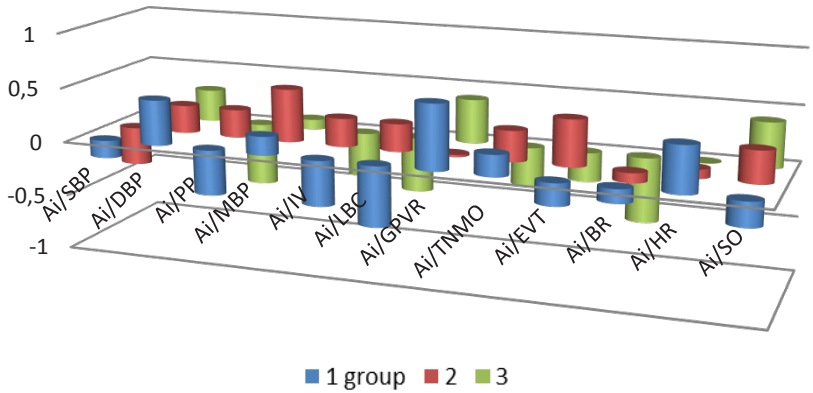

Figure 7. *Correlations between anti-inflammatory therapy and hemodynamics*

A feedback trend was found between anti-inflammatory therapy and PBP (-0.57), SV (-0.4), CO (-0.5), BR (-0.58) in group 3 (fig.7).

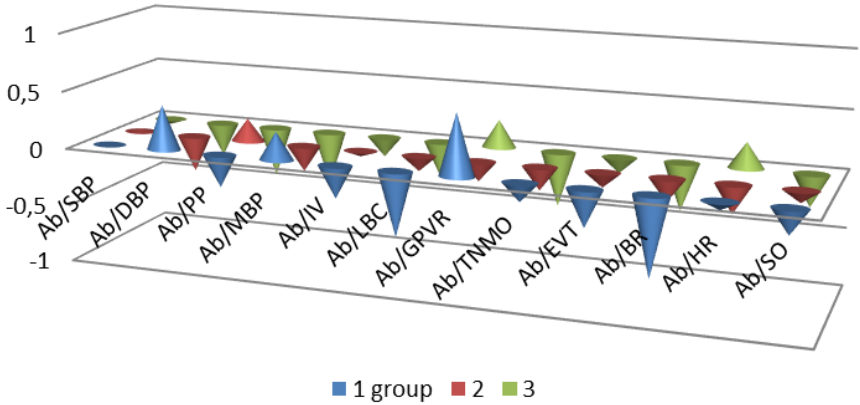

Figure 8. *Correlations between antibiotics and hemodynamics*

Significant age-related features of the effect of antibiotic therapy on hemodynamics were not revealed (fig. 8).

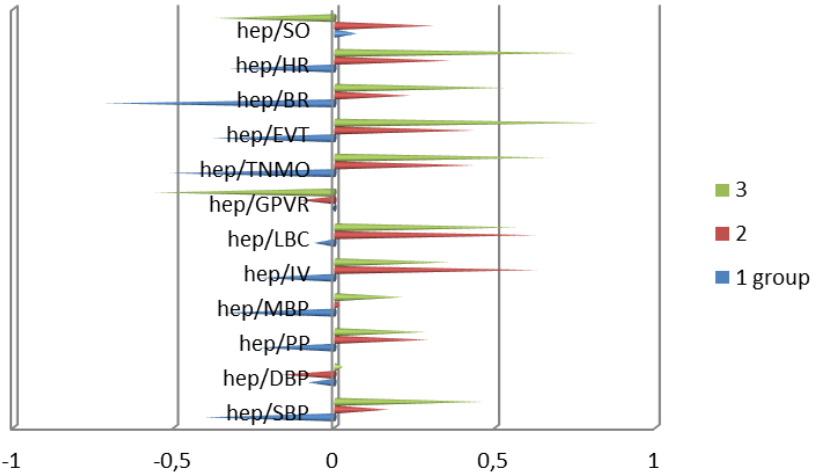

Figure 9. *Correlations of heparin and hemodynamic parameters depending on age*

A direct strong correlation was found in the 3rd group of the multiplicity of anticoagulant therapy on the indicators of HR, OBT, in the 2nd group there was a tendency to increase in SV and CO (fig.9).

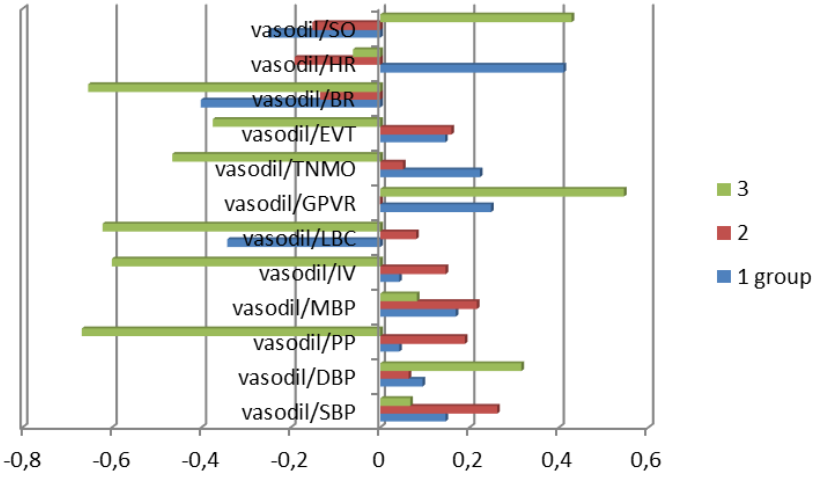

Figure 10. *Correlations between vasodilators and hemodynamics*

A direct correlation between the frequency of administration of vasodilators and indicators of oxygen saturation, TPVR and inverse with SV, CO was found in group 3 (fig. 10).

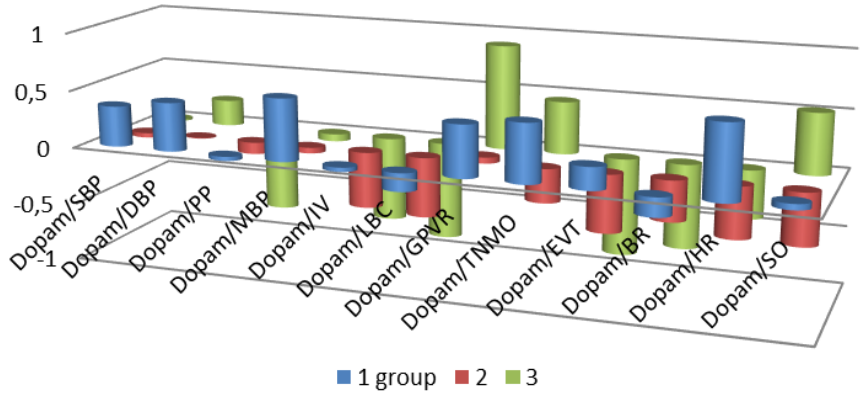

Figure 11. *Correlations of dopamine and hemodynamics*

The administered dose of the vasopressor did not significantly affect the hemodynamic parameters during the period of toxemia in children (fig. 11).

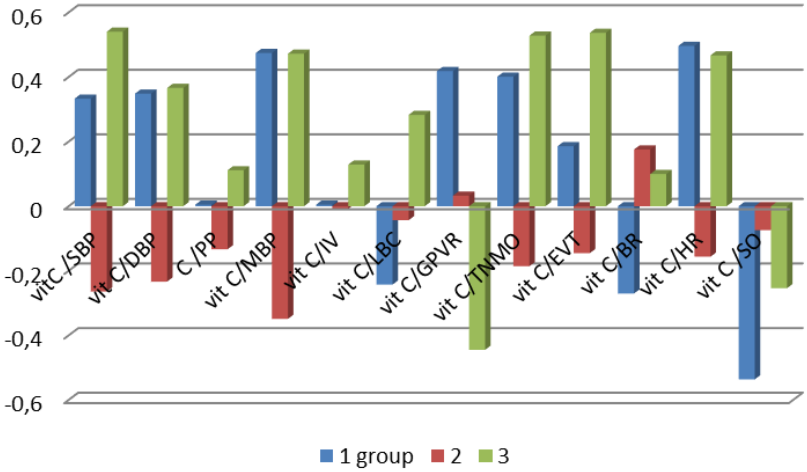

Figure 12. *Correlations between the frequency of vitamin C administration and hemodynamics*

Moderate direct correlations of vitamin C with MBP, MBP, MVP, OBT, HR were found in children of the 3rd group, in the first group they were less pronounced. In group 2, the introduction of vitamin C 2 times a day had the opposite effect (fig. 12).

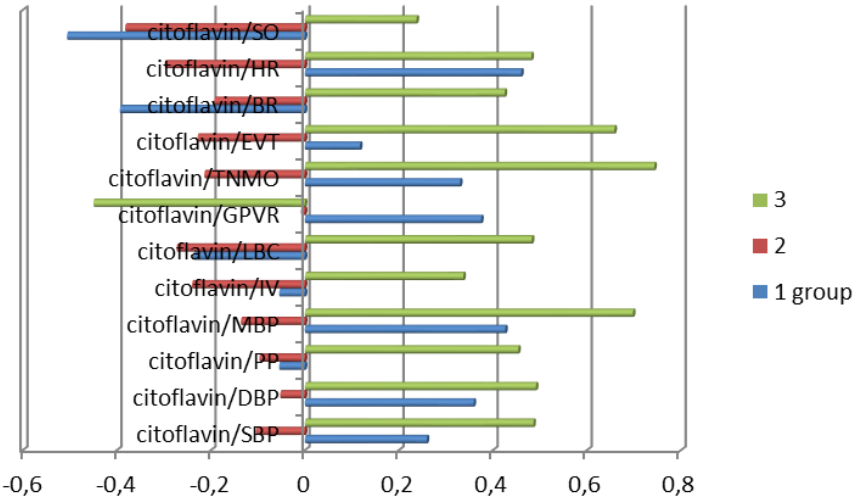

Figure 13. *Correlations of cytoflavin with hemodynamic parameters*

Administration of Cytoflavin at a dose of 7.5±3.9 ml/day to children of the 3rd group had a moderately stimulating effect on OBT, MVP, MBP, CO. The same trend, but less significant, was found in the 1st group of children (2 ml/day). While in the 2nd group, the introduction of an average of 0.8 ml/day had an insignificant reverse effect on hemodynamic parameters (fig. 13).

Conclusion

With an increase in infusion volume, there was a tendency to decrease CO, increase TPVR, MVP, respiratory rate (-0.8) in children older than 7 years. At the same time, correlations of the same direction in the younger age groups were much less pronounced. The hyperdynamic orientation of the effect of amino acids on hemodynamics was revealed. Administration of Cytoflavin at a dose of 7.5±3.9 ml/day to children of the 3rd group had a moderately stimulating effect on OBT, MVP, MBP, CO. The same trend, but less significant, was found in the 1st group of children (2 ml/day).

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恢复关于生殖健康问题的经典传统观点

RESTORATION OF THE CLASSICAL CONVENTIONAL POINT OF VIEW ON THE REPRODUCTIVE HEALTH ISSUES

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抽象的。 参加初级课程的女孩不属于生育年龄组。 因此，作为一项规则，当意外怀孕发生时，由于缺乏与孕妇健康和教育相关的教育和社会学知识，就会出现问题。 同时，孕妇也很难将学习问题与妊娠问题结合起来。 18-19岁的本科生不属于生育年龄组。 因此，作为一项规则，当意外怀孕发生时，他们会出现健康和学习问题。

关键词：生育年龄组，计划外怀孕，孕妇的健康和教育。

Abstract. *Girls enrolled in junior courses do not belong to the fertile age group. Therefore, as a rule, when an unplanned pregnancy occurs, problems arise due to the lack of knowledge of educational and sociological aspects related to both health and education of a pregnant woman. At the same time, it is difficult for pregnant women to combine the problems of learning with the problems of gestation. Undergraduate students aged 18-19 do not belong to the fertile age group. Therefore, as a rule, when an unplanned pregnancy occurs, they have health and learning problems.*

Keywords: *fertile age group, unplanned pregnancy, health and education of a pregnant woman.*

Relevance

Physiological and psychological changes during pregnancy are closely interconnected. Physiological changes affect emotions, as they are partly caused by the

changes characterized by lability and inconsistency (Ermakova E. S. et al., 2020). The main factors of the unfavorable outcome of pregnancy are as follows: the level of organization of work at maternity institutions (Suprun S. V. et al.., 2017); and the combined influence of social and biomedical factors (Filonov V. A. et al., 2009). Pregnancy at a fertile age is usually associated with the stabilization and gradual correction of the state of the immune and endocrine systems. However, in young pregnant women under the fertile age (up to 20-21 years old), pregnancy is often accompanied not only by physiological, but also social, economic, and moral problems. Because of this, chronic diseases worsen, those existing ones progress, which also has a bad effect on both a pregnant woman and her unborn child (Kitae Sohn, 2017; Kuhtova N. V., 2009). The physiological and psychological state consists of a large number of factors, among which "family relations" is one of the major ones. For a favorable intrauterine development of the baby, harmonious conditions of marital relations are mandatory (Abdurakhmanov F. M. et al., 2006). Negative factors accompanying the life of a pregnant woman will affect her health, and the first diseases that will indicate deadaptive processes in the body - urgent manifestations of adaptation to negative factors - diseases of the upper respiratory tract (rhinitis, bronchitis, etc.), (Suprun S. V. et al., 2017).

Women's well-being, and especially emotional, plays an important role in the formation of the social health of pregnant women. It consists of a number of factors: relationships with a partner, as well as the satisfaction with married life; attitude to pregnancy as a favorable situation; emotional acceptance of the unborn child and a positive attitude to pregnancy; one's own emotional state and self-satisfaction (Bezrukova O. N. et al., 2007). The fear of childbirth and the worries about the baby refer to the emotional states of a traumatic character (Kovalenko N. P., 1999). It can be concluded that the psychological state of a woman plays an important role in the course of the pregnancy and the childbirth. An urgent issue is informing pregnant women not only about preparing for childbirth and feeding, but also presenting themselves as pregnant; being ready to accept the changes that will occur due to changes in the body; being able to keep yourself under control, i.e. your body, thoughts, feelings, and emotions. All this is important for a favorable course of pregnancy (Dobryakov I. V., 2011). University students who have dared to give birth to a child face the problems of the daily routine, since the loads associated with studying at the university require considerable time. Most often, the lack of time is replenished at the expense of sleep (M. A. Reunova, 2013). According to the results of the recent studies, reducing the duration of sleep for less than 6 hours per day increases the probability of surgical delivery by 4.5 times, and with existing sleep disorders – by 5.2 times (Golokov V. A. et al., 2019). Since the early 2000s, there has been an increase in the number of women giving birth for the first time at an older reproductive age. This trend can be traced

in the countries of Europe and Russia (Smirnova E. E. et al., 2019). Women who are preparing for motherhood, face difficulties of bearing on the background of studying at a university. Junior students aged 18-19 do not belong to the fertile age group. Therefore, as a rule, when an unplanned pregnancy occurs, they have problems both in health and in education. The analysis of the scientific literature has shown that the most studied issues are those related to the physical condition of a pregnant woman and influencing factors. The relevance of the topic is due to the low level of study of educational and sociological aspects related to the change in the position of a pregnant woman in society.

The purpose of the study is to obtain an intellectual product with the participation of students to restore the classical point of view and assimilation of educational materials about the reproductive health in young men and women aged 17-19.

Methods and Materials

In the very beginning of the first academic semester, the question of switching to distance learning arose.

Online learning set certain tasks for students and teachers: the object of the study; the possibility of students ' intellectual contribution to resolving the problems of distance teaching of reproductive health issues; the subject of the study; intellectual products (a social video (Figure 1), a training manual, demonstration models) that contribute to the restoration of the classical point of view on the issues related to reproductive health (Figure 2).

Under these conditions, we developed the training manual (Reproductive health of young people as the basis of a healthy nation: practical course / E. D. Tcelykh, G. G. Zdorovtsev, D. A. Skvortsov. Khabarovsk: FESTU publishing house, 2021), which corresponds to the working program of the discipline "Human Physiology".

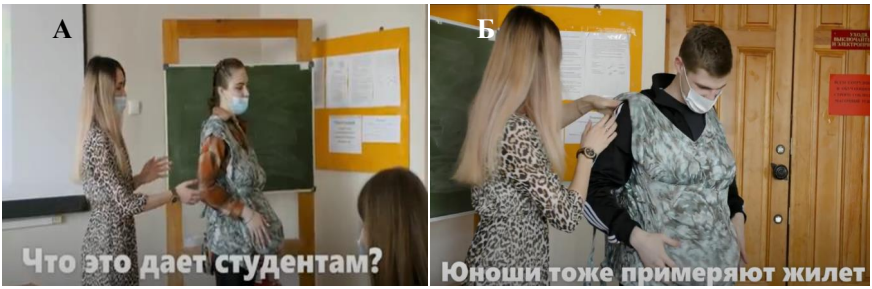

Figure 1. *Fitting " Pregnancy vest with imitation of fetal movements"*
Note: the models are students of Natural Sciences FESTU (February, 2021): A - 1st year student Natalia B.; B - 1st year student Igal O.

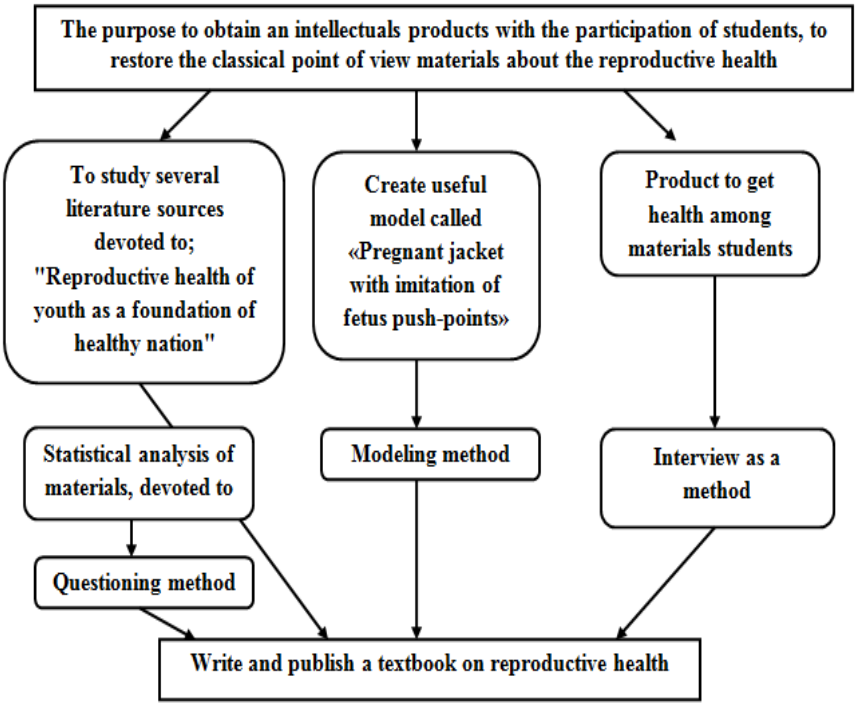

Figure 2. *Study design*

Some of the works included in the training program were supposed to be easily reproduced at home. There was a need for the availability of theoretical and illustrative materials, despite the impossibility of attending classroom classes and libraries. The manual is presented in printed and electronic form. Adjustments, in the form of changes in the form of classes, the use of additional related materials, were made by students during training, and were taken into account when publishing the training manual by one of the authors of the item – the student-author of this publication, some visual illustrative materials were developed that allow better assimilating the content of the discipline. For example, a model of a "Pregnancy vest with imitation of foetal movements" (PVWIFM). To perform the demo model, some parts were ordered from abroad.

Results and conclusions

The originality of the idea is connected with the possibility of intellectual contribution of students to resolving the problems of distance teaching of reproductive health issues. Intellectual creative products were designed and presented for the

assimilation of materials about reproductive health in boys and girls aged 17-19: several sections in the training manual created by a group of authors; a model of PVWIFM was created, a patent search is being carried out (Figure 3); the material of a social video devoted to the problems of reproductive health was removed and launched on the stands of the university and in social networks.

Figure 3. *Operating moment of connection microchips for the "Pregnancy vest"*

The public opinion poll confirmed the hypothesis that the publication of materials, the use of demonstration models, the display of a social video created with the participation of students have a positive effect on the acquisition of knowledge and the development of a position on the reproductive health in young men and women of junior courses (**Figure 4**).

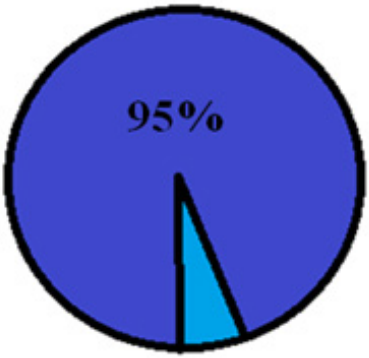

Figure 4. *The ratio of control questions with correct/incorrect answers*

The presented scientific and practical work is completed, it has a pronounced social validity, participates in the restoration of the classical point of view on issues related to reproductive health. The purpose and tasks set in the work have been fully implemented, despite the complexity of distance education. The complex work was carried out using the study of literary sources, the method of modeling, interviewing, videography, and questionnaires.

This work was in demand by information agencies of different levels: intra-university, regional, federal (**Table 1**).

Table 1.

Participation in work with the media

№ p/p	Name of the work, its type	Channel format	Name of the organization
1	Interview	Intra - university	PRESS CENTER FESTU from 26.04.21
2	Interview	Regional	TV channel "Gubernia" from 22.04.21
3	Interview	Regional	TV Channel 6 TV from 22.04.21
4	Publications in newspapers	Regional	IA "Khabarovsk Krai today", Links in publications: 1) Without format from April 16, 2021 2) Siberia. INFO from April 17, 2021
5	Reportage	Federal	Channel 5 Saint Petersburg from 04/26.21

Conclusions

1. The manual is included in the educational process, sent to the library of the FESTU and presented for general access in printed and electronic versions (February, 2021y.), (**Figure 5**)

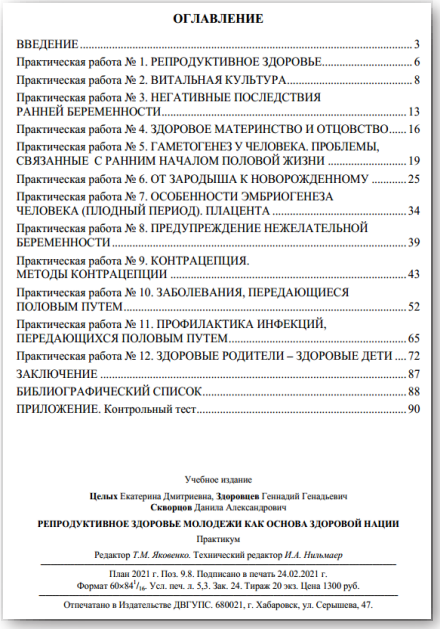

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Figure 5. *training handbook*

2. According to the results of a social survey in which the students of the Institute for Natural Sciences (FESTU) participated (n=44) during the distance learning, 90% of students answered half of the questions incorrectly (**Figure 6**).

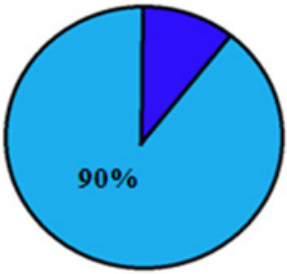

Figure 6. *The ratio of control questions with correct/incorrect answers*

Note: here and further: – correct answers;

– incorrect answers.

The results of the survey confirmed our opinion about the need for development of intellectual products with the direct participation of students, which, as the further educational process showed, has a positive effect on the assimilation of the educational materials and the development of a position regarding reproductive health in young men and women, junior students. The emphasis in the training manual was made based on the issues that cause the most contradictory opinions expressed by the respondents.

3. The feeling of empathy, which is noted by both young men and women in the process of getting acquainted with the model of PVWIFM, forms positive emotions and stimulates educational activities. The repeated survey showed that 95% (!) of students gave right answers to half of the questions (**Figure 7**).

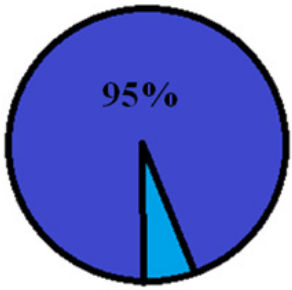

Figure 7. *The ratio of control questions with correct/incorrect answers*

Note: here and further: – correct answers;

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在结核病背景下评估 COVID-19 严重程度的风险：系统评价和荟萃分析
ASSESSMENT OF THE RISK OF SEVERITY OF COVID-19 ON THE BACKGROUND OF TUBERCULOSIS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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抽象的。冠状病毒感染与肺结核一样，主要影响呼吸器官，因此有理由假设这些疾病会相互加重。迄今为止，尚未充分研究结核病与 COVID-19 相结合的流行病学和临床特征。荟萃分析数据表明，结核病可加重 COVID-19 的病程并恶化预后 [1]。

目的。在结核感染的背景下评估 COVID-19 病程严重程度的风险。

材料和方法。在各种数据库（PubMed 数据库、MEDLINE、Cochrane 图书馆、Embase、ClinicalTrials.gov、medRxiv 和 bioRxiv 预印本、科学电子图书馆）中搜索了 2020 年至 2022 年发表的研究。临床查询和时间过滤器用于搜索出版物。荟萃分析包括 2020 年 1 月 1 日至 2022 年 1 月 31 日期间发表的研究文章，没有语言限制。纳入标准：开放式随机对照试验；队列和病例对照研究。排除标准：伪随机化、没有对照组、在各种来源重复发表；在同一组患者的参与下进行的重复研究；研究人员对研究输入的直接干预；以及混杂因素的存在，包含计算数据量不足的文章。

结果。在这项研究中，在 1670 份已确定的出版物中，考虑到纳入和排除标准，选择并纳入了 10 份出版物，总容量为 21234 名 COVID-19 患者。所有研究都对数据进行了回顾性分析。结核病人群中 COVID-19 患者的重症风险为 1.13 [CI 0.74-1.73]。比较组之间没有统计学上的显着差异。

结论。不可能断定活动性肺结核是加重 COVID-19 病程的一个因素。以结核病为背景的新型冠状病毒感染病程问题需要进一步研究。

关键词：COVID-19、结核病、危险因素、病程严重程度、严重程度。

Abstract. *Coronovirus infection, like tuberculosis, mainly affects the*

respiratory organs, which gives reason to assume a mutual aggravating effect of these diseases. To date, the features of the epidemiology and clinic of tuberculosis in combination with COVID-19 have not been sufficiently studied. Meta-analysis data suggest that TB can aggravate the course and worsen the prognosis of COVID-19 [1].

Purpose. *Assessment of the risk of the severity of the course of COVID-19 against the background of tuberculosis infection.*

Materials and methods. *Searches for studies published from 2020 to 2022 were performed in various databases (PubMed database, MEDLINE, the Cochrane Library, Embase, ClinicalTrials.gov, medRxiv and bioRxiv preprints, scientific e-library). Clinical Queries and time filters were used to search for publications. The meta-analysis included research articles published between January 1, 2020 and January 31, 2022 without language restrictions. Inclusion criteria: open randomized controlled trial; cohort and case control studies. Exclusion criteria: pseudo-randomization, absence of a comparison group, repeated publications in various sources; repeated studies performed with the participation of the same group of patients; the presence of direct intervention of researchers in the input of the study; and the presence of confounding factors, articles that contained an insufficient amount of calculated data.*

Results. *In this study, out of 1670 identified publications, taking into account the inclusion and exclusion criteria, 10 publications with a total capacity of 21234 patients with COVID-19 were selected and included. All studies analyzed data retrospectively. The risk of severe disease among people with COVID-19 in the TB population was 1.13 [CI 0.74–1.73]. There were no statistically significant differences between the compared groups.*

Conclusion. *It is impossible to conclude that active tuberculosis is a factor that aggravates the course of COVID-19. The problem of the course of a new coronavirus infection against the background of tuberculosis requires further study.*

Keywords: *COVID-19, tuberculosis, risk factors, course severity, severity.*

Conflict of interests

The authors declare the absence of obvious and potential conflicts of interest related to the publication of this article.

Source of financing

Own funds

Introduction

The novel coronavirus infection (COVID-19) pandemic has had worldwide health, social and economic impacts. To date, according to Johns Hopkins University, more than 446 million cases of COVID-19 have been registered in the

world, from the WHO report it follows that more than 10 million people fall ill with tuberculosis every year [2,3]. Tuberculosis, as well as coronavirus infection, mainly affects the respiratory organs, which suggests a mutual aggravating effect of these diseases.

According to the study by Stochino C. and co-authors, patients with tuberculosis tolerated COVID-19 in a milder form, without the need for oxygen therapy [4]. These data correlate with the results of the study by Lebedeva I.B. and co-authors, who explain that the clinical course of COVID-19 against the background of tuberculosis was characterized by predominantly mild forms with a lower realized risk of developing viral pneumonia and a significantly lower frequency of need for oxygen therapy [5].

Purpose of the study

Assessment of the risk of the severity of the course of COVID-19 against the background of tuberculosis infection.

Materials and methods

Studies were searched in various databases (PubMeddatabase, MEDLINE, theCochraneLibrary, Embase, ClinicalTrials.gov, medRxiv and bioRxiv preprints, elibrary). ClinicalQueries and time filters were used to search for publications. The meta-analysis included articles published between January 1, 2020 and January 31, 2022 without language restrictions, using keywords and their combinations. In Pubmed and Embase – Tuberculosis OR Tubercular OR Tuberculous OR TB OR Mycobacterium OR Mycobacterial AND (COVID-19 OR “COVID19” OR COVID19 OR nCoV OR 2019nCoV OR 2019-nCoV OR CoV-2OR “CoV2” OR SARS-CoV-2 OR SARS -CoV-2), in the e-library - "COVID-19", "tuberculosis", "risk factors", "severity". The outcomes of interest were severity (severe, critical, intensive care unit [ICU] admission, invasive mechanical ventilation [MV], intubation, or death). Publication inclusion criteria: open randomized controlled trial; cohort and case control studies. In the presence of several publications devoted to different stages of the same study, the latest work was included in this study. To exclude systematic errors associated with the influence of comorbid conditions on the outcome of diseases, persons under 65 years of age were included in the inclusion criteria.

Exclusion criteria: pseudo-randomization; absence of a comparison group; recurring publications in various sources; repeated studies performed with the participation of the same group of patients; the presence of direct intervention by researchers entering the study and the presence of confounding factors; articles that contained an insufficient amount of calculated data; subjects were 65 years of age or older.

Statistical data processing was performed using the Review Manager version 5.4 for Windows (https://training.cochrane.org). To visualize the results obtained in the course of the work, the Forestplot graph was used. The publication selec-

tion flowchart was created using the PRISMA tool (Preferred Reporting Items for Systematic reviews and Meta-analysis), www.prisma-statement.org. The heterogeneity of the data obtained was assessed using the Cochran Q and I^2 tests. An assessment of the publication bias of the meta-analysis results was performed by interpreting the graphical results of the funnel scatterplot.

Due to the heterogeneity of case-control studies and, on the contrary, the homogeneity of cohort studies, the Mantel-Haenszel method for random and fixed effects was chosen for the meta-analysis. Calculations were made of the standard deviation for the natural logarithm of the odds ratio, the odds ratio for each individual study, and 95% confidence intervals for them. Confidence intervals were calculated for dichotomous data according to the Cochrane Handbook of Systematic Reviews. Differences were considered statistically significant when the probability of rejecting the correct null hypothesis was $p \leq 0.05$.

Results and discussions

Out of 23,296 identified publications, 10 publications with a total capacity of 21,234 patients with COVID-19 were selected and included in the study, taking into account the inclusion and exclusion criteria [6-15]. In all studies, data were analyzed retrospectively (**figure** 1).

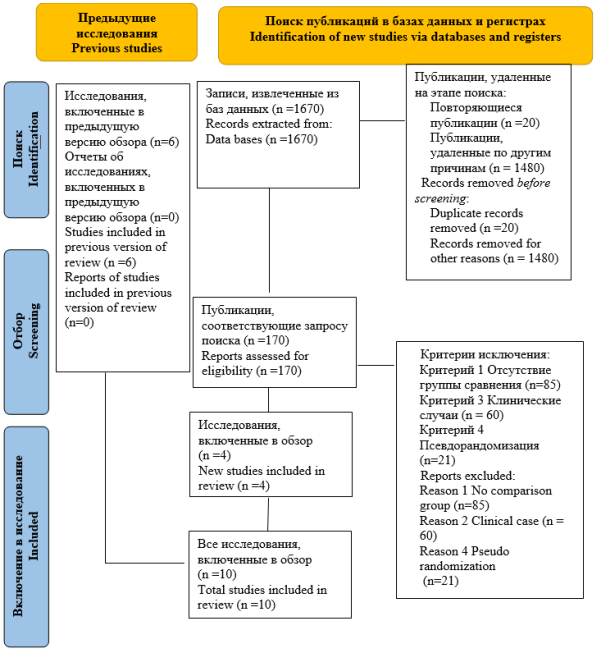

Figure 1. *Flow chart for study selection*

The proportion of patients with pulmonary tuberculosis among patients with COVID-19 in the 10 studies included in the meta-analysis ranged from 0.23% to 2.48%. Data on the highest proportion of patients with tuberculosis (2.48%) are presented in a study by Nachega JB et al. [11]. In 4 studies, the proportion of patients with tuberculosis among patients with COVID-19 is below 0.5%, in 5 studies it ranges from 0.78% to 2.48%. The average value of the proportion of patients with tuberculosis among patients with COVID-19 was 0.6%, the average age of patients was 48.8±10.7 years. Based on the results of the meta-analysis, there was no significant risk of developing severe COVID-19 in the group of people with tuberculosis (OR = 1.13 [CI 0.74–1.73]) relative to the population without tuberculosis. There are no statistically significant differences between the compared groups. Moderate heterogeneity was observed between studies (I^2 = 57%), for Chi-squared p value = 0.01 (**figure** 2).

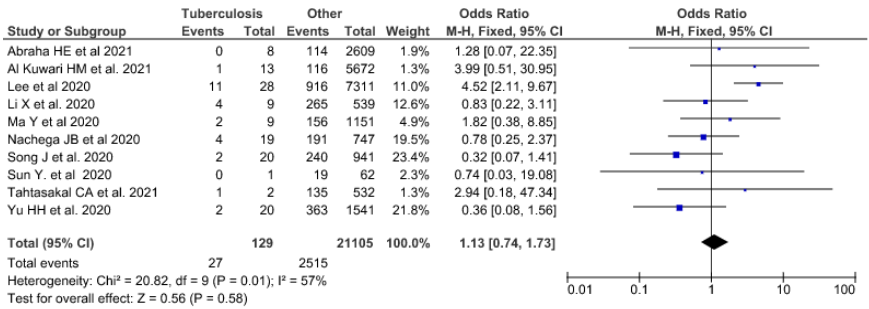

Figure 2. *Impact of tuberculosis on the severity of COVID-19 in patients*

When evaluating the funnel plot, it cannot be concluded that there are no obvious publication biases, the study by Lee et al. differed significantly from the weighted averages of other studies **(figure 3)**.

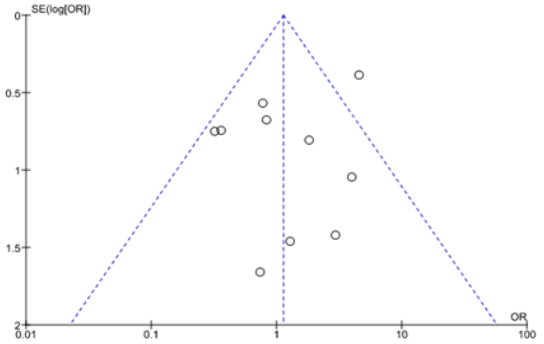

Figure 3. *Assessment of publication bias of meta-analysis results*

Based on the meta-analysis, it cannot be concluded that active tuberculosis has an impact on the severity of the infectious process in COVID-19. However, the data obtained cannot fully exclude the influence of other comorbidities on the severity of the course [16,17]. The severity of the course of COVID-19 to a greater extent may be associated with non-infectious comorbidity and advanced age. In the study of Klypa T.V. and co-authors, the clinical status of a patient with severe COVID-19 is described as: an elderly patient with increased body weight, underestimated comorbidities at the prehospital stage, severe respiratory failure, moderate pulmonary hypertension, elevated levels of fibrinogen, D-dimer, glucose and ferritin blood serum, C-reactive protein, procalcitonin, IL6 in blood serum, which may indicate the role of concomitant non-infectious pathology [18].

A study by Visca D. and co-authors indicates that older people over 70 years of age with comorbidities have a higher risk of developing a severe course of COVID-19 [19].

Conclusion

Therefore, it cannot be concluded that active TB is a worsening factor for COVID-19 1.13 [CI 0.74 – 1.73] compared to the general population without TB. There were no statistically significant differences between the compared groups. The problem of the course of a new coronavirus infection against the background of tuberculosis requires further study.

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开菲尔谷物的微生物景观
MICROBIAL LANDSCAPE OF KEFIR GRAINS

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Probiotics and fermented milk products have attracted the attention of scientists from various fields such as healthcare, industry and pharmaceuticals. In recent years, reports have shown that dietary probiotics such as kefir have great potential for cancer prevention and treatment. Kefir is a fermented milk derived from grains that contain a specific and complex mixture of bacteria and yeasts living in a symbiotic association. They can be described as gelatinous white or slightly yellow irregular masses with an elastic consistency and ranging in size from 0.3 to 3.5 cm in diameter.(1) Kefir grains contain approximately 83% water, 4-5% proteins, and 9-10% a polysaccharide called kefiran. The nutritional composition of kefir varies depending on the composition of the milk, the microbiological composition of the grains used, fermentation time/temperature, and storage conditions. Kefir comes from the Caucasus and Tibet. It has been historically reported to be a probiotic drink with great health-promoting potential, as well as a safe and inexpensive food that is easy to produce at home. (2) Regular consumption of kefir has been associated with improved digestion and lactose tolerance, antibacterial effect, hypocholesterolemic effect, plasma glucose control, antihypertensive effect, anti-inflammatory effect, antioxidant activity, anticarcinogenic activity, antiallergic activity, and healing effects.

Kefir 01, Russian kefir grains were obtained from a private household in Moscow, which is located in the center of Russia.

Kefir 02 - Caucasian kefir grains were obtained from a private household in the Caucasus.

Determination of the composition of yeast cultures in several kefir grains

Kefir grains Kefir 01 were chosen for the experiment. Analysis of the studied kefir grains made it possible to draw conclusions about the species composition of yeast in the studied samples. (tables 1 and 2).

Table 1.

Kefir 01								
	Taxon	**%**		**%**		**%**		**%**
Phylum	*Ascomycota*							100
Class	*Saccharomycetes*							100
Order	*Saccharomycetales*							100
Family	Saccharomycetaceae	98.36	*Pichiaceae*	0.08	*Dipodascaceae*	1.2	?	0.36
Genus	*Kazachstania*	98.36	*Pichia*	0.08	?	1.2	?	0.36
Species	***Kazachstania turicensis***	**85.08**	***Pichia kluyveri***	**0.08**	**?**	**1.2**	**?**	**0.36**
	Kazachstania unispora	**13.28**						

Table 2.

Kefir 02										
	Taxon	%		%	Taxon	%		%		%
Phylum	*Basidiomycota*			2.08	*Ascomycota*					97.92
Class	*Agaricomycetes*			2.08	*Saccharomycetes*					97.92
Order	*Agaricales*	0.28	*Hymenochaetales*	1.8	*Saccharomycetales*					97.92
Family	*Tricholomataceae*	0.28	*Schizoporaceae*	1.8	*Saccharomycetaceae*		97.48	*Dipodascaceae*		0.38

When comparing the species composition of yeast in Kefir 01 and Kefir 02 grains, the percentage advantage of fungi of the *Saccharomycetes* class is revealed, however, in Kefir 02 there is also an insignificant amount of yeast of the *Agaricomycetes* class - 2.08% (tab. 2). The prevalence of yeasts of the genus *Kazachstania* in the studied grains was recorded - 98.36% and 97.92% in Kefir 01 and Kefir 02 grains, respectively.

The low percentage presence of yeasts of the *Agaricomycetes* class compared to the *Saccharomycetes* class in the Kefir 02 grain sample does not yet indicate the importance of one or another genus in the microbial landscape and grain functionality. It is very possible that cells present in small numbers play important and significant roles in the physiology of the complex microbial community of grain.

Determination of the composition of bacterial cultures in Kefir 01 kefir grains

Practical method 16S rRNA profiling with bacterial primers revealed almost 100% bacterial predominance in the studied kefir grain Kefir 01.(2)

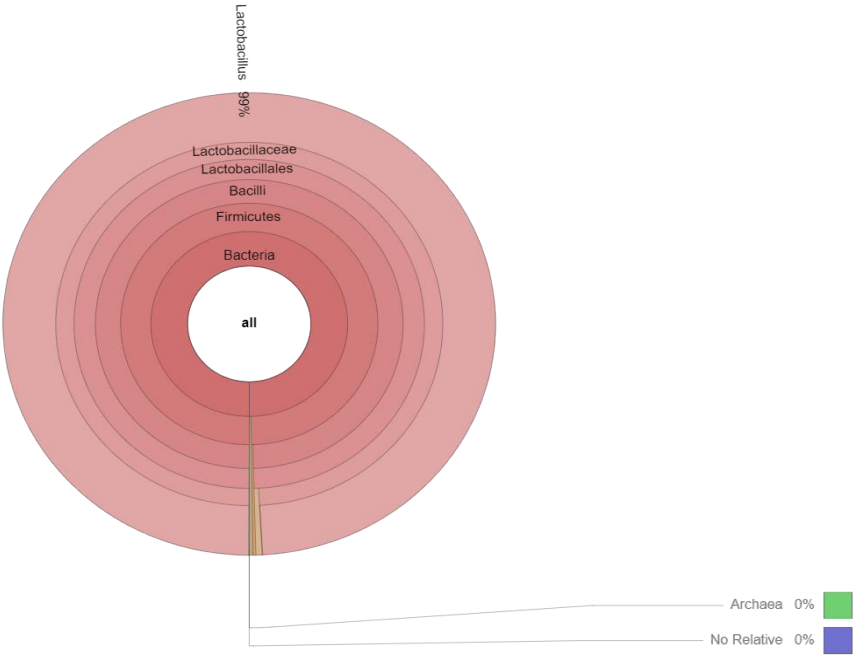

Figure 1. *Diversity of bacteria in the composition of kefir grain Kefir 01, determined by the results of high-throughput sequencing of the 16S rRNA gene*

It can be seen from the sequencing results that our studied kefir beans are dominated by lactobacilli in beans from Kefir 01.

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沉淀三羟铝石Al(OH)$_3$的热行为
THE THERMAL BEHAVIOR OF PRECIPITATED BAYERITE AL(OH)$_3$

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抽象的。 研究了通过氨沉淀获得的三羟铝石形式的氢氧化铝。 沉淀pH值采用电位法测定。 使用热分析、X 射线衍射和 IR 分析确定了高达 800 °C 的三羟铝石转变序列。 氮吸附-解吸研究可以确定勃姆石和 γ-Al_2O_3 的比表面积、体积和孔尺寸。

关键词：勃姆石，γ-Al_2O_3，三羟铝石，热解，热分析，衍射图。 红外光谱，孔径分布

Abstract. *It was studied aluminum hydroxide in the form of bayerite obtained by precipitation with ammonia. The precipitation pH was found by the potentiometric method. It was identified the sequence of bayerite transitions up to 800 °C using thermal, X-ray diffraction and IR-analysis. The nitrogen adsorption-desorption study allowed to determine a specific surface, a volume, and dimensions of pores for boehmite and γ-Al_2O_3..*

Keywords: *boehmite, γ-Al_2O_3, bayerite, thermolysis, thermal analysis, diffractograms. IR spectra, pore size distribution*

Introduction

Many oxides are obtained by the thermal decomposition of hydroxides synthesized by means of precipitation [1-8]. There were used various precipitating agents, such as NaOH and n-butylamine [2], ammonium acetate [3], ammonium carbonate [4], ammonium bicarbonate [5], soda [6], ammonia [7,8], sodium carbonate [9]. Gibbsite and bayerite are the most important aluminum trihydroxides Al(OH)$_3$ [7, 10-12]. Among aluminum hydroxides, boehmite, aluminum oxyhydroxide AlOOH, is an accepted precursor because of its heat treatment produces transition aluminas [13]. Boehmite γ-AlOOH is one of two polymorphs of aluminum oxyhydroxide (the other one is dia-spore, α-AlOOH). Boehmite can be

prepared by a solid-state thermal transformation of gibbsite [14,15]. Boehmite can be also synthesized from a liquid phase by hydrothermal/solvothermal routes or by sol-gel and precipitation techniques [16]. Experimental conditions such as an aluminum source, the nature of a precipitating agent, pH, temperature, and time of a thermal treatment may have the main influence on the boehmite crystallite size and morphology [17]. γ-Alumina is a kind of ex-tremely important nano sized materials. It is used as a catalyst, can promote the sintering behavior of alumina, etc. [18,19]. The characterization of transition aluminas formed by the dehydration of boehmite have been extensively studied [13,15].

The aim of this paper was to describe the bayerite → boehmite → γ-Al_2O_3 thermal decompo-sition and to give some characteristics of obtained boehmite and γ-Al_2O_3 .

Materials and experiments

Aluminum nitrate nonahydrate $Al(NO_3)_3 \cdot 9H_2O$, analytically grade, in the form of 0.25 M solution in a distilled water was under stirring. The ammonium hydroxide solution (chemically pure, 6 M) was added to this solution under constant stirring to pH 9.1–9.3. The precipitate was filtered, washed with distilled water, filtered again, and dried at 100–105 °C to a powder which was ground in a mortar. Dried precursor was heated at a rate of 10 °C/min in air atmosphere up to required tem-perature in a muffle oven SNOL 1300.

XRD-patterns were obtained using a diffractometer DRON-6 with a copper target (λ=1.5442 Å, 40 kV, 100 mA). Thermal analysis was performed in a computer-controlled instrument (model TGA/SDTA851^e/LF/1600); crucible 700 mkL; air blow 50 mL/min; temperature program up to 1200 °C at various heating rates (2, 3, 5, 10, 15, 20, 30, and 50 °C/min). Infrared spectra of sam-ples were obtained on Avatar 360-FT-IR spectrometer ("Nicolet"). The nitrogen adsorption-desorption measurements of calcined samples were performed using Sorbi-MS adsorption analyzer. The specific surface areas were calculated by means of the Brunauer–Emmett–Teller (BET) method and the pore size distribution was obtained according to the Barret–Joyner–Halenda (BJH) method.

Results

It was done the direct titration of aluminum nitrate solution by ammonia solution to deter-mine the precipitation pH. The equivalence point was fixed by the potentiometry (Fig. 1). The po-tential jumps (pH) corresponded to pH of the full precipitation beginning and finish, namely, 3.62 and 9.06, respectively. So, it might consider that pH ~9.1 would provide the $Al(OH)_3$ full precipita-tion. According to work [10], under precipitation by ammonia $Al(OH)_3$ was at first separated as a gel which then was crystallized in the bayerite form. It was confirmed by XRD pattern (Fig. 2).

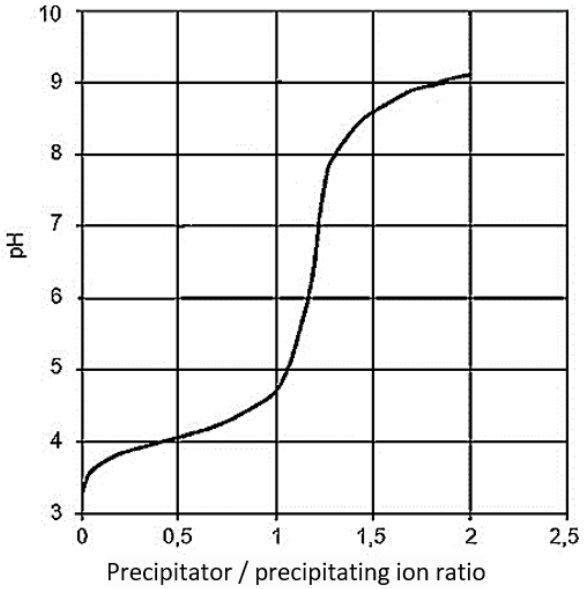


Figure 1. *The titration curve of aluminum nitrate solution by ammonia*

All main peaks corresponded to bayerite $Al(OH)_3$ (JCPDS No 21-1307). The process of its thermal decomposition was complex and run in several stages (Fig. 3). The endotherms at 138 and 203 °C on the DSC curve might refer to the removal of physical and interlaminar water which was in a low quantity. The sharp mass loss (~23.5 %) and an intense endothermic peak were observed at ~300 °C. They corresponded to the partial $Al(OH)_3$ dehydration to monohydrate as boehmite γ-AlOOH. Then an expanded water splitting off followed to form γ-Al_2O_3 from boehmite (mass loss 14.8 %). All subsequent changes run with no mass loss, so, a gradual heat release in the field of 500–1000 °C and exothermic peaks at 1109 and 1158 oC were attributed to alumina polymorphic transitions up to α-Al_2O_3 (probably, through δ- and θ-phases). Rough values of the molar water con-tent were calculated as 0.89 (300 °C), 0.19 (450 °C), and 0.07 (600 °C). The exotherm appeared at the very end of DTA curve (1158 °C) corresponded to the transformation into α-alumina.

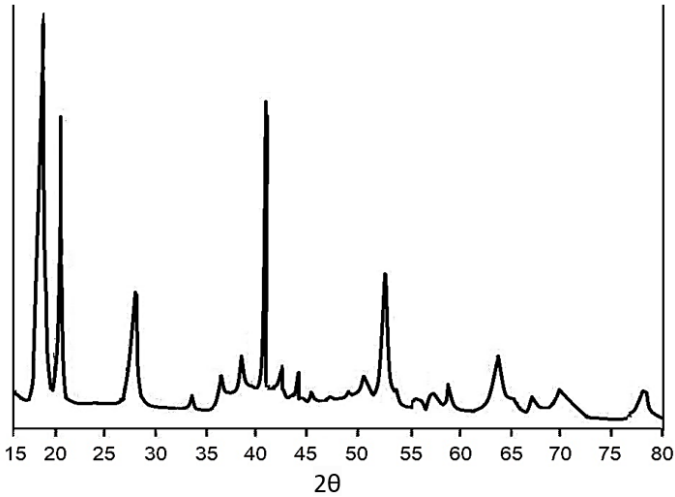


Figure 2. *XRD pattern of a precipitated product. Registered peaks refer to bayerite*

For comparison, DTA curve of the original gibbsite (Fig. 3) had an intense endotherm around 300-320 °C (gibbsite → boehmite) and a second endotherm, less intense, above 500°C (boehmite → γ-alumina). For the natural boehmite, the dehydroxylation started at 480 °C and was complete by 520 °C. Visible changes of transformations temperatures towards less values might relate to the small particle sizes of bayerite and a fresh boehmite and their high reactivities.

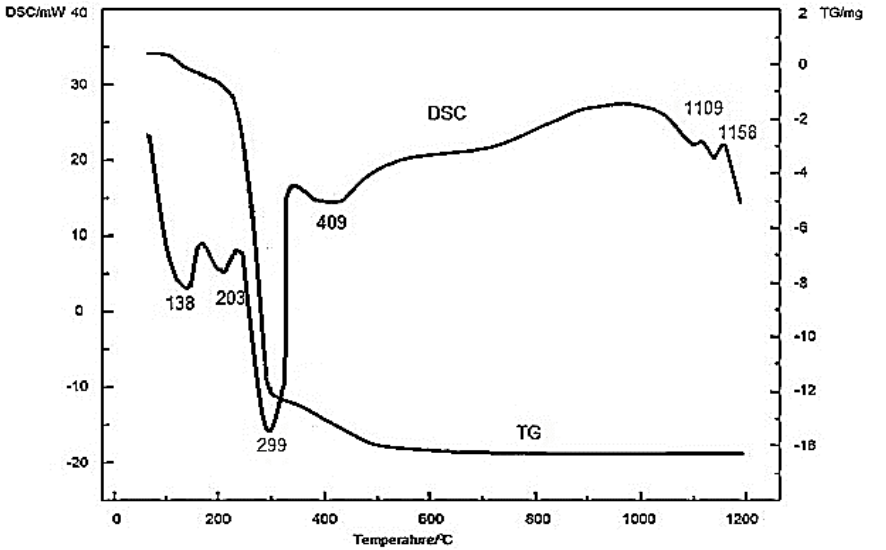
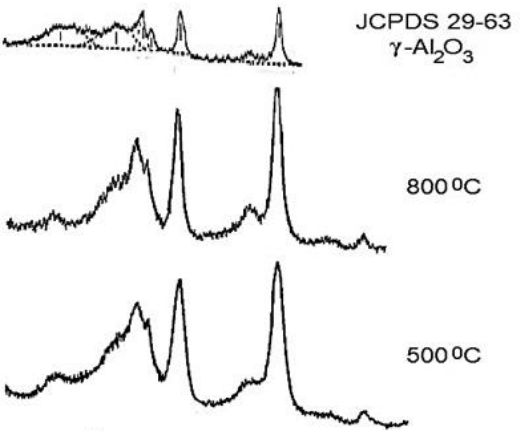


Figure 3. *TG-DSC curves of a dried precipitated product*

An obtained bayerite was treated at various temperatures. XRD patterns indicated the exist-ence of a product up to 250 °C in a XRD amorphous form. At 300 °C clear reflexes were appeared (Fig. 4).



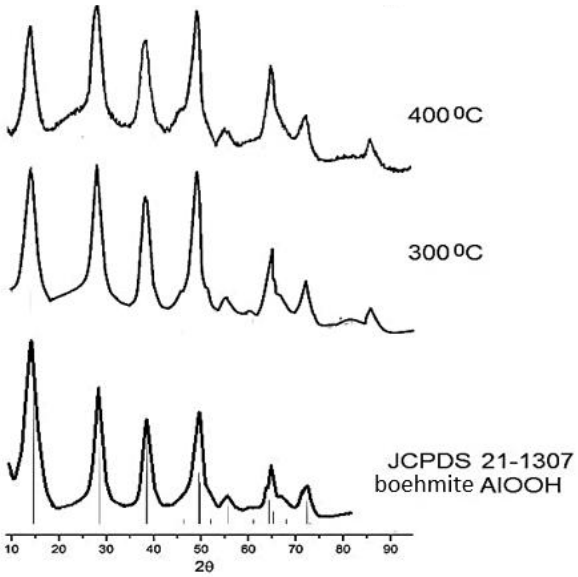


Figure 4. *XRD patterns of a precipitated product*

According to the JCPDS card No. 21-1307 for γ-AlOOH peaks (2θ) 14.48, 28.11, 38.25, 45.65, 48.81, 51.44, 55.09, 60.45, 63.88, 64.78, 67.53, 71.73 correspond to hkl positions (020), (120), (031), (131), (051), (220), (151), (080), (231), (002), (171), (251), respectively. So, boehmite represented practically the only phase in the range of 300–400 °C. At 400°C intensities of boehmite peaks were decreased and their width grew, that might indicate the start of AlOOH deconstruction to γ-Al_2O_3 that wss confirmed by the data of JCPDS Card No. 29-0063 for this phase: peaks 37.60, 39.49, 45.79, 60.89, 66.76 refer to the (311), (222), (400), (511), (440), respectively. The crystal structure of this polymorph remained up to до 800 °C. As seen in Figure 4, boehmite was trans-formed completely to γ-alumina. No intermediate compound was found.

The crystallite sizes (D, nm) of crystalline phases were estimated using Debye-Scherrer equa-tion:

$$D = 0.90\lambda/\beta\cos\theta,$$

where λ is X-ray wavelength; β and θ are full-width-at-half-maximum (FWHM) of an observed peak and diffraction angle, respectively.

The calculation of the average crystallite sizes was made using the strongest reflexes (four for boehmite and two for γ-Al_2O_3). They were found as 2.17 (300 °C) and 2.09 nm (400 °C) for boehmite, and 1.69 (500 °C) and 2.08 nm (800 °C) for γ-Al_2O_3.

IR spectra are shown in Fig. 5. The IR spectrum of boehmite had a characteristic υ_s(Al)O–H and υ_{as}(Al)O–H stretching bands or O–H stretching mode with two maxima at 3380 and ~3050 cm^{-1}. The stronger broadening band occurred due to the hydrogen bond between the various hy-droxyl groups in boehmite. This was confirmed by the presence of H–O–H bending band at about 1640–1650 cm^{-1}, originating from bending–scissoring vibrations which were typical for water mole-cules. Boehmite showed strong infrared intensity in the 1050 to 1640 cm^{-1} region. The transmission in the spectra of γ-Al_2O_3 was very weak in this field. Bands presence at ~1160 cm^{-1} (shoulder) and 1050 cm^{-1} corresponded to in-plane bending–scissoring vibration of OH in Al–O–H. The second hydroxyl deformation band at 1050 cm^{-1} related to boehmite. The dehydroxylation of the boehmite followed by the decrease in intensity of the hydroxyl deformation modes. The region of 1000–400 cm^{-1} corresponded to Al-O vibrations for γ-Al_2O_3. The bands at 668, 555, and 461 cm^{-1} were as-cribed to the stretching and bending–scissoring vibration modes in octahedral aluminum AlO6, while a band at 998 cm^{-1} related to the stretching mode of AlO_4 tetrahedral configuration.

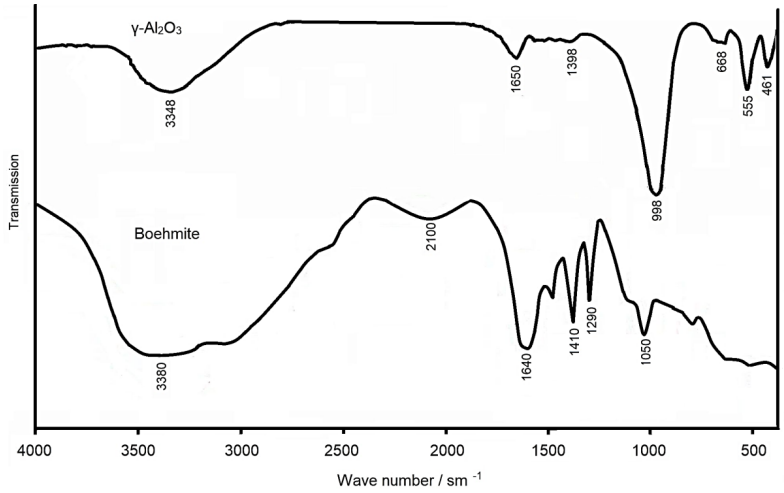


Figure 5. *IR-spectra of a product after heat treatment at 300 °C (boehmite) and 800 °C (γ-Al_2O_3)*

Nitrogen adsorption and desorption were measured to investigate the pore characteristics, namely diameter, volume, and size distributions of samples. As shown in Figure 6, both samples ex-hibited type IV isotherm with an H2 hysteresis loop according to IUPAC classification. with a ca-pillary condensation step

at p/p_0 = 0.4–0.5. It was the characteristic of a mesoporous material with the presence of cylindrical type pores in both synthesized alumina. Arched initial curve pieces indi-cated a strong adsorbate-adsorbent interaction. Pore size distributions curves are shown in Figure 7. Obtained peaks were single with narrow pore size distribution. The pore size distribution plots were uniform with one main peak in the ranges of 2–5 nm. It indicated very homogeneous mesopores by size. The average pore sizes were found as 1.7 and 3.8 nm, respectively.

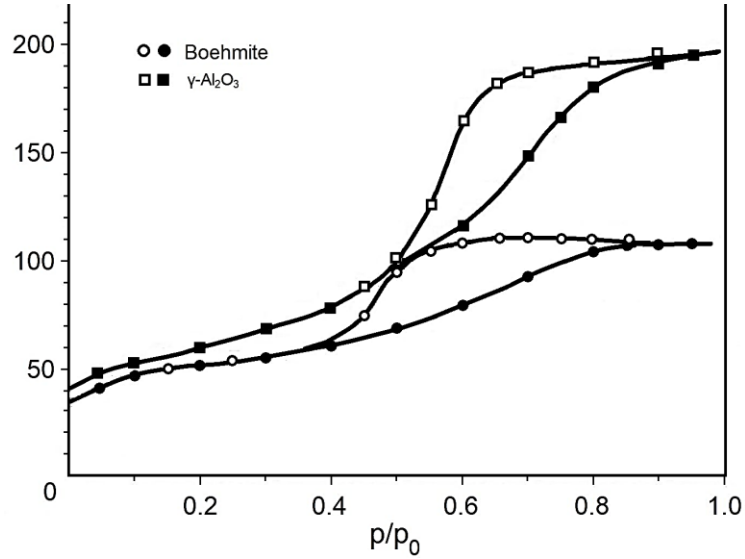


Figure 6. *N2 adsorption-desorption isotherm plots of boehmite and γ-Al_2O_3 samples*

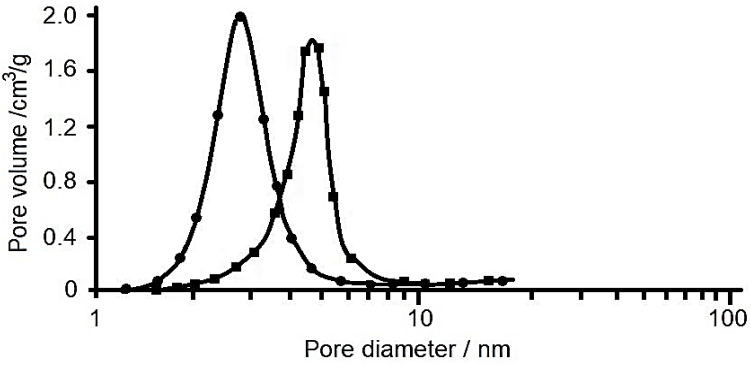


Figure 7. *Pore size distribution for boehmite and γ-Al_2O_3 samples (designation was in Fig. 6)*

Specific surface areas, SBET, were 135±2 and 238±10 m^2/g for boehmite and γ-Al_2O_3. Pore volumes were around 0.38 and 0.51 cm^3/g, respectively.

Conclusion

Aluminum hydroxide as bayerite was precipitated with ammonia. The process of its thermal decomposition was complex and run in several stages. XRD patterns indicated the existence of a product up to 250 °C in an amorphous form. The boehmite represented practically the only phase in the range of 300–400 °C. At 400°C AlOOH was decomposed to γ-Al_2O_3. No intermediate com-pound was found. The specific surface, volumes, and dimensions of pores for boehmite and γ-Al_2O_3 were determined as 135±2 and 238±10 m^2/g; 0.38 and 0.51 cm^3/g; 1.7 and 3.8 nm, relatively.

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食品工业中使用的液体分散介质的粒度分析
GRANULOMETRIC ANALYSIS OF LIQUID DISPERSED MEDIA USED IN THE FOOD INDUSTRY

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抽象的。 本文将重点关注食品生产和工厂中的水质和水量问题。 对于食品生产，重要的是要了解用水需求、污染源、水再利用和水对食品的污染如何影响食品安全。 考虑了悬浮液稠密部分的类型和浓度以及所用液相（水、牛奶、水-牛奶混合物1:1）的影响问题，考虑了胶体的形成。

关键词：分散介质，显微分析，水，液体

Abstract. *This article will focus on water quality and quantity issues in food production and in the factory. For food production, it is important to understand how water demand, sources of pollution, water reuse and contamination of food through water affect food safety. The issues of the influence of the type and concentration of the dense part of the suspension and the liquid phase used (water, milk, water-milk mixture 1:1), the formation of colloids is considered.*

Keywords: *dispersed media, microscopic analysis, water, liquid*

Introduction

Improvements in health over the past century have been underpinned by positive advances in the management of vital resources such as water and food. Water supply and quality, and food security and safety are intertwined. Freshwater resources and especially high-quality freshwater resources are becoming increasingly scarce, driven by factors including population growth, urbanisation and probably global climate change. The availability of freshwater resources adequate in both quantity and quality is vital to food security and production. It contributes in initial production (irrigation, livestock watering, aquaculture) and in processing (as an ingredient, transport medium and hygiene aid). Food companies must therefore address the future trends relating to this resource [1].

The food and water industries have a common objective, namely that of supplying quality goods or services to consumers. Implicit in this objective is that the product or service should be «safe».

Water, like food, is a vehicle for the transmission of many agents of disease and continues to cause significant outbreaks of disease in developed and developing countries world-wide. It was identified as the source of, among others, the worst outbreak of Escherichia coli O157:H7 in Canada to date (Kondro, 2000) [2]. A Cryptosporidium outbreak in Milwaukee, Wisconsin, USA in 1993, affected approximately 400,000 consumers and caused 54 deaths (Kramer, Herwaldt, Calderon, & Juranek, 1996; Hoxie, Davis, Vergeront, Nashold, & Blair, 1997) [3, 4].

Water can also contaminate food. In 1970, a cholera epidemic in Jerusalem was traced back to the consumption of salad vegetables irrigated with raw wastewater (Shuval et al., 1986) [5]. Helminths, protozoa and viruses also may be spread from contaminated water to food. Contaminated irrigation water has been associated with hepatitis A outbreaks in lettuce (Rosenblum, Mirkin, Allen, Safford, & Hadler, 1990) [6], tomatoes (Williams, Bell, Berry, & Shapiro, 1994) [7], raspberries (Ramsay & Upton, 1989) [8], and strawberries (CDC, 1997a) [9]; and cyclosporiasis outbreaks in raspberries (CDC, 1996), lettuce (CDC, 1997b) [10], and basil (CDC, 1997c) [11]. Ascaris infections have frequently been associated with the consumption of vegetables irrigated with untreated or inadequately treated wastewater (Blumenthal, Mara, Peasey, Ruiz-Palacios, & Stott, 2000; Mara & Cairncross, 1989) [12, 13]. In the context of this paper, people can be exposed to infectious agents or toxic chemicals through – the ingestion of contaminated water incorporated into foods; – the ingestion of foods irrigated with or harvested from contaminated water; and – the ingestion of foods that have come into contact with contaminated water during processing.

In industry, there are many different processes in which it is necessary to determine the size, particle size distribution (PPR) or granulometric composition (GS) in liquid dispersed media (LC).

This is required, for example, in chemical, food and pharmaceutical production, in the paint, oil refining and petrochemical industries, in environmental monitoring [14].

In laboratory conditions, it is not a particular problem to obtain the results of the HS, but its study in the conditions of the technological flow requires special measures that ensure both sufficient metrological reliability and the timeliness of the output of the result.

To determine the HS of the railway, by far the simplest and most commonly used method is microscopic analysis (for particles of 0.1-100 microns in size), which boils down to the use of optical (video) means, with the help of which the studied samples are photographed, and then the images are processed. An alternative is the nephelometric method (for particles with a size of 0.01-10 microns), which is based on the dependence of the scattering indicatrix (characteristics of the intensity of light scattering at different angles relative to the probing beam) on the RFR. Light scattering patterns can be obtained using the same video equipment, and image analysis can be conveniently performed using neural network technologies that allow processing images of the studied samples with special neural network algorithms in order to classify particles by size and shape. The presentation of the results using these methods ultimately boils down to the construction of histograms of the RFR, as well as integral and differential curves that visually describe the HS and characterize the relative content of particles of a particular size (distribution density), respectively.

However, there is currently no reliable technical implementation of a flow-based granulometric analysis (GA) system for a wide range of dispersed phase particle sizes (from 0.01 to 50 microns) based on simple and affordable methods [14].

In this paper, a solution to the problem is proposed, which consists in modifying the nephelometric method using video equipment that provides a continuous sequence of frames with scattered light images with their subsequent computer processing.

The measurement information obtained in this way has a large redundancy, due to which results related to the desired parameters of the dispersion of the railway can be obtained.

The prospects of the described approach lies in the possibility of creating automatic means for express measurements of HS in the technological cycle of a number of industries (for example, for information and measurement control systems in the paint industry, etc.), ensuring timely quality control of manufactured materials and reducing production costs.

To solve the tasks set in the dissertation work, the analysis of the works of scientists who have made a significant contribution to the development and development of systems for determining the parameters of the railway was carried

out. Fundamental studies of light scattering by particles are considered by J. W. Rayleigh, P.J. Debye, J. Tindal, G.A. Mee, H. K. Van de Hulst, K.S. Shifrin, M. Kercher, A. Ishimaru, S.P. Belyaev [14].

There are modern theoretical and practical developments of E.A. Mesropyan, V.S. Fetisov, O.A. Dmitriev, A.V. Myagchenkov and others devoted to research in the field of determining the parameters of the railway [14].

To date, there are sufficiently reliable microscopic methods of GA, which, despite their computerization, require considerable time, and nephelometric methods of HS analysis, which are well integrated into measuring systems, but do not have sufficient metrological reliability, as well as various technologies for the intellectualization of measuring processes (including artificial neural networks (INS)), which allow combining various measurement methods in the system, using the strengths of the methods and neutralizing the weak ones.

Thus, there are all prerequisites for the creation of in-line systems of the gas railway system with sufficient metrological reliability and speed.

Materials and methods

The purpose of the work is the granulometric analysis of liquid dispersed media used in the food industry. Liquid dispersed media based on water, milk and a water-milk mixture, including various types of flour: buckwheat, wheat, rice, corn, almond, flax, amaranth, were used for the study. The study of dispersed media was carried out using a modified microscopic method using video equipment. Organoleptic parameters were determined according to GOST 27558-87[15].

Results and discussions

Water of high quality is or will become a scarce commodity in many areas. Food production and processing require large amounts of water of varying quality [16]. Water reuse during food production and processing occurs and will likely increase in the future. Wastewater has been used for food production for many years in some locations. Awareness of the close association between water and food-borne disease is growing and thus there is a need to develop rational water use management plans within the food industry that maximize health protection. The food processing industry has long used hazard analysis and critical control point (HACCP) programmes to make their products safer.

Since in-line measurements of the gas of the railway are associated with the movements of the railway through the hydrodynamic system, it becomes necessary to carry out hydrodynamic calculations that will allow determining the parameters characterizing the process of transfer of the railway, such as the mode of movement of the dispersed medium, the deposition rate of DF, the change in pressure in local resistances, the flow rate of the washing liquid, as well as the quality and duration of washing when replacing the sample [17]. The listed parameters will allow, in turn, to determine the dependence of the particle size on the density

and sedimentation rate of particles, the optimal configuration of the nozzles, the duration and accuracy of measurements, as well as technical and economic indicators (for example, the volume of the used washing liquid, which is industrial wastewater, determines the further duration and cost of its processing). The main assumptions for the equations describing the motion of particles in the railway are the dilution of suspensions and the particle size of the DF, which should significantly exceed the size of the molecules of the dispersion medium and the length of their free path. Moreover, it is believed that the distances between the DF particles and their removal from the walls of the measuring chamber significantly exceed their dimensions. The shape and size of the particles are Stokes (the shape of the particles is considered spherical, the diameter of a spherical particle equivalent in deposition rate is taken as the particle size)

The mode of relative motion of particles in the EMF is determined by the Reynolds number Re, which shows the resistance force of the medium acting on a spherical particle. To determine the Reynolds number by the method of P. V. Lyashchenko, the Archimedes criterion Ar is calculated [18]. The Archimedes number Ar is defined by the formula [19]:

$$Ar = \frac{d_ч^3 \rho cp(\rho ч - \rho cp)g}{\mu^2 cp}, \quad (1)$$

where d_h is the diameter of the precipitating particle, m;

ρ_{cp} - density of the dispersion medium (water), kg/m^3;

$\rho_ч$ - particle density, kg/m^3;

g - acceleration of gravity, 9.81 m/s^2;

μ_{cp} is the dynamic viscosity of the medium, Pa *s.

Reynolds number for the resulting Archimedes number (Ar = $0.196 \cdot 10^{-3}$):

$$Re = \frac{Ar}{18+0{,}61\ Ar^{0.5}} \quad (2)$$

For laminar motion, the value of the Reynolds number Re ≤ 0.05 is valid [19]. Thus, according to the Lyashchenko method, the mode of motion of synthetic diamond particles was determined in the general case, the calculated value Re = $0.011 \cdot 10^{-3}$ indicates a laminar mode of particle motion in the railway. Laminar motion of a spherical particle in a liquid medium takes place at relatively small particle sizes, high viscosity of the medium and low flow velocity. The dependence of the particle size on the density and settling rate of the particles, as well as the density and viscosity of the dispersion medium for the case under consideration determines the Stokes law [19]:

$$Voc = \frac{d_ч^2(\rho ч - \rho cp)g}{18\ \mu cp}, \quad (3)$$

where d_h is the diameter of the precipitating particle, m;

$\rho_{ср}$ - density of the dispersion medium (water), kg/m^3;
$\rho_{ч}$ - particle density, kg/m^3;
g - acceleration of gravity, 9.81 m/s^2;
$\mu_{ср}$ is the dynamic viscosity of the medium, Pa *s.

Calculated deposition rates of DF particles of different densities for the diameter of the deposited particle dh = 2*10^{-6} m, density of the dispersion medium (water $\rho_{ср}$ = 1·103 kg/m^3, particle densityчh, kg/m^3, dynamic viscosity of the medium (water) $\mu_{ср}$ at a temperature of 20 ° C 1·10^{-6} Pa * s. It can be seen from expression (3) that the particle deposition rate is directly proportional to the difference between the densities of the DF and the dispersion medium, as well as the size of the DF - with increasing particle size, the deposition rate increases. In order to prevent the deposition of particles in the measuring chamber under the influence of gravity, it is necessary that the expiration rate of the test sample be greater than the deposition rate.

Figures 1-6 show photographs of the microstructure of liquid suspension samples based on buckwheat, flax, corn, rice, almond and amaranth 7% flour made from whole grains, and Figures 7-9 show 1, 2 and 7% concentrations of wheat flour with water. The phase composition of the suspension under study, shown in the microstructure photographs, is a solution of vegetable starch and protein, and at a concentration of 7% with the formation of a colloid.

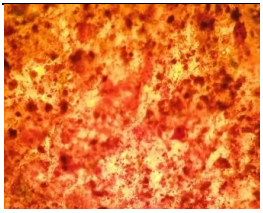

Figure 1. *Flaxseed flour + water*

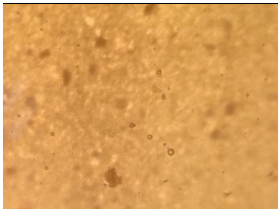

Figure 2. *Buckwheat flour + water*

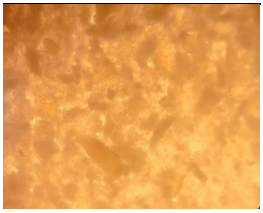

Figure 3. *Corn flour + water*

Figure 4. *Rice flour + water*

Figure 5. *Amaranth flour + water*

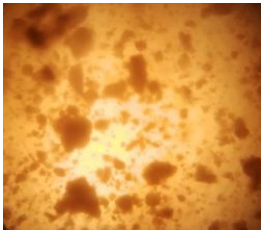

Figure 6. *Almond flour + water*

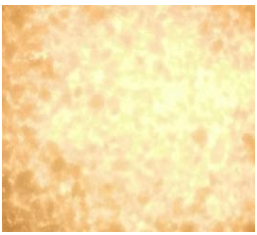

Figure 7. *Wheat flour + water, 1% flour*

Figure 8. *Wheat flour + water, 2% flour*

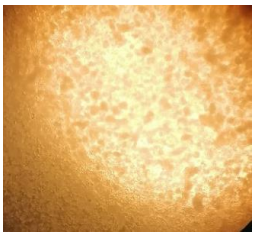

Figure 9. *Wheat flour + water, 7% flour*

The largest particles of inclusions were found in a suspension of almond and amaranth flour with water. Wheat flour, even at a concentration of 7%, did not form large clots. Apparently, the suspension structure is influenced by the degree of grinding of cereals and legumes and the amount of lipids in the feedstock. The same dependence was noted when milk or water-milk mixture was introduced into the suspension 1:1.

Conclusion

After the conducted studies of the liquid flour suspension, it was shown that the structures underwent changes depending on the concentration and type of flour [20-22]. This allows us to conclude that it is possible to determine the concentration of raw materials and the liquid phase in the manufacture of liquid dough, which will depend on the degree of grinding of the initial grains and legumes and their chemical composition. This is especially typical for low concentrations of flour in water-flour suspension (up to 7.0%).

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使用物理方法控制化工产品的质量，以确定其在井底带加工技术中的有效性

THE USE OF PHYSICAL METHODS OF QUALITY CONTROL OF CHEMICAL PRODUCTS TO DETERMINE THEIR EFFECTIVENESS IN THE PROCESSING TECHNOLOGIES OF THE BOTTOMHOLE ZONE OF WELLS

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抽象的。 这项分析工作基于光谱分析 (IR-Fourier)，使用一套研究方法创建一个方案，以控制基于流体通行证的化学产品质量，并确定其在处理石油井底带的技术中的有效性。 井。

关键词：红外傅里叶光谱分析，井底地层处理，反应流体，质量控制方案

Abstract. *This analytical work is based on spectral analysis (IR-Fourier) using a set of research methods to create a scheme for controlling the quality of chemical products based on the introduction of a fluid passport and determining their effectiveness in technologies for treating the bottomhole zone of wells.*

Keywords: *spectral analysis of IR-Fourier, treatment of the bottomhole formation zone, reactive fluids, quality control scheme*

General information about IR-Fourier spectral analysis

IR spectrometry is a method for the analysis of substances and materials based on the selective absorption of infrared radiation by a substance when this radiation passes through it.

For IR spectrometric analysis, dispersive spectrometers and Fourier transform spectrometers are used (Fig. 1).

Figure 1. *Fourier transform spectrometer Nicolet 380 (ThermoFisherScientific)*

At present, IR-Fourier spectrometry has become one of the most important methods for the qualitative and quantitative analysis of substances and materials. Using this method, such studies are carried out as:

1. Quality control and authentication of fuels and lubricants, oxygen-containing additives to gasoline.
2. Identification and determination of the service life of oils (engine, transformer, turbine, etc.) and additives to them.
3. Quality control of raw materials and organic solvents in production.
4. Determination of corrosion inhibitors in packaging materials.
5. Determination of the nature and quality of polymeric materials and composites based on them.
6. Identification and determination of the quality of building materials: paint and varnish coatings, adhesives, mastics, sealants, etc.
7. Establishing the authenticity of medicinal products.
8. Determining the origin, authenticity and presence of prohibited additives in wine and vodka products.
9. Identification and quality control of surfactants and raw materials from which they are obtained.
10. Determining the authenticity and presence of prohibited additives to cosmetics (lipsticks, creams, powders, etc.).
11. Determination of the composition of municipal solid waste before their processing.

The fact that this method is non-destructive contributed to the widespread use of the IR-Fourier spectrometry method. Modern solutions in the field of IR-Fourier spectrometry and portable devices make it possible to analyze raw materials and finished products without lengthy sample preparation, and in some cases to analyze an object without violating the integrity of its packaging [1].

In the field of oil refining and petrochemistry, IR Fourier spectrometry allows performing qualitative and quantitative analysis of raw materials, intermediate and final products of synthesis, fractional and structural-group composition of oil, gas condensates, natural gas and products of their processing.

Types of spectral analysis of substances and materials IR-Fourier

Qualitative spectral analysis. Identification of compounds and materials can be carried out by three methods:

1. By comparing the spectrum of the standard with the spectrum of the unknown component.
2. When comparing the spectrum with standard spectra from libraries.
3. By deciphering the spectrum using tables of characteristic frequencies.

The use of standard substances or their mixtures in the identification of samples is the most convenient, since the use of one method of sample preparation for all samples and identical conditions for recording the spectrum on the same instrument makes it possible to obtain the most reproducible IR spectra. However, this approach can be implemented only if a small set of objects is analyzed and standard samples are cheap enough.

In most cases, libraries of IR spectra are used. According to various estimates, at the moment there are libraries of more than 100,000-300,000 organic compounds and up to 500,000 different materials (mixtures). Quite often in the laboratory it is necessary to compare batches of raw materials and reject low-quality ones. In this case, often each recorded IR spectrum is included in the library, providing it with a detailed description. By comparing new batches of such raw materials, you can quickly determine how good they will be and whether they should be used in production.

At the same time, when working with libraries, some features should be taken into account:

- the nature of the spectrum depends on the method of sample preparation; therefore, comparison should be made only with the spectra of compounds recorded by the same method;
- when comparing spectra using a computer, the specified number of library spectra will always be displayed on the screen. The level of their compliance with the analyte has to be chosen by the analyst based on his experience.;
- the compound with the highest spectrum convergence coefficient does not always provide correct identification. If impurities are present, the component to be determined may occupy any position in the identification list or be absent altogether.;
- there are free electronic libraries containing, among other things, IR spectra of compounds. The most complete of these are the NIST and AIST libraries.

In cases where a library search does not allow unambiguous identification of a compound or material, it is necessary to decipher the IR spectra, and, based on the data obtained, carry out a group assignment and only then carry out individual identification. To do this, it is convenient to use tables of characteristic frequencies for chemical bonds included in various compounds. As practice shows, the available additional information about the samples under study greatly facilitates the interpretation of their spectra [1].

Quantitative spectral analysis. In quantitative Fourier IR spectral analysis, the greatest reproducibility of results is achieved when recording the spectra of solutions using liquid cuvettes, since in this case it is easiest to reproduce the thickness of the absorbing layer. In some cases, the potassium bromide tablet compression method can be used, but in this case it is necessary to control the mass of the analyte-potassium bromide mixture before tablet compression.

The choice of a quantitative signal processing method is determined by the characteristics of the object; as a rule, three types of tasks are distinguished:

1. Analysis of connections with non-overlapping signals.

2. Analysis of compounds whose absorption bands partially overlap with the absorption bands of other components.

3. Analysis of connections with complete signal overlap.

For the first case, the absolute grading method is most often used. A sufficiently intense band is chosen as the absorption band for which the calculation is carried out. It is not recommended to choose the bands of the OH group, since their area largely depends on the ability to form hydrogen bonds.

In some cases, the addition method or the internal standard method can also be used.

In the case of partially overlapping signals, it is necessary to build several calibration graphs, according to which, taking into account the principle of additivity of areas, calculate the concentrations of each component.

When solving a problem with completely overlapping signals, it is necessary to compose and solve a system of equations using the principle of additivity of areas. This method is considered the most accurate.

The methods of these methods of absolute calibration and additions are the same as in the case of spectrophotometry, however, the analyst has the opportunity to use a larger number of absorption frequencies for quantitative calculation than in spectrophotometry [2].

The use of FT-IR spectrometry in the treatment of the bottomhole formation zone

Fourier IR spectrometry is used to determine the composition of acid compositions for treatment of the bottomhole formation zone. An example of the use

of this method is the Bruker ALPHA II IR spectrometer. Below is more detailed information.

Samples of reactive liquids presented in tables 1-2 were provided for analysis.

Table 1.

Samples of reactive liquids with TN-SZhKS additives

№	1	2	3	4	5
TN-SZhKS, % vol.	0.5	2.5	2.5	2.5	2
36% HCl, % vol.	24	24	24	10	-
70% HF, % vol.	5	5	1	5	-
H_2O, % vol.	70.5	68.5	72.5	82.5	98

Table 2.

Samples of reactive fluids with EVASTIM MS additives

№	6	7	8	9	10
EVASTIM MS, % vol.	0.5	2.5	2.5	2.5	2
12% HCl, % vol.	24	24	24	10	-
70% HF, % vol.	5	5	1	5	-
H_2O, % vol.	70.5	68.5	72.5	82.5	98

The tasks were set as follows:

- identify the presence of absorption bands associated with individual components in liquids;
- check the possibility of constructing calibrations for quantitative analysis.

The IR spectra of the samples were measured on a Bruker ALPHA IR-Fourier spectrometer (Germany) equipped with a Platinum ATR (ATR) attachment with a diamond crystal.

This spectrometer has:

- interferometer: RockSolidTM, highly stable, no adjustment required;
- optics: sealed and drained, all mirrors are gold-plated;
- detector: highly sensitive DLaTGS, operating temperature room;
- an ATR attachment with a diamond crystal embedded in a tungsten carbide substrate without the use of glue.

Measurement parameters:

- spectral range 4000-400 cm^{-1};
- spectral resolution 4 cm^{-1}.

The processing and analysis of the spectra were carried out in the specialized OPUS software for Bruker spectrometers (Fig. 2-3).

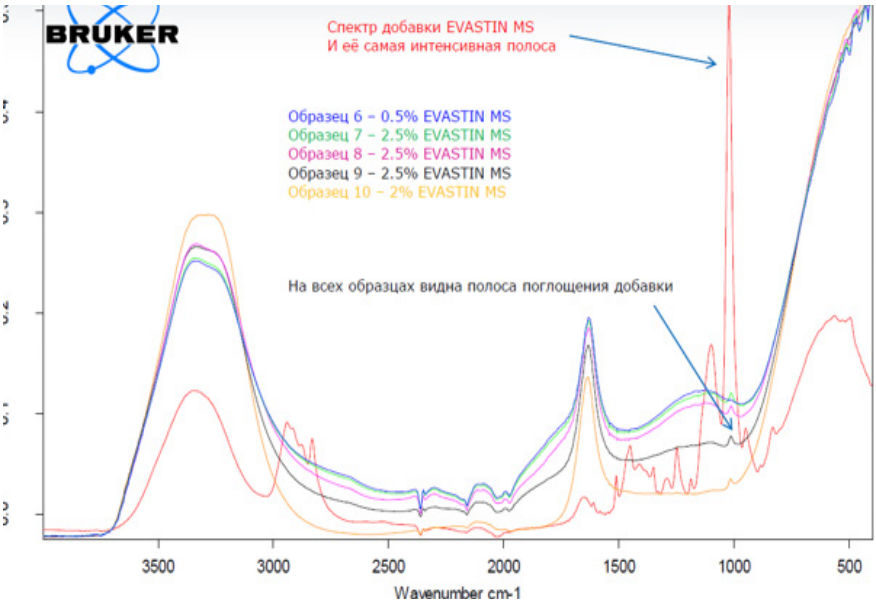


Figure 2. *Spectra of samples 1-4*

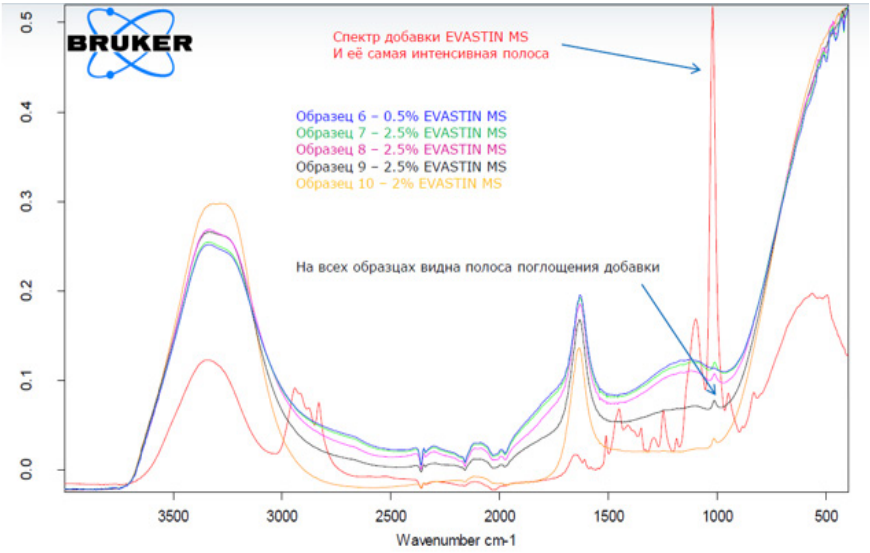
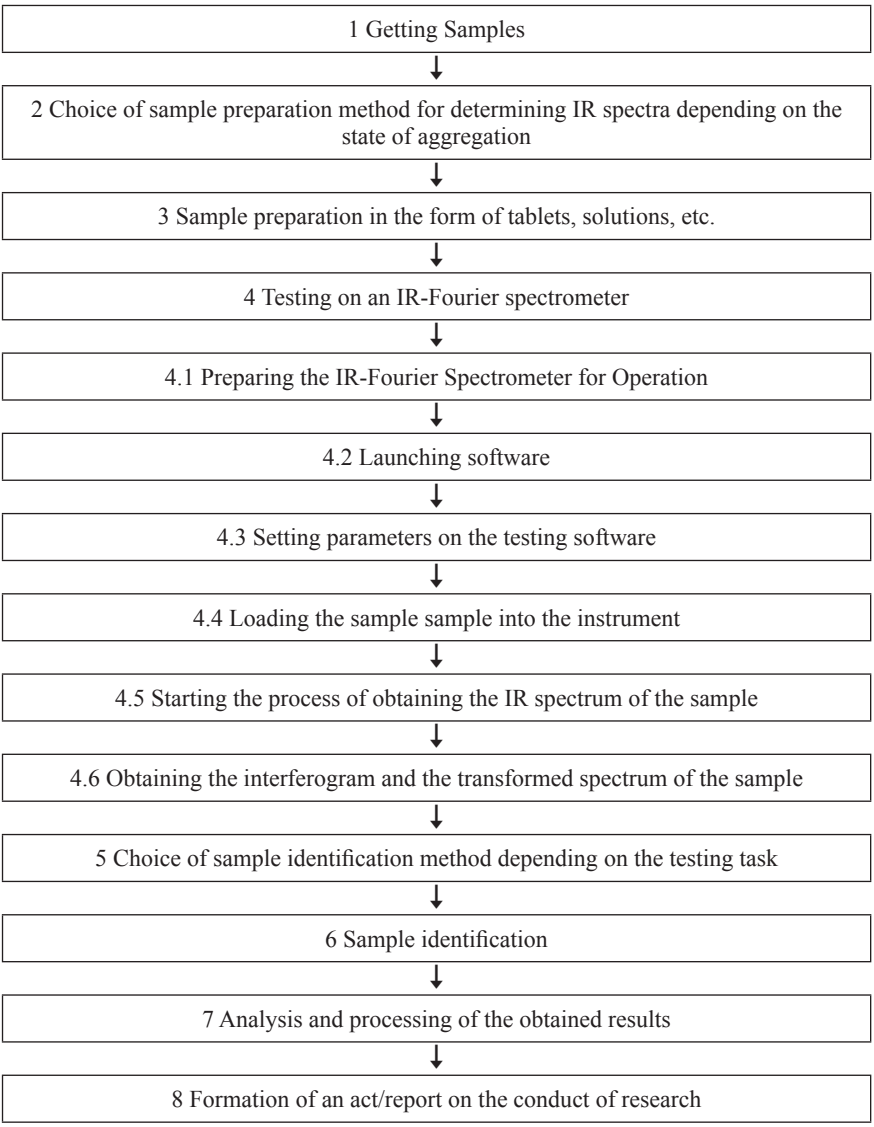


Figure 3. *Spectra of samples 6-10*

A scheme for quality control of chemical reagents was developed based on the introduction of a "passport" of liquid in the CB and spectral analysis (Fourier IR) with a set of research methods:



Conclusions

1. A scheme for quality control of chemical reagents has been developed based on the introduction of a "passport" of liquid in the CB and spectral analysis (FTIR) with a set of research methods.

2. Spectra of samples without sample preparation (ATR module) were recorded on a Bruker ALPHA II IR spectrometer.

3. Thanks to the ATR diamond crystal resistant to aggressive media, the samples were deposited directly on the crystal.

4. For each series of images, the presence of absorption bands of the corresponding additives is shown:

- for series 1-5 by absorption bands 1045 cm^{-1} and 1011 cm^{-1};
- for series 6-10 along the absorption band 1023 cm^{-1}.

5. The spectra obtained make it possible to judge the increased or decreased concentration of additives. To build accurate calibrations, it is necessary to prepare samples with different concentrations of the additive, but the same concentration of acids.

6. For visual control of additive concentrations, it is recommended to prepare model mixtures of acids with water at different concentrations and use their spectra as background ones.

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多年冻土施工规范
SPECIFICS OF CONSTRUCTION ON PERMAFROST SOILS

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抽象的。 本文重点讨论多年冻土区的建设问题。 它考虑了土壤强化选项以及与工作相关的技术。 涉及 SCU 的事故受到特别关注。

关键词：季节性运行的冷却装置，多年冻土，热稳定剂，冰石带，建设。

Abstract. *The article focuses on construction issues in permafrost areas. It considers soil-strengthening options as well as work-related technology. Accidents involving SCU are given special attention.*

Keywords: *seasonally operating cooling units, permafrost soil, thermal stabilizer, cryolithic zone, construction.*

The foundations of structures erected on permafrost soils must be designed on the basis of the results of engineering-geocryological (engineering-geological, permafrost and hydrogeological) surveys and studies carried out in accordance with the requirements of the current SNiP, state standards and other regulatory documents for engineering surveys, and studies of soils for construction purposes, with the obligatory consideration of structural features and operating conditions of the designed structures, including: thermal and mechanical interaction of structures with foundation soils; dimensions, type of structures and mode of operation of structures; loads acting on foundations.

When designing and building the foundations of structures, they are guided by two characteristic states of permafrost soils: frozen and thawed. In this regard, there are two principles for the use of permafrost soils as foundations for structures, including bridges: I - foundation soils are used in a frozen state, maintained during the construction process and throughout the entire specified period of operation of the structure; II - base soils are used in a thawing (during the operation of the structure) or in a thawed (before the construction of the structure) state.

The principle of using permafrost soils as foundation foundations is chosen based on local climatic and engineering-geocryological conditions, the depth of laying and design features of the foundations, the results of feasibility studies related to

the choice of the optimal type of foundations.
Principle I is used in cases where there is certainty, substantiated by the necessary calculations, that the frozen state of soils at the base of bridge foundations will remain during the entire period of their operation, as a rule, without the use of cooling plants. Cooling installations or stone filling of abutment cones can be used to prevent the possibility of a significant increase in the temperature of permafrost soils (compared to that assumed in the calculations) during the operation of the structures. To make a decision on the use of foundation soils according to principle I, it is necessary in the process of conducting geocryological engineering surveys to provide reliable data on the temperature of the soils at a depth of 10-12 m (from the natural surface) and on the confluence of the seasonal thawing layer with permafrost soils at the site of the designed structure.
According to principle II, permafrost soils are used based on the condition of their complete thawing, regardless of the temperature during the construction of structures.

During construction in the zone of permafrost soils (PFS), in most cases, pile foundations are used from pillars with a diameter of 0.8 m or piles with a cross section of 0.35X0.35 and 0.4X0.4 m. When erecting such foundations with a high grillage, there is no need for time-consuming and time-consuming work on the construction of pits. Work on the construction of these foundations can be comprehensively mechanized and carried out year-round. Their design is simpler and the consumption of materials is less compared to other types of foundations. Such foundations are more reliable, since the pillars and piles can be loaded without great additional costs so that their lower part rests on solid or non-sagging soils during thawing, or they can be buried in the thickness of permafrost soils that do not thaw during the operation of bridges. Seasonal changes (partial thawing in summer and freezing in winter) of the physical and mechanical properties of soils are accompanied by the occurrence of significant deformations that impede or completely exclude the normal operation of buildings, structures and pipeline systems. A great danger is the uneven settlement caused by the thawing of frozen soil, and the forces of frost heaving, which lead to buckling of piles [1].

In addition to natural temperature changes in the air, the construction process itself has a significant impact on the condition of the soil. An example is the use of construction machines and mechanisms that, during operation, emit a certain amount of energy that changes the natural environment and the soil itself. Another example, it is enough to compact or remove the snow cover in winter, remove the vegetation layer or dry the area, as the properties of PFS begin to change significantly and a reaction to external factors occurs.

In order to prevent the loss of stability of ground structures, it is necessary to maintain a stable state of permafrost. One of the most common ways to solve this

problem is the construction of ventilated subfields [2]. However, it has significant drawbacks that lead to deformations in buildings and structures and a significant increase in the cost of construction. So for the installation of a ventilated underground, a large amount of metal and special equipment is needed, which leads to the economic inefficiency of its use. In addition, ventilated undergrounds do not meet the criteria for maintainability and manageability in the event of unforeseen thermal effects. Thus, there are three main tasks facing the methods of soil thermoregulation: efficiency, reliability and controllability.

To solve these problems, seasonally operating cooling units (SCU) are successfully used [3]. They are located at the base of the foundation, or in special wells next to the foundation. In winter, heat is extracted from the soil and transferred to the environment, and a column of frozen soil is created around the underground part due to phase transformations and circulation of the coolant. In the summer, the SCU operation is stopped, as the accumulated "cold" is enough to preserve the frozen ground. The device consists of several parts:

- Air condenser – is a structure of one or more heat exchange tubes located in the above ground part. Here, the vapor phase of the refrigerant condenses as a result of heat exchange with the environment and returns to the evaporator section.
- Evaporator – the underground part of the device. In it, through the walls of the pipe, heat exchange of the refrigerant with the surrounding soil takes place. Here there is a transition of the working substance from the liquid phase to the vapor phase, which rises into the air condenser.
- Sometimes a transit part is isolated – in this part, the liquid and vapor parts of the refrigerant are transported. In the layer of seasonal freezing of the soil, the surface of the pipe is protected by thermal insulation to minimize heat loss.[4]

There are several main types of SCU:

1. Horizontal cooling devices, so-called horizontal natural-acting tubular systems (HNT).

They are a system of cooling pipes at the base of the structure, located horizontally and connected to the condenser unit. This unit is located above ground and is connected to the evaporator. The principle of operation of the entire system remains the same. The condenser is filled with refrigerant at the factory and in the amount necessary to fill the entire system. If it is necessary to operate this system in the summer, reserve pipes are connected to the refrigeration machine. HNT are used for thermal stabilization of permafrost soils of the merging type with an embankment height of not more than 4 meters.

2. Vertical cooling devices, so-called vertical natural-acting tube systems (VNT).

An analogue of the HNT system, reinforced with vertical pipes, which are placed at the required design points and connected to the condensing unit. VNT

are used for thermal stabilization of non-merging permafrost soils with an embankment height of more than 4 meters, as well as for excavation.

Features of HNT and VNT systems:

✓installation over the entire area of the foundation soil;
✓depth of vertical pipes - 10-15 m;
✓cooling area 200-500 m^2;
✓building width up to 108 m;
✓does not require electricity;
✓refrigerant - ammonia or carbon dioxide;
✓the condenser unit can be removed from the object at a distance of up to 100 m;
✓the ability to carry out thermal control of soils in inaccessible places or places where it is impossible to place above-ground elements;
✓galvanized coating of steel cooling pipes with enhanced anti-corrosion protection;
✓automatic welding with 100% computer control;
✓the possibility of connecting a refrigeration machine.

3. Individual heat stabilizers.

This is a hermetically sealed one-piece welded structure filled with refrigerant. Designed for freezing thawed and cooling plastically frozen soils in order to increase their bearing capacity and prevent pile bulging. The total length of the heat stabilizer is from 6 to 28 m. They are installed in the ground vertically, obliquely or slightly inclined.

4. Deep SCU.

Designed for freezing and thermal stabilization of soils of dams, wellheads and other structures up to 100 m deep in order to ensure their operational reliability. There are several types:

a) Single SCU – are autonomous, placed separately in vertical wells. Mounted and refueled at the facility.

b) Group SCU – consist of several individual thermal stabilizers, each of which freezes its own area of the ground. Are carried out in full factory readiness, or all-metal with field installation.

c) Collector SCU – are connected with the help of a collector to an air cooler, in which the finned tubes are blown by fans. The system is used for intensive initial freezing and further maintenance of the frozen ground zone [5].

To control the performance of SCUs, it is necessary to constantly monitor them, both during installation and during the entire life cycle.

Refusals are possible for the following reasons:

• refrigerant leakage from the internal cavity (complete failure);
• partial operation that does not provide the mode and characteristics declared by the manufacturer (partial failure);

• damage and destruction during transportation, loading and unloading or installation works (partial or complete failure);
• destruction and depressurization during operation (partial or complete failure);
• destruction or damage during operation due to vandalism (partial or complete failure).

To eliminate failures, it is necessary to analyze, identify and systematize the factors that affect the quality of the production process. These include: the quality of welding work and steel grade, the presence of visual and instrumental control of all technological operations, the presence of anti-corrosion protection, the quality of refueling and packaging, the quality of loading and unloading, construction, installation and commissioning, the quality of work on architectural supervision, the quality of control thermophysical characteristics of the SCU operation after their launch, as well as the availability of geotechnical monitoring during operation. In addition to all of the above factors, the maximum service life of the SCU must be considered. It should not exceed the life cycle of the structure on which it is installed.

Geotechnical systems using SCU in permafrost must be subject to increased requirements when making design decisions. In order to reduce production and financial risks, it is recommended to use technical audit in 100% of cases when choosing optimal design solutions and SCU suppliers [6].

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以 SKRU-3 矿场为例，研究用于回填钾盐矿床开挖区域的喷射堆垛机中气流的相互作用

STUDYING THE INTERACTION OF AIR FLOWS IN EJECTOR STOWING MACHINES FOR BACKFILLING THE EXCAVATED AREA OF POTASSIUM SALT DEPOSITS ON THE EXAMPLE OF SKRU-3 MINING FIELD

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抽象的。 这篇文章包含了喷射机中气流相互作用研究的主要成果。 介绍了带有环形弹出器的振动气动装载机的特点，用于创建钾盐矿床的装载复合体。

Abstract. *The article contains key results of the research of air flows interactions in ejector machines. The characteristics of vibration-pneumatic stowing machines with the ring ejector for creating a stowing complex of potash deposits are presented.*

The Verkhnekamskoe deposit of potassium-magnesium salts is located in the Perm Oblast and occupies an area of about 3.7 thousand km^2.

The SKRU-3 mining field is located in the central part of the deposit within the Novosolikamsky area explored in detail from the surface in the Solikamsky district of the Perm Oblast.

In the area of the mining field, an aquifer complex includes underground waters of Quaternary deposits, variegated, terrigenous-carbonate and salt-marl strata, to some extent isolated from each other by relatively impervious rocks.

The most flooded are limestones and marls of the terrigenous-carbonate stratum, to which the main aquifer, which has a regional distribution, is confined. The highest rock permeability is noted on the side slopes of river valleys, where filtration coefficients reach from a few liters to 41.87 l/day.

The upper horizons of the salt-marl strata are less watered; its lower part with layers of rock salt is practically waterless. The boundary of water-resistant rocks

passes above the upper layer of rock salt, which is taken as the roof of the water-protective strata. The thickness of the VZT above the AB formation within the mining field varies from 50 to 172 m, within the planned mining operations - 85-170 m.

Mining field SKRU-3 was opened by four vertical shafts located in the center of the mining field.

The way of processing the SKRU-3 m.f. – is panel-block. From the workings of the main directions to the northern and southern sides, there are mining panels 1200 m wide and 2.0 - 2.2 km long. Each panel is divided into blocks 400 m wide. In the middle of the panel along the KrII formation there are panel ventilation drifts. In the underlying rock salt there are panel transport and conveyor drifts, as well as block deepened conveyor drifts, interconnected by slopes. Block excavation and ventilation drifts run coaxially along the KrII and AB seams. Excavation drifts are located in the middle of the block, and along its borders there are ventilation ones. Excavation workings are oriented in the latitudinal direction. The arrangement of panel and block workings is mutually perpendicular and similar workings are connected to each other by slopes.

In order to maintain the goaf surface of the mining, we propose to use a hardening goaf backfill. The use of such a system will enable:

1. To reduce the loss of minerals in the subsoil and their impoverishment, to increase the safety of mining operations, especially with unstable side rocks and large depths of mining, when significant rock pressure develops and there is a danger of rock bursts.

2. To work out mineral reserves left under cities, individual structures, forests and reservoirs in the form of protective pillars; completely eliminate or drastically reduce the fire hazard of minerals prone to spontaneous combustion of ores;

3. Conduct mining operations in complex mining-geological and hydro-geological conditions with tectonic disturbances, watering, the presence of layering and fracturing in the ore body;

4. Provide better working conditions than when using roof collapse, eliminate the risk of injury due to collapse, fallout, gas emissions, improve ventilation and ventilation of stopes by reducing the volume of voids;

5. To increase the rate of stoping excavation in the developed fields, ensuring simultaneous work on several floors;

6. Weaken and localize oxidative processes by reducing ore losses during mining and reliable isolation of mined areas, reduce the risk of endogenous fires [1].

However, analyzing the experience of using a hardening backfill, it can be seen that the main disadvantage of systems with a monolithic backfill is the high cost of the hardening mixture components, expensive cement and aggregate, as well as mechanical delivery equipment. In the salt mining industry, pneumatic installa-

tions are most widely used, among which we single out ejector-type installations.

However, due to the complexity of technological units, ejector plants have low efficiency.

To choose a way to eliminate the shortcomings of the installation, we studied in detail the process of mixing the ejecting air flow and the ejected air mixture flow. This process has a significant impact on the performance of ejector installations and plays a decisive role in the calculations and development of this class of equipment.

Basically, according to the design scheme, ejector devices can be of two types: with a central nozzle device and with an annular ejector (fig. 1 and 2).

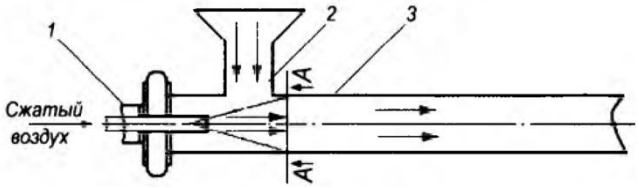

Figure 1. *Schematic diagram of the installation with a central nozzle device: 1 - ejector; 2 - loading funnel; 3 - transport pipeline (⟶ - ejected flow; ⟶ - ejector flow; ⟶ - mixed flow)*

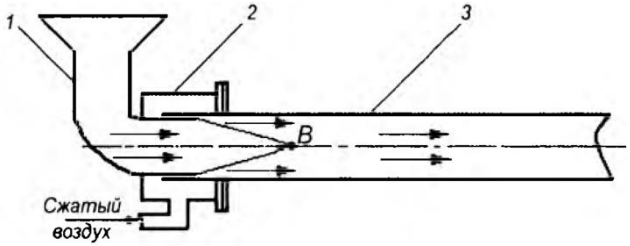

Figure 2. *Schematic diagram of the installation with an annular ejector: 1 - loading funnel; 2 - ejector; 3 - transport pipeline (⟶ - ejected flow; ⟶ - ejector flow; ⟶ - mixed flow)*

In installations with a central nozzle device, with an increase in the transportation distance, a sharp increase in hydraulic resistance and a cessation of air ejection from the atmosphere occur. The consequence of this is the locking of the ejector in the section A-A (fig. 1), in which the mixing of the air mixture flows ends.

In an annular ejector, the interaction of the ejecting and ejected flows ends at the top of the narrowing part of the mixing zone (point B, fig. 2), in this place the

velocities of the mixing flows acquire equal values, and the relative losses of kinetic energy are minimal. In addition, the movement of the ejecting air flow along the walls of the cylindrical mixing chamber minimizes potential energy losses. This specificity of the operation of the annular ejector makes it possible to increase the transportation range by reducing the total energy loss of the mixed flow.

The noted patterns of mixing air flows in an annular ejector can be used to equalize the speeds of mixing flows due to their transverse pulsations inside the conical surface with the acceleration of the ejected flow in the direction of transportation.

The domestic industry has created a number of ejector machines, presented in table 1

Table 1.

	Filling machines		
Parameters	**VPM-100**	**VPM-150**	**VPM-200**
Productivity, m^3/h	Up to 8	Up to 18	Up to 30
Maximum distance of straight-line transportation, m	Up to 120	Up to 120	Up to 120
Compressed air consumption, m^3/h, not less than	>900	> 1800	>3000
Compressed air pressure in the pneumatic network, MPa	>0.3	>0.3	0.3-0.65
The maximum size of the transported filling material, mm	30	45	80
Transport pipeline diameter, mm	100	150	207
Sound pressure level, dB	80	80	80
Installed drive power, kW	2.2	2.2	2.2
Weight, kg	190	195	200

Small overall characteristics and technological capabilities of the VPM make it possible to use it directly at the mining site with the possibility of moving the machine along the development workings after the stope. VPM with an annular ejector can be used in various mining processes, in particular, in the separate excavation of thin shallow seams.

Conclusions

Comprehensive studies of the patterns of interaction of air flows in ejector devices have shown that in an annular ejector the mixing of air flows occurs along the surface of their tangential discontinuity, which has the shape of a conical surface oriented with its top in the direction of transportation. The established patterns made it possible to determine the rational parameters and configuration of the annular ejector. This made it possible to increase the efficiency of ejector-type backfilling equipment and create a new class of small-sized, economical and highly efficient vibratory-pneumatic backfilling machines with an annular ejector.

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混凝土疲劳破坏数值模拟初始数据的准备

PREPARATION OF INITIAL DATA FOR NUMERICAL SIMULATION OF CONCRETE FATIGUE FAILURE

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抽象的。 混凝土的疲劳破坏问题是计算实践中研究最少的问题之一。 由于缺乏关于在循环作用下给定材料的结构中发生的疲劳损伤累积的实际过程的可靠数据，因此无法形成一种计算感知这种载荷的混凝土结构的方法。 为了开发上述方法，建议使用结构仿真建模。 为此，考虑了在循环载荷影响下混凝土损伤的数学模型。 该研究的目的是确定水泥石的弹性和强度特性，以进一步开发一种预测混凝土疲劳寿命的方法，同时考虑损伤累积的非线性动力学。

关键词：疲劳破坏，损伤累积模型，线性总和假设，结构模拟建模，水泥石极限强度，弹性模量，泊松比。

Abstract. *The problem of fatigue failure of concrete is one of the least studied in computational practice. The lack of reliable data on the actual processes of accumulation of fatigue damage occurring in the structure of a given material under cyclic action does not allow one to form a method for calculating concrete structures that perceive such loads. To develop the above methodology, it is proposed to use structural simulation modeling. For this, mathematical models of concrete damage under the influence of cyclic loading are considered. The purpose of the study is to determine the elastic and strength characteristics of cement stone for further development of a methodology for predicting the fatigue life of concrete, taking into account the nonlinear kinetics of damage accumulation.*

Keywords: *fatigue failure, damage accumulation models, linear summation hypothesis, structural simulation modeling, ultimate strength of cement stone, modulus of elasticity, Poisson's ratio.*

Introduction

To date, the process of deformation and destruction of loaded concrete at levels close to breaking, under conditions of low-cycle loading, remains insufficiently studied for the possibility of its explicit consideration in design practice. At the same time, there is a wide range of construction projects that, under real operating conditions, are exposed to low-cycle high-level loads (seismic, wind, wave, transport, etc.). These loads lead to a decrease in the durability of structures, up to premature and rapid fatigue failure of structures correctly designed in accordance with current building codes. A wide accumulation of experimental data is hampered by the duration and laboriousness of field experiments, as well as the need for painstaking processing and systematization of the data obtained with a large natural spread in the strength and deformation characteristics of concrete due to its significant natural heterogeneity.

The main disadvantage of the existing methodology for calculating concrete for endurance is the inability to take into account and control the process of fatigue damage accumulation. This is due to the fact that there are no objective quantitative characteristics of the physical state of concrete that would unambiguously assess the kinetics of fatigue damage accumulation and the remaining life of structures.

As a result of numerous experimental studies, it was found that the accumulation of fatigue damage in centrally compressed concrete during cyclic loading occurs nonlinearly. So, in works [1] and [2] it is shown that three successive stages of concrete deformation can be distinguished:

1) structure sealing;

2) relative stabilization of deformation;

3) deconsolidation of the structure, in which the progressive growth of deformations ends with the fatigue failure of the material.

The general patterns of concrete deformation under cyclic loads are given in [3]. Obviously, depending on the class of concrete in terms of compressive strength, the nature of the fatigue curves will change. Therefore, it is necessary to carry out fatigue tests for each class of concrete, which makes the task of obtaining curves experimentally practically unattainable due to excessively long and expensive field tests. To overcome this problem, it is possible to apply structural simulation modeling, which makes it possible to establish the mechanisms of processes and phenomena occurring in concrete under cyclic loading. At the same time, the basis of structural simulation modeling is a numerical model of the structure, which reproduces the real structure of the material as accurately as possible. It is obvious that a specific calculation technique must be applied when using this approach. In [4], a comparative analysis of the regulatory documents of the countries of the European Union, the USA, Japan, Russia, Belarus and Ukraine, regulating

the methodology for calculating reinforced concrete for fatigue life, was carried out. According to [4], in most of these standards there are simply no instructions for calculating the fatigue strength of concrete, while others take into account only the decrease in the strength of concrete depending on the level of the cycle asymmetry coefficient, the concrete strength class and working conditions. Thus, they also do not take into account the cumulative nature of fatigue damage, taking into account the increase in the number of cycles.

As part of the presented study, the goal was to develop a calculation method for predicting the fatigue life of concrete, taking into account the nonlinear kinetics of damage accumulation by conducting a numerical experiment. To achieve this goal, it is necessary to solve the following tasks:

1) the elastic and strength characteristics of the main components of the structure;

2) Determine the fatigue characteristics of the components;

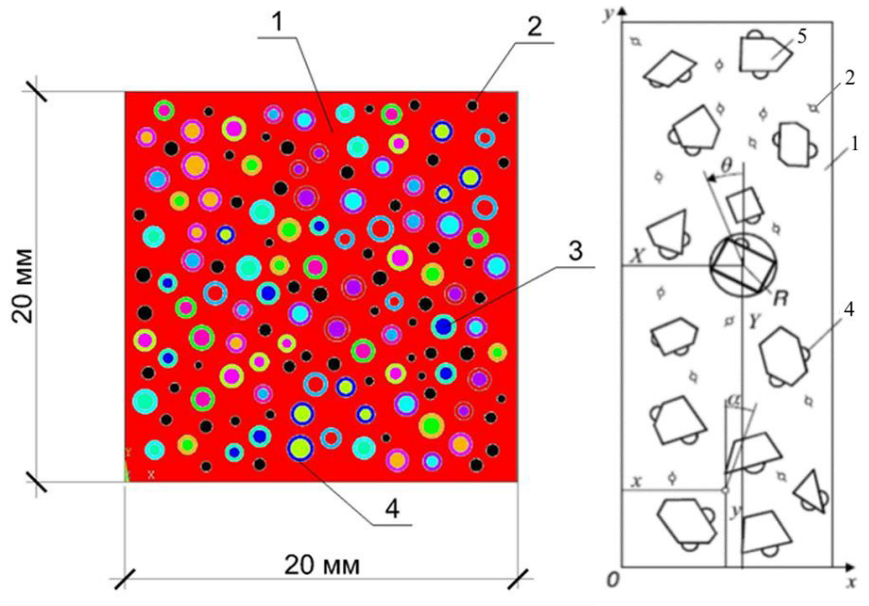
3) Create a numerical model of the concrete structure of a certain class;

4) Assign the obtained characteristics to the components of the structure and conduct a computational experiment that simulates the accumulation of fatigue damage in the concrete structure under cyclic loading.

This article discusses the solution of the first problem - the determination of the elastic and strength characteristics of the main components of the concrete structure for their further use in creating a numerical model.

Materials and methods of research

For the correct choice of the method for determining the elastic properties, it is necessary to determine the main phase components of the structure, which will subsequently be included in the model. According to [5] and [6], the cement matrix (1), pores (2), sand particles (3), contact zone (4) and coarse aggregate (5) can be distinguished as the main structural components of concrete (fig. 1).



a *b*

Figure 1. *The main components of the structure of fine-grained (a) and coarse-grained concrete (b).*

Elastic moduli and Poisson's ratios for quartz sand, crushed stone and contact zone can be taken on the basis of literature data. The elastic characteristics of cement stone can be obtained as a result of laboratory tests of standard samples of cement stone according to the instructions [7]. For the experimental determination of the mechanical characteristics of cement stone, the following variants of samples were made: cubes (70x70x70), prism beams (160x40x40 and 140x70x70) and cylinders (diameter 30 mm, length - 60 mm), shown in fig. 2. Cubes were made to determine the ultimate strength of cement stone in accordance with [8]. The tensile strength allows you to confirm the accepted brand and strength class of cement. Prism beams and cylinders were made to determine the prismatic strength and elastic characteristics of the cement stone.

a *b* *c*

Figure 2. *Fabricated samples: cubes (a), prism beams (b), cylinders (c)*

The determination of the ultimate strength of cement stone in bending and compression was carried out on a testing machine MII-100 and a hydraulic press PGM1000-MG4, respectively. According to the instructions in [8], we first test the prism beam for three-point bending, after which the obtained halves of the beam are tested for compression under a hydraulic press. In this case, the half of the beam is placed between two supporting plates in such a way that the side faces that, during manufacture, adjoined to the walls of the mold, were on the planes of the plates, and the stops of the plates fit snugly against the end smooth plane of the sample. Experimental studies of elastic characteristics were carried out on an Instron 5989 universal electromechanical system with a maximum load of 600 kN, with the joint use of a digital optical system for analyzing strain and displacement fields Vic-3d (Correlated Solutions). The scheme of the test is shown in fig. 3. The method of experimental study of the mechanical characteristics and staging of damage accumulation of cement stone used in the tests is presented in [9].

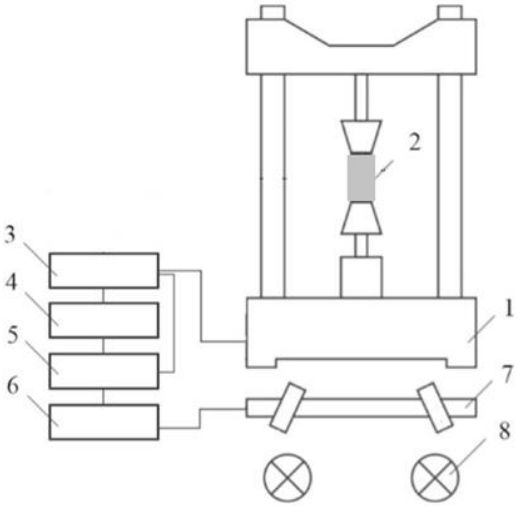


Figure 3. *Scheme of testing in conjunction with a non-contact optical video system: 1 – testing machine; 2 – sample in grips; 3 – test system controller; 4 – PC from which the machine is controlled; 5 – synchronization block; 6 – PC from which the video system is controlled; 7 – cameras mounted on a tripod; 8 – backlight system*

Research results

As a result of testing specimens for bending and compression, the values of ultimate strength of cement stone in bending and compression were obtained - 10.72 MPa and 36.27 MPa, respectively. The values determined during the experiment confirmed the design strength class of cement 32.5N. These results were presented in the form of a protocol.

Based on the results of compressive testing of specimens in order to determine the elastic characteristics, typical loading diagrams were obtained for specimens of various shapes (fig. 4).

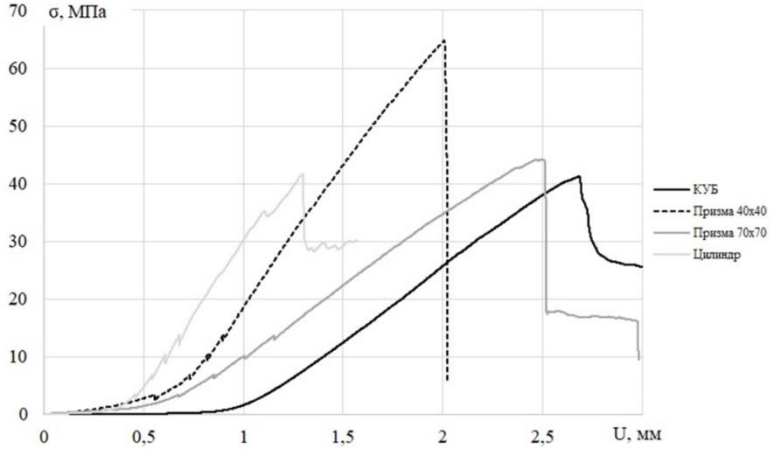
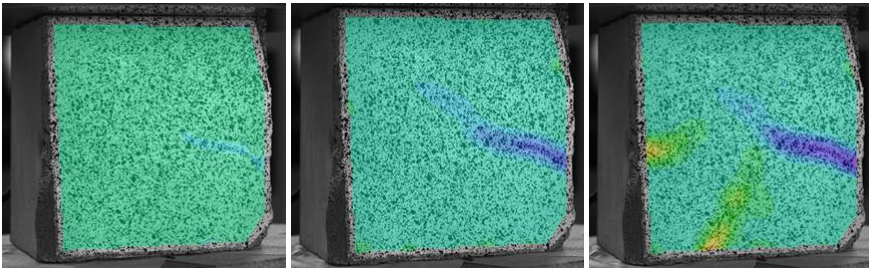
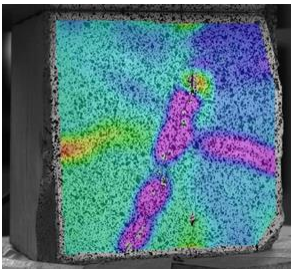


Figure 4. *Typical loading diagrams for specimens*

To determine the deformations [7], it is prescribed to use strain gauges or conductor strain gauges glued to the concrete surface. At the same time, strain gauges can be simulated using the "virtual extensometer" tool in the Vic 3D software. Its principle of operation is to track the mutual displacement between two points on the surface of the samples in accordance with the applied force. As a result of the experiment carried out according to the method [9], inhomogeneous fields of longitudinal deformations were obtained (fig. 5), which correspond to the points on the graph (fig. 4), at different levels of load for the cube sample. The results obtained make it possible to fix the moment of initiation and development of cracks on the sample surface, which lead to complete destruction under loading.



P_1=16,7 kN P_2=59,9 kN P_3=84,1 kN



P_4=164,4 kN

Figure 5. *Inhomogeneous fields of longitudinal deformations for a sample-cube at different levels of loading*

Determination of the elasticity modulus and Poisson's ratio of the cement stone was carried out by gradual loading with exposures (steps) of the samples until failure, in accordance with the instructions [7]. In this case, the strain values were fixed at the third stage. The results obtained are shown in tab.1.

Table. 1.

The results of compression tests of cement stone samples of various shapes

№	Sample shape	Modulus of elasticity, GPa	Poisson's ratio
1	Cylinder	29,0	0,22
2	Prism 40x40	22,5	0,30
3	Prism 70x70	19,5	0,19

Conclusion

As a result of the study, an algorithm was compiled for the method of predicting the fatigue life of concrete, taking into account the nonlinear kinetics of damage accumulation, and the elastic and strength characteristics of cement stone were experimentally determined. In the future, the obtained experimental data will be used to create a numerical model of concrete. This approach can be applied in the future to fix the rate of damage accumulation under cyclic loading. Thus, as the next stage of the study, the authors plan to conduct cyclic tests of cement samples in order to obtain the fatigue characteristics of the cement stone (i.e., fatigue curves).

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使用神经网络预测土壤水泥柱的直径

PREDICTING THE DIAMETER OF SOIL-CEMENT COLUMNS USING NEURAL NETWORKS

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抽象的。 长期以来，喷射注浆技术一直用于各种结构的地基加固。 然而，开发有效的方法来预测水泥土柱的实际几何和物理力学参数的任务仍然很紧迫。在设计阶段将神经网络应用于水泥地柱直径分配，可以显着提高水泥地柱设计参数分配的准确性，降低设计方案的成本。

关键词：喷射注浆，水泥土柱，直径，神经网络，预测。

Abstract. *The technology of jet grouting has been used for ground stabilization during construction of various structures for quite a long time. However, the task of developing effective methods of predicting actual geometric and physical-mechanical parameters of soil-cement columns is still urgent. Application of neural networks for assignment of ground-cement column diameters at the design stage can significantly increase the accuracy of assignment of design parameters of ground-cement columns and reduce the cost of design solutions.*

Keywords: *jet grouting, soil-cement column, diameter, neural network, prediction.*

Introduction

The technology of jet grouting of soils has been widely used in the practice of construction production since the 80s of the XX century. The essence of the jet grouting technology is to use the energy of a high-pressure jet of cement slurry to destroy and simultaneously mix the soil with the cement slurry in the "mix-in-place" mode. After cement hardening, a new material is formed - soil cement, which has sufficiently high strength and deformation characteristics [1, 2].

The most widely used jet grouting technology is to strengthen weak soils at the base of foundation slabs of buildings under construction. The settlement of foundations is calculated both by standard methods described in the regulatory literature and by numerical simulation. The reinforced base is most often modeled as homogeneous, with the given effective characteristics of the deformation modulus, the value of which is largely determined by the soil cement deformation modulus and the proportion of the fixed soil mass. These parameters are set at the design stage and determine the final design and economic efficiency of the selected solution [3].

Figure 1. *GCE at the base of the foundation slab*

Design of soil-cement arrays

One of the main problems in the design of foundations reinforced by the technology of jet grouting is the problem of matching the design parameters of the fixed soil mass to the actual results.

At the moment, when assigning the preliminary diameter of soil-cement columns and the technological parameters of their device, the regulatory documentation (SP 291.1325800.2017 Reinforced soil-cement structures) recommends using reference tables.

Table 1.
Recommended diameters of soil-cement elements (according to SP 291.1325800.201)

Soil type	TBSH GCE	Diameter of soil-cement elements, mm, for technology		
		one-component	two-component	three-component
Clay soils	200-300	500-600	1000-1300	1000-1500
Sandy soils	300-400	600-1000	1100-2000	1200-2000
Gravel soils	350-450	700-1100	1000-1500	2000-2400
Note – When using more powerful pumps, drill strings and special nozzles, soil-cement columns with a diameter of 3000-4000 mm can be obtained.				

This method of assigning the design diameter of a soil-cement element has a number of significant disadvantages:

- The recommended values of diameters have a fairly large spread within one type of soil; the effect of the strength characteristics of the soil at the construction site on the GCE diameter is not described;

- The values of the diameters of soil-cement elements for certain types of soils look underestimated, which is confirmed by experimental data and field observations, which in some cases leads to reloading of volumes at the design documentation development stage.

There is currently no standard method for calculating the diameter of a soil-cement element formed during jet grouting. The dependencies currently available are often based on the empirical experience of their author and are often applicable only for specific soil conditions and certain technological regimes of jet grouting.

Application of neural networks to predict the diameter of soil-cement columns

The problem of predicting the diameter of a soil-cement element can be solved using neural networks trained on the documented results of jet grouting using the example of actually implemented objects.

An artificial neural network is a subset of machine learning algorithms that arose when trying to simulate the processes that occur in the human brain when signals are transmitted between biological neurons. Each node (artificial neuron) is connected to other nodes with a certain weight and threshold value. If the output of any node exceeds the threshold value, then that node is activated and sends data to the next layer of the network. Otherwise, data is not transmitted to the next layer of the network. Training data is used to train and incrementally improve the accuracy of neural networks.

Artificial neural networks consist of nodes forming layers: an input data layer, one or more hidden layers, and an output data layer [4, 5].

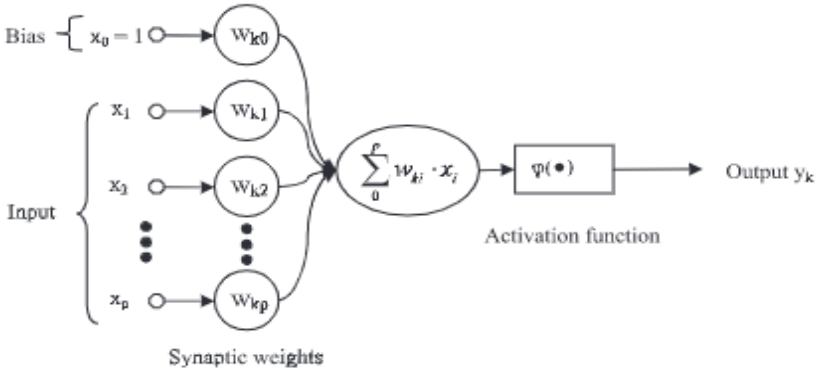

Figure 2. *Basic structure of an artificial neuron*

In general terms, the structure of the designed artificial neural network is shown in fig. 3.

We used the following as input parameters:

- Angle of internal friction and specific cohesion of soil at the construction site;
- Specific energy of destruction of a jet of cement slurry during jet grouting E_g (MJ/m)

The diameter of the soil-cement element was chosen as the output parameter.

The parameters of the physical and mechanical parameters of soils are determined based on the results of standard engineering and geological surveys.

The value of the specific fracture energy can be determined by formula (1).

$$E_g = \frac{0.1PQ}{V} \quad (1)$$

where Q – solution consumption (l/min);

P – discharge pressure (Mpa);

V – monitor lifting speed (cm/min).

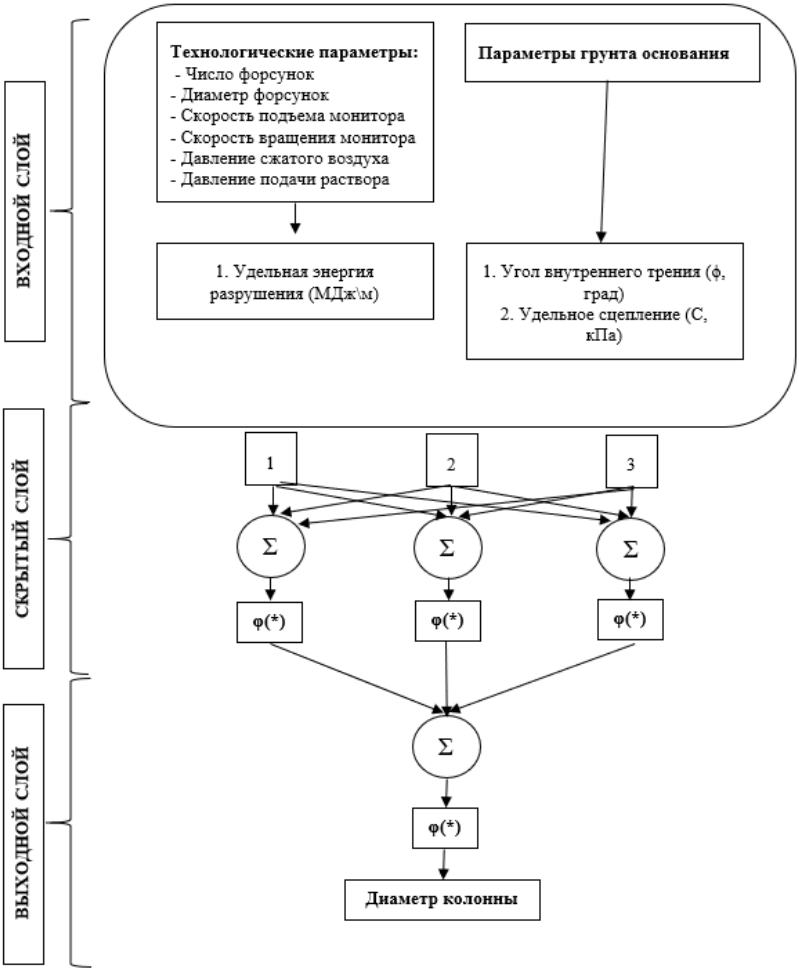

Figure 3. *Structure of the designed neural network*

To assess the applicability of neural networks for solving the problem, two neural networks were created in the EXCEL software systems (Neural Excel add-on) and MATLAB.

The parameters of neural networks are shown in tab. 2.

Table 2.

Neural network parameters

№	Neural Excel	MATLAB
Number of hidden layers	2	1
Number of neurons in a layer	100	100

The training of the neural network was carried out on the basis of the actually measured average diameters of soil-cement columns at 38 construction sites in various engineering and geological conditions.

A set of experimental data, indicating the input and output parameters, is presented in table 3.

Table 3.

Multitude of experimental data for neural network training

№	Soil type	C, kPa	ϕ, hail	Specific energy of destruction, MJ/m	Measured FCC diameter, m
1	Sandy loam plastic	10	16	59.85	2.49
2	Soft-plastic loam	13	13	47.88	1.40
……..					
37	Clay semi-hard	20	15	59.85	2.09
38	Dusty sand	1	31	59.85	2.20

The values were normalized in the range from 0 to 1 by interpolation methods relative to the maximum values of the output data. A fragment of the normalized learnings of the training set is presented in table. 4.

Table 4.

Multitude of normalized data

№	Soil type	Training set				Result	
		Input			Output	EXCEL	MATLAB
		C, kPa	ϕ, hail	Specific energy of destruction, MJ/m	Measured FCC diameter, m		
1	Sandy loam plastic	0.4	0.52	1.0	0.87	0.88	1.00
2	Soft-plastic loam	0.52	0.42	0.80	0.49	0.55	0.65
……							

37	Clay semi-hard	0.8	0.48	1.00	0.73	0.73	0.83
36	Dusty sand	0.04	1.00	1.00	0.77	0.78	0.90

After transferring the obtained values from the normalized ones to the calculated ones, the results of the neural network operation are obtained, shown in fig. 4.

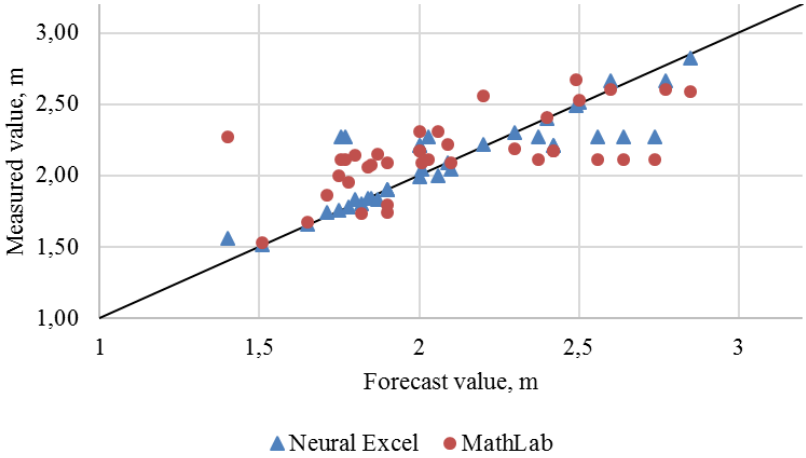

Figure 4. *Forecast result*

Conclusion

Based on the results of the preliminary calculations, the following conclusions can be drawn:

1. The average deviation in the diameter prediction using a neural network in EXCEL was 0.11 m, with an average specified column diameter of 2.1 m.

2. The average deviation in the diameter prediction using a neural network in MATLAB was 0.22 m, with an average specified column diameter of 2.1 m.

3. Neural network models can be used to assign the diameter parameter of a soil-cement element at the design stage.

4. Further study of the applicability of artificial neural network models for the prediction of GCE diameter is needed.

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改用绝缘线时架空电力线节电量的测定
DETERMINATION OF ELECTRIC ENERGY SAVINGS IN OVERHEAD POWER LINES WHEN CHANGING TO INSULATED WIRES

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抽象的。 结果表明，在改用绝缘线时改变架空线参数，电压损失和电能损失均降低，从而为农村供电系统获得显着的经济效果。

关键词：绝缘线，损耗，经济效应。

Abstract. *It is shown that when changing the parameters of the overhead line when switching to an insulated wire, both voltage losses and electrical energy losses decrease, which makes it possible to obtain a significant economic effect for the rural power supply system.*

Keywords: *insulated wire, losses, economic effect.*

The solution of issues aimed at reducing costs in the transmission of electrical energy is relevant at the present time. This problem is especially acute in rural distribution networks, which are characterized by a significant length, a high degree of wear and tear of the main equipment and the lack of effective electricity metering. Among other components in the structure of total costs for the transmission of electrical energy, the most significant for rural networks are the costs caused by theft of electrical energy and losses of active power in power lines.

Together with the solution of issues to ensure the economical transmission of electrical energy, the issues of ensuring the normalized indicators of the quality of electricity require consideration, among which the most important is the voltage deviation at consumers. It is known that it is possible to provide the required level

of voltage deviation for consumers by influencing the magnitude of voltage losses in electrical networks, which in turn depends on the parameters of the power line.

Currently, on the territory of the Russian Federation, a mass transfer of overhead lines with a voltage of 0.38 and 10 kV, made from bare wires to an insulated wire, is being carried out, which leads to a change in the parameters of the power line. Consider, using a specific example, what effect this will have for the rural power supply system, which is mainly performed by overhead lines (OL), in terms of efficiency and quality of power supply.

For consideration, we will take two options - using uninsulated and insulated wires of identical cross sections for OL, which feeds a group of residential buildings. The calculation is feasible without taking into account the costs associated with theft of electricity, although OL with insulated wires is characterized by a decrease in these costs, especially in the domestic sector [1].

The initial data for the line and the parameters of the wires taken into consideration are presented in table 1.

Table 1.

Initial data

Mark and section of the wire	A-70	SIP23x70+1x54.6
Specific active resistance r_0, Ohm/km	0.42	0.44
Specific inductive reactance x_0, Ohm/km	0.3	0.0789
Line unit cost k, thous. rubl./km	106.42	125.58
Length of the reconstructed line l, km	0.6	
Annual power consumption W_l, thous. kWh	132	
Cost of electric energy $c_э$, rub./kWh	4	

We will replace the uniformly distributed load created by a group of residential buildings with an equivalent concentrated load applied to the middle of the line under consideration, and determine the maximum voltage loss using the formula:

$$\Delta U_{\%} = \frac{(P_{\max} \cdot r_0 + Q_{\max} \cdot x_0) \cdot l \cdot 10^3}{2 \cdot U_{ном}^2} \cdot 100\%,$$

where P_{max} – active power transmitted through the head section of the line in the maximum load mode, kW;

Q_{max} – reactive power transmitted over the head section of the line in the maximum load mode, kvar;

r_0, x_0 – respectively specific active and inductive resistance of the wire, Ohm/km;

l – length of the main section, km;

$U_{ном}$ – rated voltage, V.

The value of the maximum active power is determined using data on the annual power consumption for the line

$$P_{\max} = \frac{W_{Г}}{T_{\max}},$$

where T_{max} – the time of using the maximum load, which can be determined from the reference data, depending on the nature of the load and the annual power consumption.

Knowing the nature of the load, we calculate the value of reactive power

$$Q_{\max} = P_{\max} \cdot tg\varphi.$$

Let's find the loss of electrical energy relative to the volume of electricity supplied to the line, using the expression

$$\Delta W_{\%} = k_{нм} \cdot \Delta U_{\%} \cdot \frac{\tau}{T_{\max}},$$

where $k_{нм}$ – coefficient of transition from voltage losses to power losses.

The results of the calculation of technical indicators are presented in table 2.

Table 2.

Calculation of technical indicators for reconstruction options

Mark and section of the wire	A-70	SIP23x70+1x54.6
Active power in maximum load mode P_{max}, kW	66	
Reactive power at maximum load Q_{max}, quart	49.5	
Voltage loss ΔU, %	8.84	6.84
Relative value of electrical energy losses ΔW, %	3.25	2.52
The absolute value of the loss of electrical energy ΔW, kWh	4294.2	3323.4
Saving electrical energy losses Э, kWh	-	970.9

An analysis of the calculations performed shows that an insulated wire, due to its design, has a significantly lower specific inductive resistance compared to an uninsulated wire of the same cross section, with almost the same values of specific active resistance, which leads to a decrease in voltage losses. Reducing voltage losses, on the one hand, leads to a smaller voltage deviation at the consumer, which is aimed at solving the issue of ensuring high-quality power supply, and

also reduces load losses of electrical energy, which contributes to solving the issue of efficient power supply.

It should be noted that the existing operating experience [2] shows that lines made with insulated wires are characterized by a reduction in maintenance and repair costs compared to OL made by bare wires. However, today, the cost of insulated wire exceeds the cost of bare wire. Therefore, it is necessary to calculate the economic indicators of the compared options.

Let us determine the total annual costs for the replacement of wires on the line under consideration, which will consist of depreciation deductions $И_a$, the costs of maintenance and repair of the $И_O$ and the costs due to the loss of electrical energy during its transmission to the $И_П$:

$$И = И_a + И_0 + И_П = K \cdot \alpha_a + K \cdot \alpha_0 + c_Э \cdot \Delta W,$$

where K – capital investments in the options under consideration, thous. rubles;

a_a, a_0 – rate of deductions for depreciation and maintenance and repair, respectively, r.u.;

$c_Э$ – cost of electric energy, rub./kWh.

The calculation of private economic indicators is presented in table 3.

Table 3.

Calculation of particular economic indicators

Mark and section of the wire	A-70	SIP2 3x70+1x54.6
Capital expenditures $K = k \cdot l$, thous.rub.	63.85	75.35
Excess capital cost $\Delta K = K_2 - K_1$, thous.rub.	-	11.49
Depreciation deductions $И_a = K \cdot \alpha_a$, thous.rub.	3.83	4.52
Maintenance and repair costs $И_0 = K \cdot \alpha_0$, thous.rub.	0.64	0.75
Costs associated with the loss of electrical energy during transmission $И_П = c_Э \cdot \Delta W$, thous.rub.	17.18	13.29
Total annual costs $И = И_a + И_0 + И_П$, thous.rub.	21.65	18.57
Annual economic effect $Э = И_2 - И_1$, thous.rub.	-	3.08

Analysis of the data in Table 3 indicates the effectiveness of the use of insulated wires when carrying out measures to modernize the electrical network. However, in comparison with the option of using a bare wire, large capital investments will be required, but at the same time, due to the reduction of electrical energy losses, the annual economic effect will be about 3 thous.rub.

Considering that the length of rural electrical networks made by 0.38 kV OL is about 880 thousand km, and 6-10 kV OL is about 1150 thousand km, the economic effect on a national scale can be very significant.

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以 Transkam 为例的山区雪崩危险
AVALANCHE DANGER IN MOUNTAINS ON THE EXAMPLE OF TRANSKAM

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抽象的。 本文介绍了在山区条件下保护道路免受雪崩影响的方法。 在山区条件下铺设的道路一直需要密切关注。 山区的自然环境主要以崎岖的山坡为代表，山坡上往往存在潜在危险的雪团，能够因自然和人为影响而失去平衡，其后果有时会导致人员死亡。 在这方面，安排了雪崩走廊，这并不总能改善道路安全状况。

关键词：山路、防护结构、雪崩、画廊。

Abstract. *The article describes methods for protecting roads in mountainous conditions from avalanches. Roads laid in mountainous conditions have always required close attention. The natural environment of mountain areas is represented mainly by rugged slopes, on which often potentially dangerous snow masses lie, capable of losing balance from natural and man-made impacts, the consequences of which are sometimes associated with the death of people. In this regard, avalanche galleries are arranged, which do not always improve the state of road safety.*

Keywords: *mountain roads, protective structures, avalanches, galleries.*

Essence of the question

Roads laid in flat conditions are fundamentally different from roads laid in mountainous areas. Mountain landscape conditions, avalanche features and natu-

ral and climatic factors of the Transkam [1] are extremely diverse and require a comprehensive solution to the problem - the creation of a highly efficient system and technical solutions to ensure road safety. With the need to lay roads in mountainous conditions, there is an urgent need to ensure road safety on it, which includes the protection of people, the protection of roads, engineering structures, etc.

The problem of protecting [2,3] mountain roads from avalanche danger has both scientific and technical content. The scientific side of the problem consists in studying the laws of avalanche phenomena, the degree of their danger in relation to mountain roads, as well as in developing optimization solutions in the system of methods for calculating snow cover, avalanches and protective structures. The technical side of the problem consists in the development of technical solutions for the creation of protective structures, depending on the nature and parameters of the avalanche danger in relation to the Transkam and other roads in the mountainous regions of Russia and other countries.

There are different classifications of avalanches, of which one of the most mentioned is the genetic classification of snow avalanches (table 1).

Table 1.

Genetic classification of avalanches

Avalanche class	**Avalanche type**	**Avalanche subtype**	**Diagnostic signs of avalanches**			
			Weather conditions prior to avalanches	**The predominant form of separation**	**Snow stratigraphy above the shear surface**	**The location of the sliding surface at the break point**
I. Syngenetic avalanches (caused by an increase in forces that move snow off a slope due to an increase in snow depth)	1.Snow avalanches 2. Avalanches of general snowstorms 3. Snowstorm avalanches	Y Y Y	Snowfall without a blizzard Snowfall with blizzard Blowing snow or drifting snow	Dotted Areal *	Layer of freshly fallen snow Layer of freshly fallen snow Layer of swept snow	Inside the freshly fallen snow or by its contact with the old At the contact of freshly swept snow with old, sometimes inside the swept snow At the contact of the swept old snow with the underlying layer, sometimes inside swept snow

II. Epigenetic avalanches (caused by a decrease in the forces holding snow on a slope without an increase in snow depth)	1. Avalanches of thermal loosening of snow	a) caused by the weakening of bonds in the depth of the snow mass b) caused by the destruction of bonds with the surface of the snow mass	Long frosty period, possibly combined with periods of snowmelt Long frosty period with virtually no snow deposition	* Dotted	One or more layers of old snow Deep frost layer	On a weakened layer inside the snow mass or on the ground Inside the surface loosened horizon, by its contact with the bound layer or along the ground
	2.Avalanches of wind loosening of snow 3. Snowmelt avalanches	Y a) caused by the formation of two-zone adhesive properties of snow b) caused by snow moistening to the value of its water-holding capacity	Continuous strong gusty winds with low air humidity Warming, intense solar radiation in the first days after a snowfall Strong warming	Areal Dotted Y	One or more layers of old snow A layer of wet loosely bound snow One or more layers of wet, loosely bound snow	On a weakened layer inside the snow mass or on the ground Inside a layer of loosely bound snow at the contact of zones with different adhesive properties On the ground or on a water-resistant layer inside the snow mass
III. Polygenetic avalanches (caused by an increase in the forces that move snow off the slope, while at the same time a decrease in the forces that hold the snow on the slope)	1.Avalanches caused by rain 2-10. Combined avalanches	Y	Rain Long period with severe frosts, winds or snowmelt, immediately before the avalanche - snowfall, general or blowing blizzard	Y Areal	Same One or more layers of old and necessarily a layer of freshly deposited snow	Same On a weakened layer inside the old snow or on the ground

As follows from table 1, a significant role in the initiation of avalanches belongs to the age of snow (fresh, old snow), as well as the bonding forces at the boundary of the snow mass: the slope surface (underlying surface), as well as a large number of other factors with varying degrees of influence on avalanches.

A snow avalanche is a dangerous slope phenomenon. According to the results of research on the example of the Transkam at the end of the last century, an average of 4-5 people fell under avalanches and died annually. The mountain road is always subject to avalanche danger. Despite the small length of the high-mountainous part - 57 km, the road is technically one of the most unique and complex objects. Certain sections during the design and construction were not entirely successful, which leads to frequent interruptions in work due to avalanche collapses. The operational complexity is also expressed by overcoming high altitudes, about 2000 m above sea level, while the Alpine Mountains and other European and Asian passes and examples of their crossing usually do not exceed about 1500 m. Figure 1 shows the scheme of avalanche danger (main) on the Transkam, the most difficult and high mountain motorway in Europe. The road is of the third technical category and, in violation of the design statement of maintenance, is divided into two parts, which is a negative factor in its operation.

In the last two decades, significant work has been carried out on the northern slope to ensure avalanche safety and the Main Roki Tunnel has been repaired. Work continues in this direction.

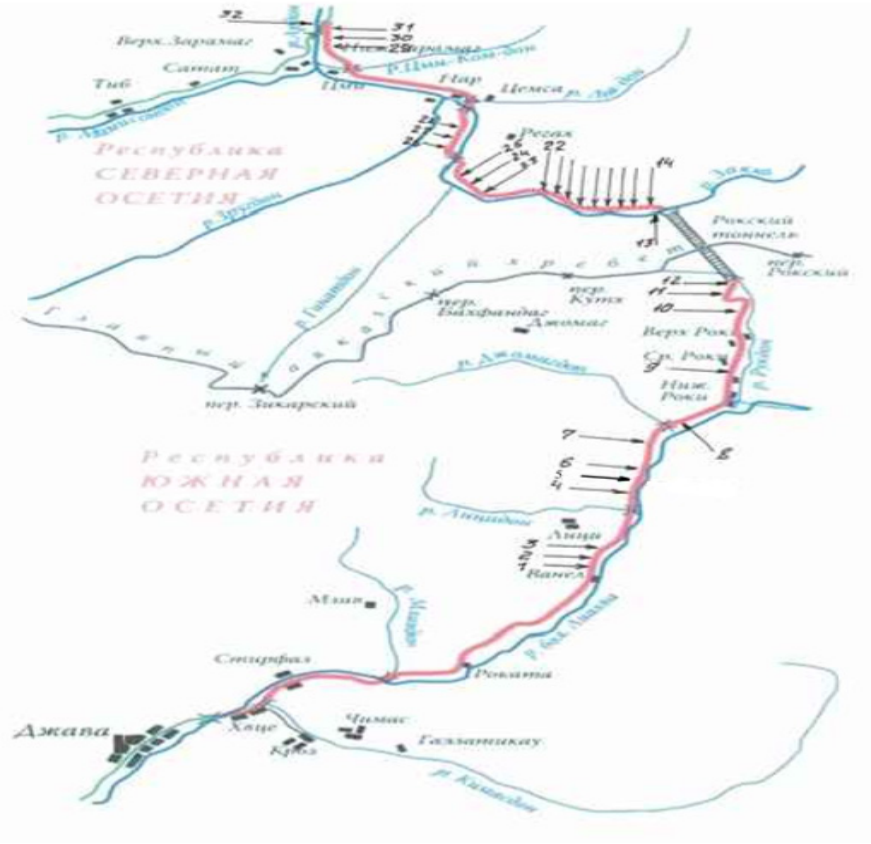

Figure 1. *Scheme of the avalanche danger of the Transkam*

As for the Southern Slope, here the issue is still frozen. In the above diagram, out of 12 avalanche-prone places, only №6 and №12 are protected by galleries. Instead of the destroyed gallery, a retaining wall was built on the avalanche site №11, which, instead of safety, creates the most dangerous traffic conditions (figure 2). One gallery number 5 has remained unfinished since the Soviet era.

Figure 2. *Avalanche area № 11. A retaining wall built instead of a demolished gallery, creating dangerous conditions for road users*

Avalanche pockets № 8 is rare, but falls from the opposite slope. № 9 are out of reach for the road. № 10 requires additional research.

Thus, avalanche centers № 1-5, № 7 and, in particular, № 11 are subject to being brought to a safe state for movement. In addition, in the section between avalanche sources № 10 and № 11, the road was designed with acceptable SNiP standards, but is dangerous. 0.5 km of the road should be brought to a safe condition for movement.

As an example, quite recently, on December 21, 2022, an avalanche descended on the southern section of the Transkam (figure 3), 5 people who guarded the tunnel and were at that time in the barracks found themselves under the snow. Two were rescued, three were killed.

a) b)

Figure 3. *a) The moment of the avalanche on the Transkam b) search and rescue team*

In connection with the need to ensure road safety, protective structures are arranged, which do not always justify themselves in terms of design. In 1986-90, rectangular avalanche galleries were built on the Transkam.

Flexible connections of structural nodes during collapses [4] of slope phenomena created conditions for deformation and subsequent destruction of the structure. An example of deformation and destruction of the gallery is shown in figure 4.

Figure 4. *Deformed rectangular structures of protective structures on the example of Transkam*

Thus, we can conclude that such a design is unsuitable for protection against snow avalanches and other slope phenomena.

In connection with the above, the authors propose an avalanche protection device. With a steep slope of the mountain and a large volume of avalanche mass, the authors propose an avalanche protection device made of a metal frame. The invention is a successful development of technical thought in the field of design development of avalanche protection structures. The structural diagram of the structure is shown in figure 5.

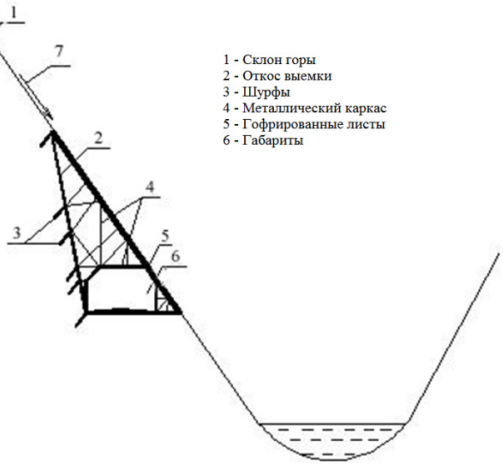

Figure 5. *Avalanche protection device*

The invention relates to devices designed to protect avalanche sections of roads and railways laid in mountainous conditions.

The technical result of solving the problem is a lightweight construction of a metal frame 4 and straight metal corrugated sheets – 5, 7 mm thick and 6x1 m in size.

The strength and attachment of the avalanche protection device to the rock mass is carried out through two-meter reinforcing bars with a diameter of 32-40 mm, inserted into the pits 3 and monolithic with cement mortar to the rock mass of the slope 2. The avalanche mass 7 on the metal surface of the avalanche protection device slides more easily than on the slope surface itself, which often has an uneven and dried grassy surface 1. The structural dimensions of the frame parts are selected taking into account the overall dimensions of the road 6.

The optimal technical solution has a number of significant differences that give an economic effect: structures and parts are designed to be straight, which facilitates their manufacture, transportation and installation; there is no need to build a bulky and difficult - technological over-gallery embankment; the overall operational safety of the device and local road safety are increased, which increases the reliability, comfort and durability of the transportation of goods and passengers and, in general, positive operating conditions for vehicles and the entire transport complex.

Conclusions

1. The use of protective measures and structures should be justified in a comprehensive manner in technical, economic, environmental plans, especially in the effectiveness of ensuring road safety.

2. Scientists, or individual scientists in traffic safety, or practical specialists in the roads of Ossetia and other regions should group up and develop original, novelty designs of protective structures to protect against avalanche masses for the benefit of world science.

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饮用水快速分析与 21-22 岁男孩和女孩 COVID-19 发病率相关的预后价值
PROGNOSTIC VALUE OF EXPRESS ANALYSIS OF DRINKING WATER IN RELATION TO THE INCIDENCE OF COVID-19 IN BOYS AND GIRLS AGED 21-22 YEARS

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抽象的。迄今为止，饮用水水质问题及其对人类健康的影响已被广泛报道。因此，在 2020-2021 年，对哈巴罗夫斯克 5 个区的 600 个样本进行了快速分析，对集中供水的饮用水进行了快速分析，以定性和半定量测定 pH、NO_2^-、NO_3^-、Cl^-、GH 作为因子在 21-22 岁的男孩和女孩中形成 COVID-19 发病率。 pH、NO_2^-、NO_3^-、GH等指标对应2020-2021年各区全季标准。根据哈巴罗夫斯克地区和 2020 年的季节，饮用水中 Cl— 的特性或多或少偏离标准。而在 2021 年，Cl— 指标符合常态。还分析了居住在哈巴罗夫斯克不同地区的参加研究的学生的 COVID-19 发病率，并确定了男孩和女孩的 COVID-19 发病率与集中供水的饮用水指标的一些特征的相互依赖性。

关键词：集中供水饮用水， 哈巴罗夫斯克， pH， NO_2^-， NO_3^-， Cl^-， GH，COVID-19

Abstract. *To date, the problem of drinking water quality and its impact on human health has been widely covered. Thus, in 2020-2021, 600 samples were examined in 5 districts of Khabarovsk by conducting an express analysis of drinking water of centralized water supply for qualitative and semi-quantitative determination of pH, NO_2^-, NO_3^-, Cl^-, GH as factors in the formation of COVID-19 morbidity in boys and girls aged 21-22. Such indicators as pH, NO_2^-, NO_3^- and GH correspond to the standard in all districts and all seasons of 2020-2021. The characteristics*

of Cl^- in drinking water deviate from the standard to a greater or lesser extent, depending on the district of Khabarovsk and the 2020 season. While, in 2021, the Cl^- indicators correspond to the norm. The incidence of COVID-19 of students participating in the study living in different districts of Khabarovsk was also analyzed and the interdependence of the incidence of COVID-19 of boys and girls with some characteristics of drinking water indicators of centralized water supply was determined.

Keywords: *drinking water of centralized water supply, Khabarovsk, pH, NO_2^-, NO_3^-, Cl^-, GH , COVID-19*

Relevance

Providing the population with high-quality drinking water is a task of paramount importance, which is solved through constant monitoring of drinking water at modern water treatment plants (Abdullaev M.Sh. Magdiev A.M., Gafurov M.M., 2018). Currently, increasing negative anthropogenic impact on the environment leads to deterioration of many sources of drinking water supply in a wide range of indicators (Blagodatsky G.A., Bas A.A., Gorokhov M.M. et al., 2018). According to the World Health Organization, drinking water contains 13 thousand potentially toxic elements and compounds; 25 million people die annually from water pollution. According to the research of the last 5 years, every 3rd sample of drinking water does not meet the Sanitary Regulations and Norms on the territory of the Russian Federation (Ageeva P.D., Katina A.P., 2018). High-quality water that meets sanitary, hygienic and epidemiological requirements is one of the indispensable conditions for preserving human health (Nutrients in drinking water, 2004).

The purpose of the study to conduct EXPRESS analysis of drinking water for qualitative and semi-quantitative determination of pH, nitrates-nitrites ions, chlorine ions, water hardness as factors in the formation of COVID-19 morbidity among 21-22 year old boys and girls.

Methods and Materials

In 2020-2021, drinking water samples were taken in Khabarovsk during 4 seasons (Central district n=120; Kirovsky n=120; Krasnoflotsky n=120; Industrial n=120; and Railway (n=120). Overall, there were 600 samples.

The characteristics of drinking water were identified by the method of qualitative and semi-quantitative express analysis on the basis of FESTU research laboratory.

You can see some test strips for determining the characteristics of drinking water samples of centralized water supply by express analysis.

Figure 1. *operating time of measurement of drinking water samples of centralized water supply*

Results and conclusions

In the table 1, the percentage of samples that do not meet the standard is shown in red. The average annual percentage of samples with a high content of chlorine ions in drinking water in all districts of Khabarovsk, except Industrial, is 33.3 percent, in Industrial district - 25.0 percent.All other indicators fully comply with the standard.

Table 1

Average annual values of the studied indicators of drinking water of centralized water supply in different districts of Khabarovsk

District of Khabarovsk	The studied indicator	% of samples that do not meet the standards	% of samples corresponding to the upper - lower limit of the standard	% of samples corresponding to MAC
Central district	pH	0,00	0,00	100,00
	Cl^-	33,30	*66,67*	0,00
	Gh	0,00	0,00	100,00
	NO_2^-	0,00	0,00	100,00
	NO_3^-	0,00	0,00	100,00
Kirovsky district	pH	0,00	0,00	100,00
	Cl^-	33,30	*66,67*	0,00
	Gh	0,00	0,00	100,00
	NO_2^-	0,00	0,00	100,00
	NO_3^-	0,00	0,00	100,00
Krasnoflotsky district	pH	0,00	0,00	100,00
	Cl^-	33,30	*66,67*	0,00
	Gh	0,00	0,00	100,00
	NO_2^-	0,00	0,00	100,00
	NO_3^-	0,00	0,00	100,00
Industrial district	pH	0,00	0,00	100,00
	Cl^-	25,00	*75,00*	0,00
	Gh	0,00	0,00	100,00
	NO_2^-	0,00	0,00	100,00
	NO_3^-	0,00	0,00	100,00
Railway district	pH	0,00	0,00	100,00
	Cl^-	33,30	*66,67*	0,00
	Gh	0,00	0,00	100,00
	NO_2^-	0,00	0,00	100,00
	NO_3^-	0,00	0,00	100,00

Figure 2 shows the compliance of pH in all centralized water supply samples with MAC (maximum allowable concentration) (6-9) in all seasons of the year in all districts of Khabarovsk in 2020-21. Analysis of the pH of drinking water of the central water supply showed the predominance of samples with a shift towards increasing acidity (slightly acidic, even closer to a neutral medium).Neutral medium is 7.0; acidic medium is lower than 7 (from 6.9 to 0) and alkaline medium is higher than 7 (from 7.1 to 14.0).

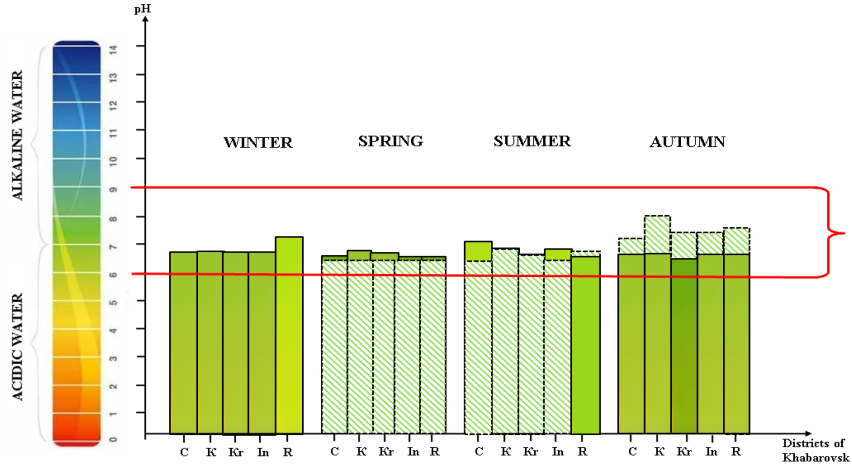

Figure 2 - Change in pH in samples of drinking water of the central water supply in Central, Kirovsky, Krasnoflotsky, Industrial, Railway districts of Khabarovsk in different seasons of 2020 and 2021.

Note: here and further, a significant difference with the limit of the standard is shown: p≤0, 05 (*); p≤0, 01 (**); p≤0, 001 (***); — limits of the standard for drinking water; — indicators for 2021

Figure 3 shows the change in the content of chlorine ions in samples of drinking water of centralized water supply in different districts of Khabarovsk.

In 2020, the average water chlorine ions index for the year is higher than the norm or corresponds to the upper limit of the standard in all districts of Khabarovsk.

The highest chlorine ions content was determined in the Industrial district, with an excess of the upper limit by 4 times, the difference with maximum allowable concentration is significant (p≤0.001), and in the winter of 2020, hyperchlorination of drinking water was determined.

It should be noted that it was in February 2020 that the first outbreaks of coronavirus infection were detected in Russia. It is known that as soon as an infectious disease outbreak is detected, the drinking water treatment plant immediately increases the dose of chlorine several times. It is worth noting that in 2021 the average indicator of the content of chlorine ions corresponds to the upper limit of the standard.

In the works of Ren Qian, Cao Bo, Qiu Zhi-qun, it was revealed, that the use of chlorination for disinfection of tap water leads to the formation of organochlorine compounds, which contributes to a significant decrease in the testosterone content in blood serum and an increase in the number of abnormal spermatozoa in men (Sertoli cells) (13.6-18.3% with 6.7% in the control).

Thus, disinfection of water with chlorine can become a trigger for weakening the human immune system and lead to even more serious health problems.

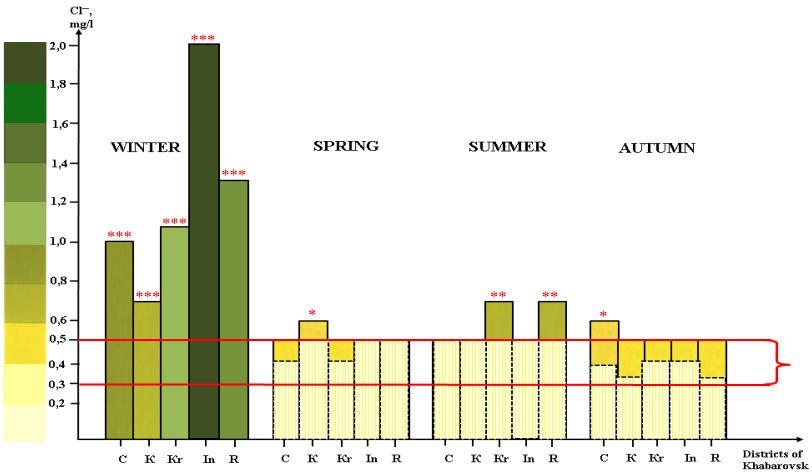

Figure 3 - Change in the content of Cl⁻ in samples of drinking water of the central water supply in the Central, Kirovsky, Krasnoflotsky, Industrial, Railway districts of Khabarovsk in different seasons of 202 and 2021

Note: ▯ – indicators for 2021.

Figure 4 shows " The change in the water hardness index in samples of drinking water of centralized water supply in different districts of Khabarovsk in different seasons of the year.

Water with a water hardness of 1.5-4 mg-eq/l is considered soft from 4 to 8 mg-eq/dm3- medium hardness, from 8 to 12 mg-eq/l- rigid and above 12 mg-eq/l is very rigid. [7].Looking at the figure, it can be seen that in 2020, the average annual hardness (Gh) of central water supply in all districts is consistently average.

The greatest water hardness was observed in the autumn period - 6±0.0001 mg-eq/l. The average hardness of the analyzed water samples in all seasons of 2020-2021 corresponds to the standard (up to 7 mg-eq/l), there is a tendency to soften drinking water.

In European countries, the standards of the stiffness index are regularly reviewed. For example, in the Czech Republic in 2003 the requirement for rigidity was revised - from 2 to 3.5 mg-eq/l. This fact testifies to the focus of national standardization on the establishment of optimal health requirements based on up-to-date scientific data.In addition, the recommended value of the hardness of drinking water from the point of view of the WORLD HEALTH ORGANIZATION (WHO) is 1.5 - 2.5 mg-eq/l. However, according to Sanitary Rules and Norms 1.2.3685-21 "Hygienic standards and requirements for ensuring the safety and (or) harmlessness of environmental factors for humans" dated January 28, 2021 N 2, the hardness of drinking water of centralized water supply should not exceed 7 mg-eq/l.

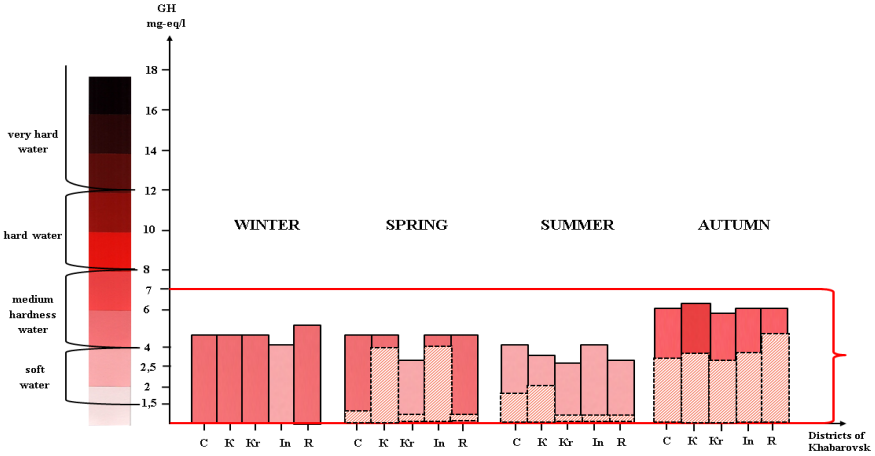

Figure 4 – Change of the GH indicator in samples of drinking water of the central water supply in the Central, Kirovsky, Krasnoflotsky, Industrial, Railway districts of Khabarovsk in different seasons of 2020 and 2021

Note: – indicators for 2021.

Figure 5 shows the change in the content of nitrites in samples of drinking water.

The content of nitrite ions corresponds to the maximum allowable concentration, regardless of the season of the year in 2020 and 2021.

In 2020, the highest content of nitrites in drinking water is observed in the winter period of the year, since the bulk of the ions are in liquid water, and a reduced concentration is in ice crystals, according to literature data, there is an accumulation effect.

Nitrites that end up in the body with drinking water are considered substances with a high level of toxicity. Their danger to humans lies in the ability to form methemoglobin – if its level in the blood exceeds 20%, there is a serious risk of hypoxia.

Together with this dangerous disease, a high percentage of nitrites in the water risks leading to other problems: tachycardia, increase in blood vessels, deterioration of the stomach, expressed by nausea and vomiting, difficulties with the functioning of the thyroid gland, weakness, severe headaches, the appearance of signs of central nervous system depression.

The main risk group that nitrates can affect the most are infants and children younger than 12 months. This is due to the fact that their body did not have time to form protective functions in sufficient quantity to combat irritants.

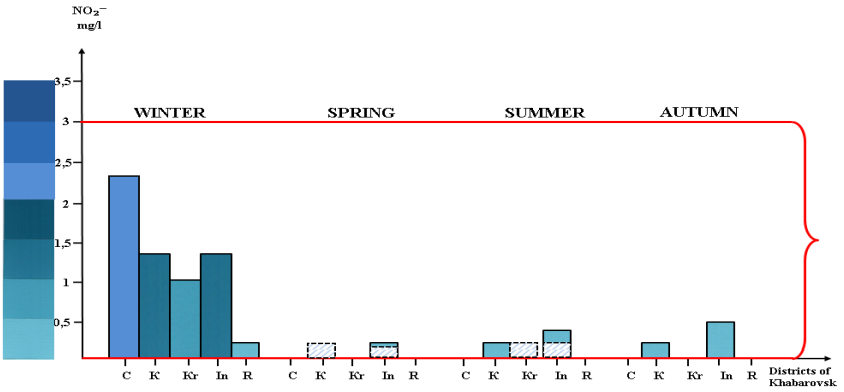

Figure 5 — Change in the content of NO_2^- in samples of drinking water of the central water supply in the Central, Kirovsky, Krasnoflotsky, Industrial, Railway districts of Khabarovsk in different seasons of 2020 and 2021

Note: ▭ — indicators for 2021.

The analysis of the nitrate content in the drinking water of the central water supply revealed the complete absence of nitrate ions, which corresponds to the standard (Figure 6) .

Nitrates Contribute to the formation of a dangerous substance in the blood - methemoglobin, which leads to oxygen deprivation.

If the methemoglobin index is 15%, this is manifested by rapid fatigue, lethargy and dizziness. An increase in methemoglobin up to 60% leads to a fatal outcome. Excess concentration of nitrates in water causes poisoning, disruption of the gastrointestinal tract, excretory and endocrine systems, destruction of tooth enamel and the appearance of caries.

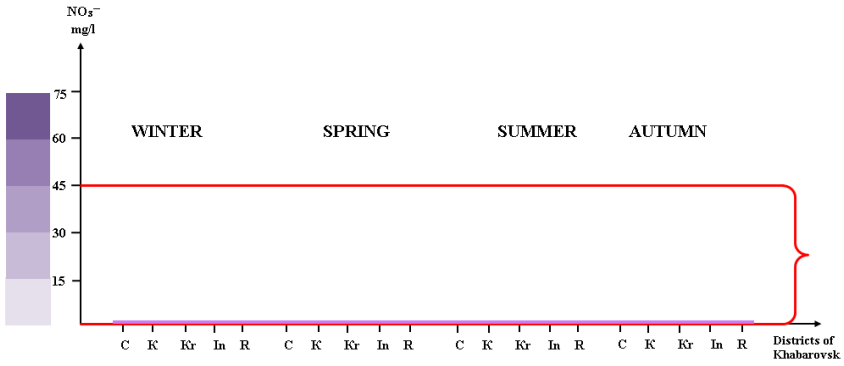

Figure 6 — Change in the content of NO_3^- in samples of drinking water of the central water supply in the Central, Kirovsky, Krasnoflotsky, Industrial, Railway districts of Khabarovsk in different seasons of 2020 and 2021

In the course of the study, we interviewed students, who provided us with water samples during 2020-2021.

During the survey, it was revealed that 23 out of 75 people had been ill with coronavirus.(31%)

As a result, it became possible to conduct a mathematical analysis of the relationship between the characteristics of drinking water of centralized water supply with the incidence of coronavirus. (regardless of the area)

The analysis of the work showed excessive chlorination of drinking water of the central water supply of Khabarovsk. A significant weak correlation was determined between intensive chlorination of drinking water exceeding the upper limit of the norm by 1.5 times and the incidence of coronavirus. The analysis revealed that water hardness does not affect morbidity.

The pH value of drinking water corresponds to the norm, despite this, a reliable correlation between the pH of drinking water and the incidence of COVID-19 was determined.

It was revealed that students whose samples of drinking water were closer to a neutral environment were more likely to get sick. The content of nitrites and nitrates in samples of drinking water of the centralized water supply of Khabarovsk does not exceed the maximum allowable concentration, but a reliable relationship between nitrite contamination of drinking water and the incidence of coronavirus has also been determined (Figure 7) .

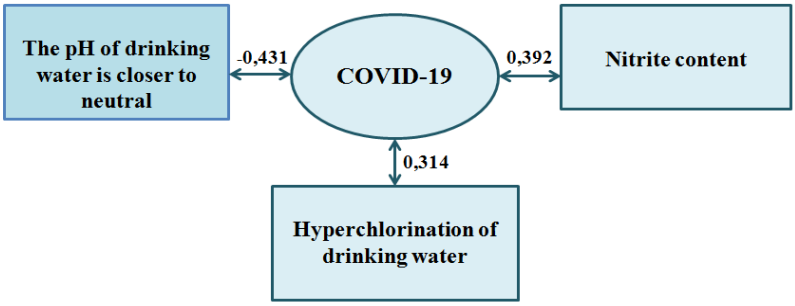

Figure 7. *the relationship of negative characteristics of drinking water centralized water supply with the incidence of COVID-19*

Conclusions

1. The characteristics of pH, nitrate-nitrite ions, water hardness in drinking water of centralized water supply, in all seasons of 2020-2021, in all districts of Khabarovsk comply with hygienic standards.

2. The content of chlorine ions in 2020, on average, in 32 percent of drinking water samples from different areas, especially in winter, does not meet the standard, the water is hyperchlorinated. In 2021, the content of chlorine ions in drinking water corresponds to the maximum permissible concentration.

3. Correlation of COVID-19 incidence with characteristics of pH, NO2─,Cl─, in drinking water of centralized water supply has been revealed.

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全球化背景下亚太地区国家与远东俄罗斯的跨境关系矛盾
CONTRADICTIONS OF CROSS-BORDER RELATIONS BETWEEN THE COUNTRIES OF THE ASIA-PACIFIC REGION AND THE FAR EAST RUSSIA IN THE CONTEXT OF GLOBALIZATION

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抽象的。 考虑了后苏联时期远东地区全球化、利益平衡和跨境关系的优势等因素。 东部地区损失惨重，至今未得到补充。 由于跨境贸易，该地区作为资源供应商单方面融入世界贸易。 结果表明，跨界关系对公共生活的所有领域都有不同的影响，导致转型社会的政治、社会经济形势发生变化。 所形成的结构的双重性质被确定，从而消除了与周边国家交往中经济需求之间的政策差异。

关键词：远东，区域优势，一体化，跨境交流，全球化。

Abstract. *The factors of globalization, the balance of interests and the advantages of cross-border ties for the Far East in the post-Soviet period are considered. The eastern regions have suffered significant losses and so far they have not been replenished. As a result of cross-border trade, the region is unilaterally integrated into world trade as a supplier of resources. It is shown that cross-border relations have a different impact on all spheres of public life, lead to changes in the political, socio-economic situation in transformed societies. The dual nature of the formed structures is determined, which smooth out the policy discrepancy between the economic needs in contacts with neighboring countries.*

Keywords: *far East, the regional advantages, integration, cross-border communication, globalization.*

Introduction

Socio-economic development at the beginning of the XXI century. It has

brought a lot of new things not only to industry structures, but also increased interest in the problems of territorial organization of the population. The improvement of the level and quality of life is largely hindered by the unresolved number of procedural problems in the form of the movement of capital, goods, services, innovations, information, people, production, etc. the territorial organization of society is carried out as a result of the influence of many conditions, prerequisites and factors.

The relevance is determined by the task of solving the problem of negative population dynamics in the Far Eastern Federal District, which is considered peripheral.

Materials and methods

The use of the comparative geographical method makes it possible to trace the trends of the emerging development and in the future take into account the influence of certain factors on the socio-economic dynamics in the region.

Problem statement

In the conditions of reform, work on the development of the labor market, new types of migration, and problems of population reproduction have become in demand. There have been studies focused on sociology, regional economics, and the rationale for the new regionalization of Russia [3, 10]. In addition to the current traditional assessment of demographic dynamics, there are notable works that provide new directions for regional demographic research [6, 7, 8]. Attention to the study of demographic problems has significantly increased, taking into account the emerging new factors of globalization in the natural resource, demographic, and economic spheres [11, 5].

Discussion of the results

The decline in economic ties with the Center has brought the Russian Far East face to face with the most intensively developing economies in the world. Asian countries turned out to be much closer and more accessible than the European part of the Russian Federation. A huge territory, which makes up almost half of the country, turned out to be "remote". In the new century, the Far East turned out to be "distant" only for its own capital. Nearby there are "global cities" (Tokyo, Osaka, Shanghai, Hong Kong 3) with an active economy that draws in the economic systems of the periphery. Here there is a conceptualization of new threats, more precisely, the old ones are transformed. The permanent orientation of the peripheral region towards cities – the "gateway to the global world" - contradicts the idea of an outpost. At the same time, Veselovsky S.Ya. [2] showed that at least a fifth of the increase in total income over the more than 60-year post-war period was obtained in one way or another due to the action of factors, the source of which was globalization. The image of the surrounding ("hostile") foreign policy environment is transformed into the idea of "demographic pressure" on borders.

Their aggressive economy was in dire need of the region's natural resources and was ready to pay for them. It is essential that these "gates" hypothetically could splash out on the near periphery of capital and other resources that are so necessary in the conditions of "separation". The period of "shuttle" trade, which stirred up the population of the region, the privatization of the Far Eastern part of the "Soviet trophy" created the necessary conditions for the inclusion of the population in international trade [4]. However, unlike the "big trophy", which was shared in the European part of the country, the eastern "trophy" was much more specific. The "side" activities turned out to be more valuable. The catch of valuable species of fish and other seafood (fishing fleets), mining, forest plots, etc. For them there was a struggle in the first half of the 1990s. Of course, fish could well be consumed within the region, and huts could be set up from the forest. But trade provided a qualitatively greater resource and income for traders [9].

As a result of the increased interest in the Asia-Pacific region in the processes of regional globalization relative to this region, it should be noted that among the new phenomena of geographical reality, the strengthening of the influence of the natural resource factor on the regional structure of the economy is highlighted. Given that the natural resource potential, including fuel and energy resources and a huge sales market in Asia are a positive factor in the cross-border development of the region, a contradiction appears. The "far Periphery" receives practically nothing in exchange for the supplied resources. Even if these resources are extremely valuable, the benefits of "trade" extend only to a small group of representatives of this "distant periphery", without affecting the general population. This socio-economic heterogeneity of the territory was identified in the conditions of the eastern outskirts of the Russian Federation.

Another important feature is the growing importance of the geopolitical position of the Far Eastern District. More than 200 million residents from neighboring countries (China (Manchuria), the Republic of Korea and the DPRK, Japan) live in total around the region along the southern borders [11]. The largest Far Eastern cities (Vladivostok, Khabarovsk), in comparison with such Asian megacities as Beijing, Shanghai, Hong Kong, Singapore, Bangkok, are not comparable in size. Cities in the northeast of China have developed especially intensively over the past 30-40 years, with a clear asymmetry of superiority over Far Eastern cities.

The third feature is environmental problems. In resource areas, environmental sustainability is important to obtain a long-term economic effect from the exploitation of resources. As one of the areas of research at the intersection of geography, ecology, and politics, a political and environmental direction of interaction between countries has been formed. The transboundary properties of the geographical environment encourage interaction and joint operation of river systems (the Amur River basin), marine areas (the Sea of Okhotsk and the Sea of Japan), etc.

The interaction between society and the environment at different territorial levels can affect political and economic inequality.

Certain factors that take place in public life contribute to the growing influence of globalization. Under the influence of globalization, spatial economics acquires new features. The main signs of the influence of globalization are the formation of the information space; the strengthening of the interdependence of countries in all spheres of human life; the strengthening of the social orientation of interrelations [9, 10].

The events in the Middle East (2011-2014), in Ukraine (since 2014) clearly demonstrate that the realities of the modern world, such as freedom of information dissemination and the formation of virtual social networks, which have become the most characteristic signs of the globalization of information flows, not only stimulate the processes of transformation in developing countries and transition countries, but also give them new shades, form new situations in international markets. The negative effects of economic globalization, especially international trade, manifested in national labor markets, are constantly in the focus of public discussions. The long-term equilibrium of the markets was envisaged, but this often does not happen. Globalization has different effects on the economies of individual countries, national labor markets and the income structure of the population [2]

However, in globalization, there are both winners and losers of entire countries and individual structures. The costs associated with the adaptation of the economy to global changes may have too high a social price. Countries that facilitate the flow of foreign goods to their markets are now increasingly evaluated with caution when new transnational structures for the production of certain goods (cellular communications) are formed. The available resources are used more efficiently and productively. The impulses of choosing forms of economic activity, especially coming from near China, are felt in the region to the greatest extent [4, 7]. Through cross-border trade, the region was gradually drawn into global trade. Consumer goods, computers, cars, currency and much more were coming towards the forest, fish and minerals.

Globalization processes in the economic sphere had great prospects, but the events currently taking place in the EU show that problems are often solved at this level from a position of strength, with unilateral interest. The most "weak links" of geo-economic potential become a place of pressure on the state from the outside, and vice versa, the more developed each component of the aggregate potential is, the more stable its position in international relations is.

For Russia, globalization is not only of interstate importance. In inter-regional integration, in particular in the Asia-Pacific region, geographical interests are the compatibility of the processes of transnationalization with local economic tasks;

the possibility of the formation of powerful economic structures, in the form of the development of large urban agglomerations [3]. The Far East is integrated into the Asia-Pacific region only with its natural resources. It is considered a source of raw materials, as well as a market for industrial equipment and consumer goods produced in the Asia-Pacific countries. Of course, the region has integrated into the Asia-Pacific region, but not in the status of a post-industrial center, but as a supplier of resources. This situation made traditional activities quite profitable and cost-effective. The lack of well-established industrial production affects the increasing dependence of the Far East on imports. The result of excessive openness is that Asian light industry products are already the majority in the Far Eastern market.

Russia also has the opportunity to repeat the successes of the economic development of the countries of the "Asian tigers", with the available natural resources, spatial, scientific and technical resources. But in its dynamic movement, the most important limiting factor is the smallness of the population and the underestimation by management structures of all levels of this factor for the development of the economy and national security. The demo-graphic potential of Russia, in comparison with other main components of the geo-political situation, is its weakest link.

Thus, the integration of the economy of the Russian Far East into the Asia-Pacific region causes various kinds of imbalances. The process of regionalization in the Asian megaregion is asymmetric, characterized by particular complexity and diversity due to the different levels of capitalization of states.

Globalization makes it possible to use internal advantages that give wide development to international cooperation and the opportunity to respond to the challenges it brings. Vladimir Putin declared the XXI century the century of development of the Far East - to reach a fundamentally new level of economic and social development, to determine the development of the region for the future. The adopted regulatory documents on the development of the economy of the Far East, such as laws on land, investment support, tax benefits, territories of advanced development, the free port of Vladivostok, become prerequisites for stimulating the region's economy in order to integrate into the Asia-Pacific region, will allow solving their own political and economic problems, taking into account the correlation of their interests with the interests of partners.

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城市土壤作为大城市生态框架要素状态的指标

URBAN SOILS AS INDICATOR OF THE STATE OF THE ELEMENTS OF THE ECOLOGICAL FRAMEWORK OF A LARGE CITY

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抽象的。 对城市林荫大道和城市领土生态框架内的四个公园的土壤覆盖进行了评估。 结果表明，城市化不仅导致了自然景观的转变，而且还导致了它们的局部变化。

关键词：土壤覆盖，城市公园，生态状态。

Abstract. *An assessment of the soil cover of the city boulevard and four parks included in the ecological frame of the city territory was carried out. It is shown that urbanization has led not only to the transformation of natural landscapes, but also to their local change.*

Keywords: *soil cover, city parks, ecological state.*

In recent decades, the world has seen an unprecedented growth of cities. For example, in 2015, almost 4 billion people lived in cities, which accounted for 54% of the world's population, and by 2030 this number is projected to increase to about 5 billion. Cities provide fertile ground for innovation, job creation, and economic growth. However, rapid urbanization is causing serious problems, including environmental problems. [Report, 2017]. Currently, there are two ways to improve the environmental situation in the city. The first one is to reduce air emissions hazardous to health from stationary and mobile sources and discharges of untreated effluents into open water bodies. The second is the spatial organization of the territory, which includes environmental planning. The meaning of ecological planning of any territory is to choose and justify such a variant of its structure, which would ensure the preservation of ecological balance during the development of natural resource potential and would guarantee comfortable conditions for human life.

Environmental planning should reflect a systemic basis and be expressed in

an easily readable manner. Both of these requirements are feasible in the development of the ecological framework of the urban area. The ecological frame, presented cartographically, is the result, the model of this type of planning. The ecological frame of an urban area (EFUA) is a set of environment-forming and environment-stabilizing natural and natural-anthropogenic complexes of free space, ranked according to the modes of use, formed to create a comfortable environment and ensure sustainable development of the territory. It is based on green areas, open water spaces, artificially created biogeocenoses, as well as restoration lands [Narbut, 2019].

Structurally, the ecological framework developed for the city of Khabarovsk includes a wide range of lands of an areal structure (OOPR, collective gardens, landscape and recreational areas, memorial complexes), extended linear forms (boulevards, protective zones of enterprises, water protection zones of small rivers), as well as plots dedicated to residential and industrial zones ("green" threads along city roads and pedestrian roads, green spaces inside yards, schools, etc.) [Mirzekhanova, Narbut, 2013.]. For the effective functioning of EFUA, it is necessary to connect its main areal elements - "cores", not only with each other, but also with the green areas of the suburban area. Such a connection is carried out by linear structures - green spaces of embankments, boulevards and water protection zones.

It should be noted that when forming EFUA, researchers pay attention to the vegetation cover of its elements, without paying due attention to the state of soils. Whereas soils determine the state of the vegetation cover, they are an indicator of the state of vegetation of the elements of the ecological framework.

The purpose of the work is to characterize the soil cover of the main elements of the ecological framework of the city of Khabarovsk.

Materials and methods

Research methods widely used in the Earth sciences and soil science were used: morphological, lithological-geomorphological, profile-genetic.

The object of study is the soil cover of Ussuriysky Boulevard and four parks of the city of Khabarovsk, located in different areas. All parks are public areas, included in the ecological framework as "cores" - the most stable (permanent) group of territories.

Results and its discussion

Park of the stadium named after V.I. Lenin, an area of 29.2 hectares, is located on a swampy undulating-maned floodplain of the river. Cherdymovka, in its natural state, is composed of plastic loams with interlayers of silty and fine sands. After the development of this area in 1957 and the erection of an embankment (grass-gravelly soils, uneven-grained sands with inclusions of gravel and pebbles), the area of which is 54 thousand m^2, loamy-sandy-loamy soil-like bodies were artificially created, on which forest plantations were organized (poplar and pine) and

lawns [Podgornaya, Roslikova, 1999]. The soils are referred to as constructozems on engineered gravelly and clay-sandy soils. The newly created artificial soil-like bodies over the past more than 60 years have not reached a developed soil profile. The accumulative thickness is only about 5 cm. The rest of the thickness remains undeveloped by soil-forming processes.

The Gagarin Park, an area of 8.78 hectares, is located in the area of the Khabarovsk Institute of Culture, on a gently sloping (towards the Amur) upper Quaternary lake-river terrace. Small slopes, weakly filtering clay soils, ensured the presence of perched water at a depth of 5–6 m. The construction of a road embankment along Krasnorechenskaya Street disrupted the flow of atmospheric precipitation in the direction of the Amur channel. This contributed to the development of flooding processes, which immediately affected the state of the soil cover. There were real wetlands. Despite the planning work, adding peat-soil mixtures, most of the park's territory is experiencing the imposition of a new geological process - flooding. It is also associated with an additional influx of the water component due to emergency leaks from the heating main, which runs along the eastern edge of the park. The processes of flooding are developed here. Soils are anthropogenically transformed soddy-gley soils; swamping processes are also noted in constructozems. Deeply transformed texture-differentiated soils have formed in the more autonomous positions of the park zone. Taking a general look at the soils of the Gagarin Park, it should be noted that the anthropogenic load in different locations manifested itself ambiguously. Thus, in autonomous locations, near-surface soil horizons (up to 15–20 cm) have noticeable features of transformation (horizons are not consistent in terms of composition color, nature and degree of inclusions, transition boundaries, etc.). However, over the period that has elapsed since the laying of the park (more than 50 years), there has been a significant development of the soil layer. Despite the large anthropogenic load (compacted lawns, a lot of paths, the remains of bonfires), a sod horizon was formed.

"Dynamo" Park is located between Karl Marx Street and Ussuriysky Boulevard, adjacent to the city ponds. The total area is 24.45 hectares. The park is located on a undulating-ridged surface composed of clay-silica shales overlain by an eluvial-deluvial cover. The surface of the park is gently sloping, cut through by a branched ravine-beam network. The most characteristic soils of the "Dynamo" park in their natural state were burozems under coniferous-deciduous forests with a typical morphological appearance. Anthropogenic and technogenic impact has led to the transformation of soils. In drainless depressions, swampy areas with typical marsh vegetation. A significant part of the bottoms and slopes of ravines was turned into spontaneous dumps for household and construction waste. In addition, the park has a large number of paths, trampled lawns created by the anthropogenic factor. In them, the accumulative stratum is completely absent. Up to 30 cm, the

entire thickness is represented by very dense mineral horizons with inclusions of household waste. All this testifies to the low bioproductivity of these soils. The area with dead wood of oak woodlands is distinguished by a huge accumulation of various kinds of garbage. It is represented by the remains of building material (reinforced concrete blocks, reinforcement, broken bricks and glass). Here, with the violation of the vegetation cover, intensive erosion processes began. In young ravines and at the bottom of the ravine itself, there are large accumulations of household waste. It should be noted that Dynamo Park is an essential and special element of the ecological framework. The peculiarity lies in the fact that it is one of the few elements of the Khabarovsk EFUA territorially and functionally through a system of corridors – Ussuri Boulevard, the Amur riverside, the Amur channel, the Ussuri river – connected with elements of the ecological framework of a higher hierarchical level.

Ussuriysky Boulevard was formed on purposeful artificial embankments that blocked the floodplain landscapes of the Plyusninka river. In different parts of the boulevard, they are heterogeneous. In some areas, they consist of a mixture of natural soils, clay-sand with an admixture of crushed stone of massive crystalline rocks, and in others they are composed of construction waste. As a result of leveling work and the addition of loamy-gravel-sandy natural soils with an admixture of construction and household waste, new primary formations were formed. On the site of the former bed of the Plyusninka river, ponds were built, and its mouth was also leveled and covered with additional loamy-gravelly sandy stratum, followed by concreting. The development of zonal soil processes characteristic of a given natural setting is not morphologically expressed in the areas under consideration.

The Gaidar Park (an area of 2.4 hectares) is located in the central district of Khabarovsk at the intersection of Karl Marx and Leo Tolstoy streets. In engineering and geological terms, it is identical to the "Dynamo" park. The surface is wavy-ridged, composed of eluvium-deluvium of clay shales. In contrast to the "Dynamo" Park, in the Gaidar Park the surface is uniform, flat, gently sloping towards Amur Boulevard. There is no ravine-beam network here and there are no various kinds of dumps for both household and construction waste. In terms of vegetation, larch plantings are characteristic, which are in different conditions in different parts of the park. On the western side of the park, throughout the entire segment of Lev Tolstoy Street and up to Karl Marx Street, all plantings (15–20-year-old) larch died. The cause of death is caused, first of all, by the violation of the water regime, due to the laying of a trench for a high-voltage cable.

Conclusions

The studied soils of park areas, located in various engineering and geological conditions of the city, are sharply distinguished by the heterogeneity and heter-

ochrony of the profile. Despite the fact that the functional purpose of the parks is unambiguous, however, for each of them (despite the same type of economic activity), geostructural parameters determine the nature of the transformation of the soil cover. It should be noted that urbanization has led not only to the transformation of natural soils, but also to the formation of new pedosystems – preferred soil formations that are unable to fully perform ecological functions (Roslikova, Matvienko, 2018). However, their inherent spatial heterogeneity provides them with the properties of a "living blanket" (Vorobiev, 2016), and the preferred soil formations (as well as natural soils) continue to act as a "life prolonger". This is the stability of one of the main links of the ecological framework of this territory. Assessing the state of soils in the park areas of Khabarovsk, it should be noted that in order to ensure the balance of the ecological framework, it is necessary to develop a functional-ecological approach, which will manifest itself in the study of the spatial diversity of surface formations. The improvement of the urban environment and the solution of a series of interrelated tasks should be developed in the following areas: geoecological - assessment of the current state of the geological environment and soil cover in an urbanized area; landscape design - purposeful improvement of the quality of disturbed territories; eco-restoration - construction and exploitation of cultural landscapes based on new urban planning methods.

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评估冬季车辆对 Gremyachya Griva 生态公园（克拉斯诺亚尔斯克）境内的影响
ASSESSMENT OF THE IMPACT OF VEHICLES ON THE TERRITORY OF THE GREMYACHYA GRIVA ECO-PARK (KRASNOYARSK) IN WINTER

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抽象的。 这项工作致力于研究冬季汽车运输对位于克拉斯诺亚尔斯克西部郊区、固定源排放区之外的 Gremyachya Griva 生态公园的影响。 在距离交通繁忙的高速公路 2 至 80 m 的三个样带上采集积雪样本。 结果表明，在距离道路 2 m 的点处发现了最大量的氯化物，这可以通过防冰剂的存在来解释。 硝酸根离子的含量在较小程度上取决于与行车道的距离，但在交通不均匀的情况下会增加。

关键词：空气污染，车辆，离子色谱

Abstract. *This work is devoted to the study of the impact of motor transport in the winter period on the territory of the Gremyachya Griva eco-park, located on the western outskirts of Krasnoyarsk, outside the zone of emission from stationary sources. Snow cover samples were taken along three transects at a distance of 2 to 80 m from a highway with heavy traffic. It was revealed that the maximum amount of chlorides was found at points located at a distance of 2 m from the road, which is explained by the presence of anti-icing agents. The content of nitrate ions to a lesser extent depends on the distance to the carriageway, but increases in the case of uneven traffic.*

Keywords: *air pollution, vehicles, ion chromatography*

The development of motor transport leads to a significant impact of pollution on ecosystems, including suburban forests that perform recreational functions. Urban road transport is one of the strong sources of impact on the urban environment. Exhaust gases include up to 200 chemical compounds, including several carcino-

genic ones. Toxic substances are mainly concentrated at low altitudes, including in the human breathing zone, so road transport should be analyzed as a priority source of urban air pollution. It was noted [1] that the growth in the number of cars enhances a number of negative urban processes, the regulation of which is most difficult in large cities. A number of scientists [2] call road transport the most dangerous and large-scale source of environmental pollution.

The purpose of this study is to assess the distribution of the impact of automobile pollution on the territory of the Gremyachya Griva eco-park, depending on the distance from the highway and the density of tree and shrub vegetation. "Gremyachya Griva" eco-Park is located on the western outskirts of Krasnoyarsk (Fig. 1), on the windward side. It is not affected by emissions from stationary sources.

To take snow samples, three transects 80 m long were laid perpendicular to the motorway (Fig. 1). Sampling points are located at the beginning (at a distance of 2 m from the roadside), middle and end of each transect. The volume of each sample was 1.5 liters. The melted snow water was filtered and chloride, nitrate and sulfate ions were determined in the filtrate [3], the results are presented in Table 1.

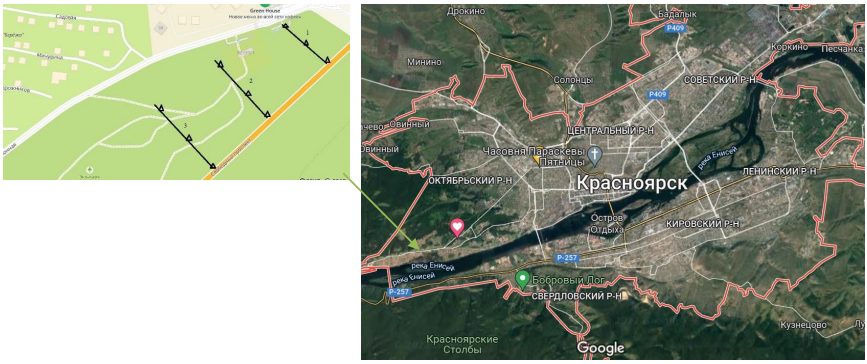


Figure 1. *Location of transects for sampling snow cover in the "Gremyachya Griva" eco-park (Krasnoyarsk)*

The work was performed at the Common Use Center "Science-based Methods for Research and Analysis of New Materials, Nanomaterials and Mineral Raw Materials" of the Siberian Federal University (CCU SFU) on a high-performance liquid chromatograph LC-20 Prominence with a conductometric (CDD-10 Avp/10Asp) detector in the version of a two-column ion chromatography (separating column KanK-AST, 14 μm; SPS-SAC suppression column, 6 × 200 mm). A carbonate buffer solution (2.5 mM Na2CO3 + 3.0 mM NaHCO3) was used as the eluent. The volume of the injected sample is 100 μl. The eluent flow rate was

2.0 ml/min. The column oven temperature is 33°C. The fluid supply unit creates a solvent stream that passes through the autosampler, columns, and conductometric cell. Separated sample components cause a change in the electrical conductivity of the cell. The voltage proportional to the electrical conductivity is fed through an analog-to-digital converter to a personal computer, where it is displayed in the form of a chromatogram on the monitor. The instrument was controlled and chromatograms were processed using the LCSolution program on a personal computer.

Table 1.

The content of anions in melted snow water

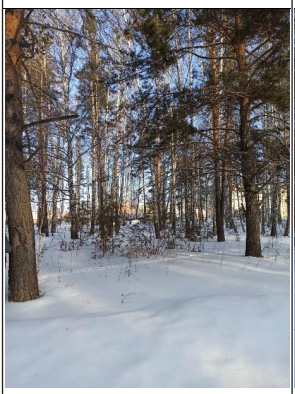
Sample	Cl^-, mg/dm$_3$	NO_3^-, mg/dm$_3$	SO_4^{2-}, mg/dm$_3$
	$\bar{C}\pm\Delta$	$\bar{C}\pm\Delta$	$\bar{C}\pm\Delta$
1 point 1 transect	152±23	12,5±1,9	10,5±1,6
2 point 1 transect	4,2±0,6	4,7±0,7	6,9±1,0
3 point 1 transect	4,7±0,7	4,7±0,7	8,5±1,3
4 point 2 transect	196±29	3,3±0,5	6,7±1,0
5 point 2 transect	3,3±0,5	3,2±0,5	4,3±0,6
6 point 2 transect	1,4±0,2	3,2±0,5	4,3±0,6
7 point 3 transect	257±38	3,5±0,5	6,0±1,0
8 point 3 transect	4,3±0,6	3,0±0,5	3,8±0,6
9 point 3 transect	1,8±0,3	3,3±0,5	4,3±0,6

As can be seen from the data presented in Table 1, the maximum amount of chlorides was found at points located at a distance of 2 m from the road (points 1, 4 and 7), which is explained by the presence of ice melting agents used when backfilling the roadway. Point 3 of the first transect is adjacent to the parking lot for visitors to the eco-park, where the amount of chlorides is slightly higher than in the others. Perhaps this is due to the drift of anti-icing reagent on car tires. At other points, the chloride content decreases with distance from the road. The maximum amount of nitrates and sulfates in snowmelt water was found at point 1 of the first transect, which is located 100 m from the controlled intersection and the pedestrian crossing. Cars with uneven movement (braking followed by acceleration) emit more exhaust gases containing combustion products. No significant differences in the distribution of nitrate ions were found in the second and third transects. The content of sulfate ions is significantly higher ($p\geq0.95$) at sampling points 1, 4 and 7, adjacent to the road relative to the middle and end points of the corresponding transects, which indicates their faster subsidence.

For each transect, the density of trees and shrubs was estimated, the results are presented in Table 2. The tree layer includes *Pinus sylvestris* and *Betula pendula*, shrubs - *Rosa acicularis* and *Rubus idaeus*. The correlation analysis did not confirm a positive relationship between the spread of pollutants deep into the territory of the eco-park and the density of tree and shrub layers in winter.

Table 2.

Characteristics of tree and shrub vegetation (including undergrowth)

1 transect	**2 transect**	**3 transect**
		
Species included in tree and shrub layers, including undergrowth		
Pinus sylvestris L. *Betula pendula* Roth. *Rosa acicularis* Lindl.	*Pinus sylvestris* L. *Betula pendula* Roth. *Rosa acicularis* Lindl.	*Pinus sylvestris* L. *Betula pendula* Roth. *Rosa acicularis* Lindl. *Rubus idaeus* L.
Vegetation density		
0,8	0,6	0,7

Thus, it can be concluded that the maximum amount of chlorides was found at points located at a distance of 2 m from the road, which is explained by the presence of anti-icing agents, the content of nitrate ions to a lesser extent depends on the distance to the roadway. However, it increases in case of uneven traffic, and the content of sulfate ions is higher at sampling points adjacent to the road relative to the middle and end points of the corresponding transects, which indicates their faster subsidence. In winter, vegetation has practically no effect on the distribution of vehicle emissions at a distance of up to 80 m from the road.

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生物生长调节剂对苹果果实品质指标影响的研究
RESEARCHES OF THE INFLUENCE OF BIOLOGICAL GROWTH REGULATORS ON THE QUALITATIVE INDICATORS OF APPLE FRUITS

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注解。 本文介绍了使用生物生长调节剂对苹果（Aidared、Fuji 品种）进行非根部处理的新实验数据，采用不同的矿物质和微生物组合（木霉），这些处理提高了与增加的果实质量相关的水果质量。 通过增加花青素的合成速率和增加水果的抗氧化活性，增强水果在贮藏过程中对生理疾病发展的抵抗力，从而使苹果皮的颜色。

关键词：苹果果实，生长调节剂，花青素，收获时间，定性组成。

Annotation. *This article presents new experimental data on the use of biological growth regulators on apples (Aidared, Fuji varieties) in non-root treatments with a different combination of minerals and microorganisms (trichoderms), which improve the quality of fruits associated with an increase in the color of the skin apples by increasing the rate of synthesis of anthocyanins and increasing the antioxidant activity of fruits, enhancing the resistance of fruits to the development of physiological diseases during storage.*

Keywords: *apple fruits, growth regulators, anthocyanins, harvesting time, qualitative composition.*

Due to the increasing competition of fruit products in the market, the stability of fruiting and the quality of products is relevant in improving the efficiency of

horticulture. Currently, an equally urgent problem is the color of the fruit. Natural color is acquired due to the difference between day and night air temperatures. In recent years, there has been a lack of large temperature differences in almost all parts of Russia, and therefore in many farms the decision to start harvesting apples is postponed until they acquire at least some color [1, 2]. As a result, overripening of fruits on the tree occurs, which leads to the crumbling of the fruits, and hence to a decrease in standardity [3-5].

Tests of growth regulators - organic products of plant origin, consisting mainly of vegetable oils, represented by hydrolysate obtained as a result of processing 35 species of herbaceous plants, as well as organic hydrocarbons; potassium, zinc, calcium, free amino acids, microorganism (trichoderms) had an effective effect on improving the commercial vid of the fruits of the Aidared and Fuji apple varieties.

Due to the vital activity of microorganisms and the use of the internal biological potential of microorganisms (trichoderms), which are part of the developed biological preparations with different combinations of mineral substances, the issues of improving the quality indicators of fruits associated with enhancing the color of the skin of apples by increasing the rate of synthesis of anthocyanins were purposefully solved. Due to the vital activity of microorganisms (trichoderms) that are part of the drug that affect the skin of apples, the synthesis of anthocyanins increases by almost 2.0 times in comparison with the control, which enhances the color of the fruits without causing their overripening.

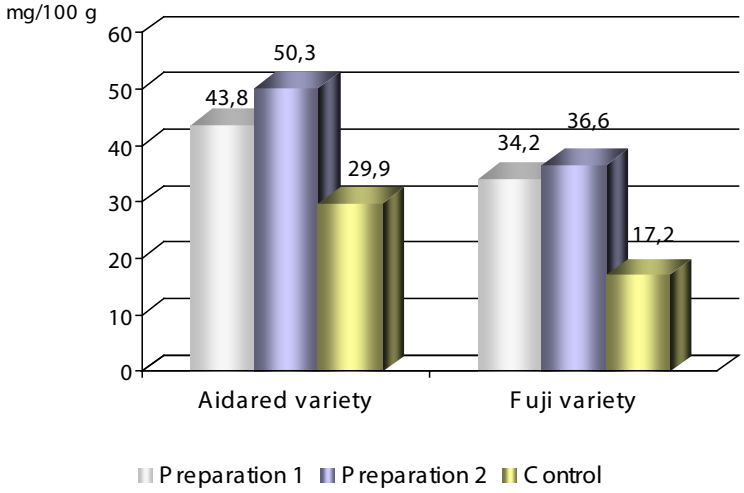

Figure 1. *The content of anthocyanins in apple fruits as a result of treatment with biostimulants*

When using a preparation with a zinc content that affects the permeability of membranes, stabilizing cellular components and microbial systems, increases the resistance of plants to dry and hot climates, fungal and bacterial diseases, the fruits had a more attractive color, the content of anthocyanins was 50.3 mg / 100 g in the Aidared variety, 36.6 mg / 100 g in Fuji sor, which is 7-13% higher than when treated with a drug containing calcium.

Treatment with these drugs made it possible to improve the presentation of apple fruits, the cover color of apples was colored earlier than in the control, but in terms of maturity, the fruits were greener than in the control. The starch content in the control fruits was 4-5 points, in the processed ones - 2-3 points (Fuji variety) and 3-4 points (Aidared grade) (Table 1, Figure 2).

Table 1.

Chemical indicators of fruits taking into account the treatment of growth regulators

Variant	Flesh hardness, kg/cm^2	Starch, score	Dry substances, %	Sugar, %	Acidity, %	Saccharic acid index, o.e.
Aidared variety						
control	7,6	4-5	12,4	8,7	0,66	13,2
preparation 1	8,2	3-4	11,9	8,3	0,74	11,3
preparation 2	8,1	3	11,8	8,3	0,75	11,0
Fuji variety						
control	8,0	4-5	12,8	9,0	0,54	16,6
preparation 1	8,7	2-3	11,8	8,3	0,62	13,3
preparation 2	8,9	2-3	12,0	8,4	0,60	14,0

A researches of the chemical composition of the fruit showed that the accumulation of soluble solids is higher in control apples than in processed ones and amounted to 12.4% (Aidared variety) and 12.8% (Fuji variety), and 11.8% - 12.0% (Aidared, Fuji varieties), respectively. The processed fruits had a harder pulp by 7-11% more than in control apples. That is, treatment with growth regulators, allows you to adjust the timing of removing apples, which will positively affect the keeping properties of the fruit.

New experimental data were obtained on the use of biological growth regulators on apples (Aidared, Fuji varieties) in foliar treatments with different combinations of minerals enriched with calcium and sulfur, allowing to purposefully form the quality of fruits during cultivation in order to better assimilate calcium (by 22-26%), which reduces losses from bitter dimpling and increases the antioxidant

activity of fruits, enhancing the resistance of fruits to the development of physiological diseases during storage (Figure 2).

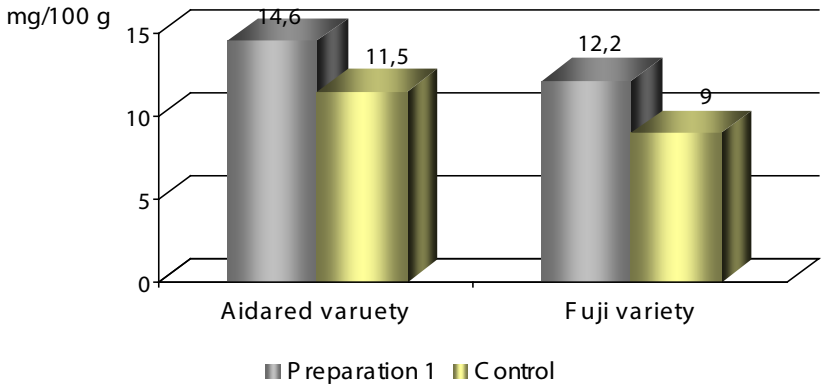

Figure 2. *Calcium content in apple fruits during treatment with biostimulants*

The commercial evaluation of the fruits of the Aidared, Fuji apple varieties and the tasting of their taste qualities did not reveal any differences between the variants of the experiments. The yield of fruits of the highest and first grade was on average 78-86%. The overall tasting assessment of commercial fruits was in the range of 4.5-4.7 points. A decrease in the commercial qualities of fruits and a change in their organoleptic properties as a result of the treatments carried out has not been established.

When determining the patterns affecting the shelf life of the fruit, it was found that there are no signs of rapid overripening of the fruit after processing and during short-term storage. The applied growth regulators can improve the color of the fruits without causing rapid overripening of the fruit.

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探索在饮料生产技术中使用细菌素的可能性
EXPLORING THE POSSIBILITY OF USING BACTERIOCINS IN BEVERAGE PRODUCTION TECHNOLOGY

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抽象的。 目前，化学来源的防腐剂的使用变得无关紧要，因为它们会对人体产生负面影响。 文章讨论了使用丙酸杆菌的细菌素作为对人体安全的防腐剂的可能性，以及将其用于以天然原料生产饮料的技术的可能性。

关键词：细菌素，丙酸菌，抗菌活性，腐败微生物，丙酸，食品工业，饮料，稳定性。

Abstract. *Currently, the use of preservatives of chemical origin is becoming irrelevant, as they negatively affect the human body. The article discusses the possibility of using bacteriocins of propionic acid bacteria as a preservative that is safe for the human body, as well as the possibility of their use in the technology of production of drinks from natural raw materials.*

Keywords: *bacteriocins, propionic acid bacteria, antimicrobial activity, spoilage microorganisms, propionicins, food industry, drinks, stabilization.*

Introduction

Regulation of growth and development of microbial cultures in natural communities is carried out with the help of low-molecular substances of various chemical nature. These molecules provide information exchange between individual microbiome cells and form the so-called "Quorum sensing" [1,2].

Under conditions of limited food sources, these molecules allow microorganisms to control the growth of their own culture and suppress the growth of competitors. Such QS-signals are autoinducers, which include glutamate, succinate, methionine, aspartate, lactate, alkyloxybenzenes, unsaturated fatty acids, peptides, homoserine lactones, and some other compounds [3].

Bacteria use QS signals not only to transmit information within their own species, but also at the interspecies level of bacteria. In Gram-positive bacteria, QS systems are widespread, in which peptides play the role of informational molecules, which can be linear or have a thiolant ring in the molecule [3, 4].

An important role in the formation of microbial communities is played by bacteriocins, which are peptides of various structure, composition, and molecular weight [5]. The action of bacteriocins is aimed at inhibiting the growth of competing cultures and can manifest itself both in relation to strains of their own species and to microorganisms of other species and genera [6]. Bacteriocins differ in the mechanism of action on the target cell, but the result of the attack is always the destruction of the structures of the competitor cell and its death [7].

The ability of bacteria to produce bacteriocins has traditionally been used in the technology of fermented foods [8]. Starter bacterial cultures used in the technology of dairy products and in the fermentation of vegetables are characterized by the ability not only to stabilize the product, but also to normalize the state of the human intestinal microbiota. Active producers of bacteriocins are probiotic cultures that can improve the microecology of the human body through the synthesis of metabolites with different functions, but also by suppressing the activity of pathogenic cultures [8,9].

A number of bacteriocins are well studied, produced by the industry and used in the food industry as preservatives. The advantages of bacteriocins over chemical preservatives are their low toxicity and the ability of the body to completely metabolize them. Nisin (E234) preparations containing bacteriocins produced by Lactococcus lactis subsp. Lactis, and Natamycin (E235) containing bacteriocins produced by Streptomyces natalensis and Streptomyces chattanoogen [10,11,12]. Another type of microorganisms traditional for the food industry is propionic acid bacteria used in cheese making. They synthesize bacteriocins propionicin PLG-1, propionicin T1, propionicin F, propionicin SM1. It is believed that their action is directed mainly to closely related strains, although recently data have appeared on the action of propionocins on microscopic fungi [13]. Since bacteries are capable of synthesizing several types bacteriocins that differ in activity and direction, the study of the spectrum of antimicrobial activity of propionocins will make it possible to recommend them for replacing chemical preservatives in food products.

Purpose: study of the possible use of bacteriocins of propionic acid bacteria in beverage technology.

Methods and objects of research: pure cultures of the following strains of microorganisms were used for research - Aspergillus niger, Penicillium nigricans and Lactobacillus plantarum. The experimental nutrient medium was malt wort with a dry matter content of 20%, further diluted with distilled water to a dry matter index of 7%, bacteriocin was added to the diluted wort at a concentration of 0.5%, 1.0%, 1.5%, 2.0% and agar-agar at a concentration of 1%. The medium was heated until the agar completely melted in the medium and sterilized by autoclaving at 121 °C for 15 minutes. The cultivation of filamentous fungi was carried out in a thermostat at a temperature of 25 °C for 5 days, lactic acid bacteria at 27 °C for 3 days.

Results and discussion: the influence of propionicins on the main groups of spoilage microorganisms - filamentous fungi and on probiotic cultures was studied. To assess the fungicidal activity of propionicins, test cultures of Aspergillus niger and Penicillium nigricans were used.

The tests were carried out by sowing test cultures on a dense nutrient medium containing malt wort with a solids concentration of 7% and propionicins from 0.5 to 2%. Cultivation was carried out for 5 days at a temperature of 25 °C, culture growth was controlled visually.

Since it is known that preservatives used in foods can negatively affect the human gastrointestinal microbiome, the effect of propionicins on lactic acid bacteria was studied. To study the effect of propionicins, a pure culture of Lactobacillus plantarum was used. The L. plantarum culture was cultivated at 27 °C for 3 days by inoculation on an agar nutrient medium containing malt wort with a solids concentration of 7% and propionicins from 0.5 to 2%.

The results obtained for the determination of the fungicidal activity of propionicins are shown in table 1 and in figures 1, 2.

Table 1.

Effect of propionicins on the growth of filamentous fungi

Test-cultures	Propionicin concentration, %				
	0	0.5	1.0	1.5	2.0
Aspergillus niger	***	***	**	**	*
Penicillium nigricans	***	**	*	*	*

Designations: * - no growth
** - weak growth
***- strong growth

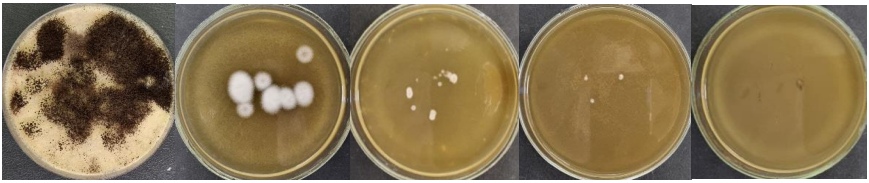

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Figure 1. *The influence of propionocins on the growth of the culture of filamentous fungi Aspergillus niger*

a - control sample of Aspergillus niger culture without addition of bacteriocins in a solid medium, b - sample of Aspergillus niger culture with the addition of propionocins at a concentration of 0.5%, c - sample of Aspergillus niger culture with the addition of propionocins at a concentration of 1.0%, d - sample of Aspergillus niger culture with the addition of propionocins at a concentration of 1.5%, e - sample of Aspergillus niger culture with the addition of propionocins at a concentration of 2.0%.

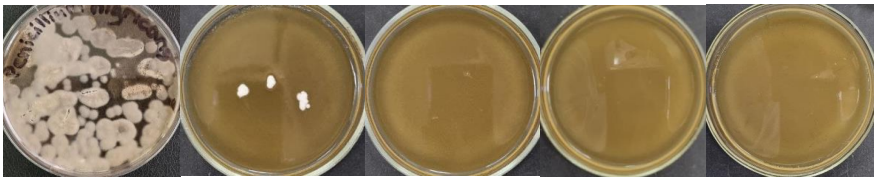

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Figure 2. *Effect of Propionocins on the Growth of a Culture of Mycelial Fungi Penicillium nigricans*

a - control sample of Penicillium nigricans culture without adding bacteriocins to a solid medium, b - sample of Penicillium nigricans culture with the addition of propionocins at a concentration of 0.5%, c - sample of Penicillium nigricans culture with the addition of propionocins at a concentration of 1.0%, d - sample of Penicillium nigricans culture with the addition of propionocins at a concentration of 1.5%, e - sample of Penicillium nigricans culture with the addition of propionocins at a concentration of 2.0%.

The study of the effect of propionicins on lactic acid bacteria showed that in the studied range of concentrations of bacteriocins, the suppression of the culture of Lactobacillus plantarum is not observed, on the contrary, the introduction of propionicins stimulates the growth of the culture, figure 3.

a b c d e

Figure 3. *Effect of propionocins on the growth of lactic acid bacteria*

a - control sample of Lactobacillus plantarum culture without adding propionicins to a solid medium, b - sample of Lactobacillus plantarum culture with the addition of propionocins at a concentration of 0.5%, c - sample of Lactobacillus plantarum culture with the addition of propionocins at a concentration of 1.0%, d - sample of Lactobacillus plantarum culture with the addition of propionocins at a concentration of 1.5%, e - sample of Lactobacillus plantarum culture with the addition of propionocins at a concentration of 2.0%.

Analysis of the results showed that the use of propionocins inhibits the growth of Aspergillus niger and Penicillium nigricans cultures selected for testing. It should be noted that the growth inhibition of Aspergillus niger begins to appear at a concentration of 1.5%, at 2.0% complete inhibition. For Penicillium nigricans, the effect of bacteriocin begins to appear at a concentration of 0.5%, and complete suppression at 1.0%. The addition of propionocins to the nutrient medium for the cultivation of Lactobacillus plantarum not only did not cause suppression, but also enhanced the growth of the culture.

Conclusion

Thus, the data obtained allow us to conclude that propionicins can be used to suppress microorganisms spoiling raw materials, namely natural juices and drinks based on natural raw materials. One of the possible negative effects of bacteriocins is the inhibition of the indigenous human microbiota, however, our data showed that they not only do not have a negative effect, but also enhance the growth of the probiotic culture of Lactobacillus plantarum. Thus, the results show that propiocins can be used as preservatives for soft drinks, which include natural raw materials.

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集约化养猪技术条件下公猪生产者的评价与使用

EVALUATION AND USE OF BOAR PRODUCERS IN CONDITIONS OF INTENSIVE PIG BREEDING TECHNOLOGY

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抽象的。 分析了“Lozovoye”SO 3行代146头种公猪的数据。 研究了长白和杜洛克品种的公猪在活重达到 100 公斤时的发育指标以及由它们授精的繁殖母猪的生产力。 结果表明，在长白3代育种中，活重100公斤的日龄降低了5天（136–131厘米），每增重1公斤的饲料成本降低了0.16个饲料单位， 母猪的调查目标是 11.8个目标。

对秋明州“Lozovoye”SO种公猪的发育指标与世界领先遗传公司的动物指标进行了比较分析。

关键词：种猪、早熟、生长、发育、世代、体长、脂肪厚度、多胎妊娠、种猪。

Abstract. *The data on 146 breeding boars in three rows of generations of the "Lozovoye" SO were analyzed. The boars of the Landrace and Duroc breeds were studied in terms of their development indicators upon reaching a live weight of 100 kg and the productivity of the breeding sows inseminated by them. The results showed that in the Landrace breeding for three generations there was a decrease in the age of reaching a live weight of 100 kg by 5 days (136-131 cm), feed costs per 1 kg of gain by 0.16 feed units, the number of sows was 11.8 goals for a survey.*

A comparative analysis of the indicators of development of breeding boars of the "Lozovoye" SO of the Tyumen Oblast and the indicators of animals of the leading genetic companies of the world was carried out.

Keywords: *breeding boars, precocity, growth, development, generation, body length, fat thickness, multiple pregnancies, breeding sows.*

Introduction

The mobilization of the genetic potential of the productivity of pigs provides

for the intensive use of boars and sows, which reduces the cost of the resulting offspring and creates a reserve for pork production. However, the issues of rational and intensive use of boars and management of their reproductive capacity in the conditions of industrial pig breeding have not been fully resolved. In the references, it is noted that the differences between the breeding boars, evaluated by the quality of the offspring in the conditions of the complex, reach 20–22% in the fertility of the queens, 17–25% in early maturity, and 12–23% in the number of carcasses of the highest category. [1,2,] Some scientists note that the index of product homogeneity (coefficient of variability of carcass mass) in the offspring of the tested boar reaches 100%. [1,2,]

In this regard, the assessment of the productive and reproductive qualities of young boars, the choice of selection criteria for transferring them to the test group, as well as ways to increase the reproductive function of adult boars, are very relevant.

The purpose of the research is to substantiate a set of techniques for preparing boars for intensive use, increasing the reproductive function of breeding boars and the productivity of their offspring under industrial technology.

To achieve the goal, the following tasks were set:

- evaluate the productive qualities of rearing boars;
- to study the reproductive qualities of sows inseminated with the sperm of breeding boars.

Material and research methods

The studies were carried out at the artificial insemination station of the "Lozovoye" SO in the Tyumen Oblast. Photographing of 96 breeding boars and exterior description was carried out. All young boars were evaluated in vivo according to the speed of reaching 100 kg, fat thickness, muscle depth, feed consumption. The tested and main boars were evaluated according to the reproductive qualities of sows. 146 boars were evaluated for three generations.

Research results

For three generations, the age of reaching 100 kg in boars decreased by 10 days; average daily gains increased by 89 grams. Other indicators remained at the same level or slightly decreased. The results are shown in table 1.

Table 1.

Evaluation of breeding boars for three generations in terms of development

Breed	Age of reaching 100 kg live weight, days	Body length, cm	Fat thick-ness, mm	Depth of the muscle, cm	Average daily gain, g	Feed costs per 1 kg of growth, feed units
Landrace	134	121	11	54,5	1142	2,84
Duroc	139	117	12	52,2	1063	3,02
Pietrain	158	114	10	61,9	929	3,23
Large white	145	118	12	53,6	1033	2,7
On average	144	118	11	55,6	1042	2,95

Further, the changes in growth and development indicators that occur in boars by generations in the Duroc breed are considered in detail (Table 2). Thus, 12 heads were evaluated for the first generation, precocity was 142 days, body length 117 cm, fat thickness 13 mm, muscle depth was not measured. Average daily gain was 1049 g, feed costs were 3.9 feed units According to the second generation, 14 goals were evaluated, the indicators were: 137 days, 118 cm, 12 mm, 1008, 3.19 feed units. 13 goals were evaluated for the third generation, the indicators were: 137 days, 116 cm, 12 mm, 48.4 mm, 1099 g, 3.14 feed units. 5 goals were evaluated for the fourth generation, the indicators were: 141 days, 116 cm, 11 mm, 55.2 mm, 1069 g, 2.71 feed units.

Table 2.

Evaluation of Duroc boars by generations

№	boar inventory no.	generation/filia-tion	Development indicators					
			Age of reach-ing 100 kg live weight, days	Body length, cm	Fat thickness, mm	Depth of the muscle, cm	Average daily gain, g	Feed costs per 1 kg of growth, feed units
1	400721	grand-son 3/3	138	115	11	-	1071	3,16
2	500173	grand-son 3/1	136	116	10	-	1048	4,04
3	500185	grand-son 3/3	135	118	11	-	1016	4,26
4	500439	grand-son 4/3	151	117	12	58	1032	2,58

5	500771	grand-son 3/2	142	118	12	45	1071	2,93
6	501173	grand-son 3/1	132	113	13	60,4	1366	2,41
7	501185	grand-son 4/3	130	115	10	59,4	1316	2,53
8	501227	grand-son 4/3	148	115	10	45,8	968	2,9
9	600017	grand-son 3/3	138	117	11	50,8	1114	2,55
10	500713	grand-son 4/1	140	118	10	55,9	981	3,11
11	501159	grand-son 4/4	136	116	12	57	1049	2,42
12	501203	grand-son 3/1	131	116	15	37,3	1158	2,66
13	200703	father 1/1	143	122	12	-	983	2,86
14	200945	father 1/1	149	120	13	-	1000	3,04
15	200953	father 1/1	148	114	13	-	983	3,09
16	200253	father 1/2	141	117	13	-	1055	3,2
17	200085	father 1/3	128	116	14	-	1196	2,87
18	201195	father 1/3	141	113	14	-	1049	3,4
19	200129	father 1/4	143	117	14	-	1076	3,14
20	201177	son 2/1	134	114	13	-	1050	3,19
average value			**139**	**117**	**12**	**52,2**	**1063**	3,02

Thus, over three generations, the following happened: the age of reaching 100 kg decreased by 2 days, but in the fourth generation this figure increased by 2 days compared to the average. The body length of the boars decreased by 1 cm. In boars of the 4th generation, the muscle depth indicator increased by 3 cm, the average daily gain by 6 g, feed costs per 1 kg of gain decreased by 31 g.

Boars of the Landrace breed are characterized by good early maturity of 134

days, body length of 121 cm, average daily gain of 1142 g, feed costs of 2.84 feed units Figure 1 shows a comparison of body length and growth rate to achieve a live weight of 100 kg by breeds.

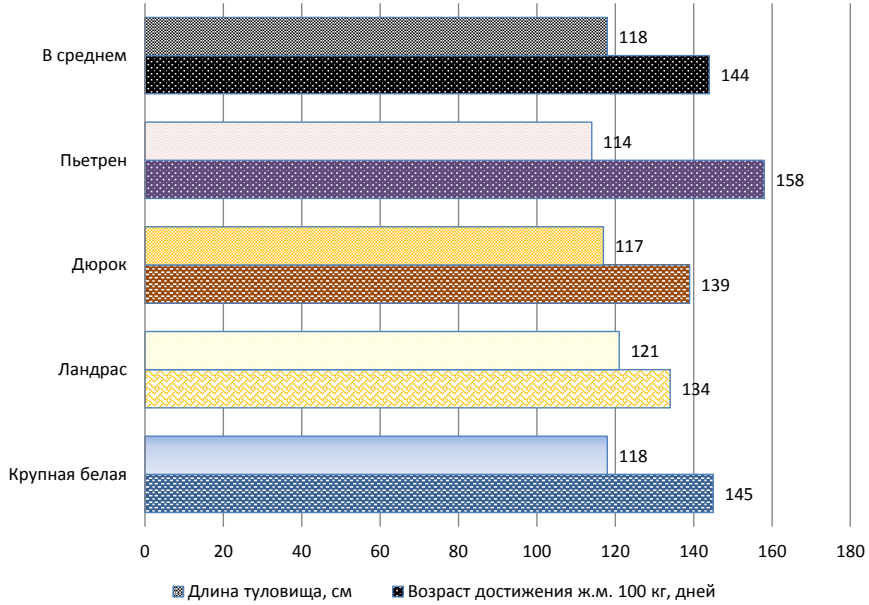

Figure 1. *Comparison of breeds by precocity and body length*

The average body length for all breeds was 118 cm, Landrace boars exceeded this figure by 3 cm. Pietrain boars are significantly inferior in body length and precocity to all other breeds. It should be noted that in each breed there are outstanding animals. In the Landrace breed: boar No. 553139 live weight of 100 kg reached 120 days; boars No. 550561, 650147, 650185 for 125 days, boar No. 552493 for 126 days with an average of 134 days for the breed. According to the length of the body: boar No. 552493 - 134 cm, No. 250419 - 130 cm, No. 650185 - 129 cm, with an average of 121 cm for the breed. In the Duroc breed: boar No. 200085 reached a live weight of 100 kg in 128 days; boar No. 501185 - 130 days, 501203 - 131 days with an average of 139 days for the breed. Along the length of the body: No. 200703 - 122 cm, No. 200945, No. 300039 - 120 cm, with an average length for the breed of 117 cm.

The indicators of the reproductive ability of boars were evaluated based on the results of farrowing of sows inseminated with the sperm of breeding boars (Table 3).

Table 3.

Evaluation of breeding boars by the productivity of dams inseminated with their semen.

Breed	Number of boars, heads	Inseminated dams, heads	Farrowing heads received	Live piglets were born per 1 farrow, heads	% stillborn	Pig weight at birth, kg	Piglet weight at 21 days, kg
Landrace	102	112	84	11,8	8,9	1,48	8
Duroc	41	52	37	9,6	11,7	1,42	7,9
Pietrain	35	27	20	9,2	10,5	1,42	7
Large white	28	34	23	12,1	9,6	1,21	7
On average	**206**	**56**	**41**	**10,7**	**10,2**	**1,38**	**7,5**

On average, 10.7 piglets were obtained from boars for all breeds. From large white boars, 1.4 heads more than the average were obtained, but piglets were 170 grams smaller than the average. Landrace breed has good maternal qualities. All scores are above average. For three generations, the rate of multiple pregnancy increased by 0.3 heads. The percentage of stillborn piglets decreased by 1.4%. The weight of the piglet to weaning increased by 200 g.

Thus, the developed set of techniques for evaluating breeding boars of paternal breeds makes it possible to obtain high-quality offspring. Great importance is attached to the uniformity of offspring in purebred breeding. When working with various combinations of crosses to create specialized hybrid producers and obtain from them uniform in quality marketable young animals to meet the needs of the meat processing plant.

Conclusion

At the Lozovoye breeding center in the Tyumen Oblast, pig breeds are constantly being improved in accordance with the requirements of hybridization systems. Thus, intensive technologies for the industrial production of pork require from mother breeds a strong constitution, high fertility, duration of use, evenness of the nest, optimal growth of piglets; from paternal breeds high disease resistance, strong constitution, efficient feed conversion, increased lean meat yield. For animals of meat breeds, the main breeding traits are: the length of the body, the depth of the muscle, the taste of meat, the yield of the main parts of the carcass (ham, loin, brisket, shoulder blade). Table 4 shows the comparative indicators of the development of breeding boars of the "Lozovoye" SO and the leading genetic companies of the world.

Table 4.

Evaluation of breeding boars

Breed	Age of reaching 100 kg live weight, days	Body length, cm	Fat thickness, mm	Depth of the muscle, cm	Average daily gain, g	Feed costs per 1 kg of growth, feed units
"Lozovoye" SO of the Tyumen Oblast						
Landrace	134	121	11	54,5	1142	2,84
Duroc	139	117	12	52,2	1063	3,02
Pietrain	158	114	10	61,9	929	3,23
Large white	145	118	12	53,6	1033	2,7
On average	***144***	***118***	***11***	***55,6***	***1042***	***2,95***
Norsvin company (Norway)						
	Age of reaching of l.w. 110 kg, days	**Body length, cm**	**Fat, mm**	**Depth of muscle, mm / lean carcass meat**	**Average daily gain, g**	**Feed units per 1kg gain**
Landrace	154	-	6,2	-/65	960	2,25
Duroc	146	-	8,1	-/57	900	2,1
Hermitage company (Ireland)						
Large white	131,2	-	7,62	60,7/62,9	1140	2,46
Duroc	144,3	-	8,98	57,2/61,9	1190	2,57
Pietrain	142,6	-	8	58,8/64	1160	2,28
MQM Hylean DxP			9	55,2/62,8	1130	2,48
Pietrain Hylean 50	139,6	-	8,2	55,2/63,8	1230	2,38
KBxp	138,3	-	9,3	57,9/62,5	1310	2,62

The data in the table indicate that the indicators of development of the young animals of the "Lozovoye" SO are at a fairly high level, and superiority is observed on some indicators.

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NOTES

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