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These Conference Proceedings combine materials of the conference – research papers and thesis reports of scientific workers. They examines tecnical and sociological issues of research issues. Some articles deal with theoretical and methodological approaches and principles of research questions of personality professionalization.

Authors are responsible for the accuracy of cited publications, facts, figures, quotations, statistics, proper names and other information.

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FINANCIAL RISKS OF AN ENTERPRISE AND THE INTERNAL CONTROL SYSTEM

Kachalova Elena Shaidatovna
Doctor of Economic Sciences, Full Professor

Chernenkaya Irina Gennadevna
Candidate of Economic Sciences, Associate Professor

MIREA - Russian Technological University

Abstract. The article discusses the impact of financial risks on the activities of a modern enterprise in a crisis and their management in the system of internal control of the enterprise. A correct assessment of financial risks helps to increase the stability of the enterprise, and the construction of an internal control system at the enterprise also contributes to the minimization of financial risks.

Keywords: Financial risks. Risk assessment. Internal control system. Control environment.

The issues of enterprise risk management during the crisis and the downward trend in economic growth in the Russian economy are of particular relevance. Risk is a probabilistic category and therefore, for many entrepreneurs, its occurrence is very often a big surprise. At the same time, the nature of the risk lies in the fact that, despite its supposed randomness, each specific risk is accompanied by quite certain factors on which its manifestation depends, and therefore the risk assessment is directly related to the permissible values of a number of financial indicators.

If we talk about the existing approaches to the classification of risks of industrial enterprises, then the general approach for all sectors of the Russian economy is the division of risks into internal and external. For an industrial enterprise, the following main risks are distinguished: commercial, financial, production, organizational, investment, innovation - i.e. the risks of the enterprise are considered by the spheres of occurrence and correlate them with the main functions and processes of the enterprise. [5]

In addition to the above risks, the classification includes technogenic, natural, mixed, social, environmental, professional, informational, tax, le-

gal and other risks. In publications on the study of enterprise risks, there are even competitive and market risks. Thus, there is no unified approach to the classification of enterprise risks, which negatively affects the mechanism for managing such risks, not only of the enterprises themselves, but also of the regulatory authorities. Unified methodological approaches to risk classification, identification and systematization of the most dangerous risk factors in conjunction with the use of appropriate methods of enterprise risk management will allow enterprises to effectively reduce risks.

Large corporations operating in the global market widely use various methods of risk management, which is associated with international requirements for the fulfillment of certain financial obligations of the company. However, medium and small businesses, as a rule, work in manual mode, managing risks, often already when they occur. In the context of a pandemic, this process manifested itself most sharply, since most of the companies that left the market belonged specifically to medium and small businesses. Despite the fact that small companies seem to have their own obvious advantages, which include flexibility, the ability to quickly make and manage decisions, they find themselves in a more difficult financial situation due to the lack of a mechanism for managing the company's financial risks and the availability of risk management specialists. Lack of adequacy of reserve funds, insurance protection, diversification of risks, imbalance of assets and liabilities of the company and overstated loan obligations with an increase in the risk of receivables and a decrease in consumer demand, were the result of the bankruptcy of many companies in the Russian market.

The assessment of financial risk is based on a plurality of various factors, which are initially assessed quantitatively, and then after determining the most significant among them, i.e. those that have the greatest impact on the likelihood of financial risk, a group of factors is determined to assess the quantitative indicators of risk.

A factor should be understood as a causal source of a process, a phenomenon that determines its characteristic features. The level of reliability of the financial risk assessment will depend on how correctly the "factors of influence" on the risk are identified at the enterprise. A factor in the emergence of financial risk in an enterprise can be a high level of accounts receivable, an increase in inventory in the warehouse and, in connection with this, a reduction in the current cash flow, which leads to the risk of a decrease in the company's solvency.

In a crisis, the financial risks of enterprises not only increase sharply, but can also lead to cascading risks, in which a failure in one financial

system can lead to failures and accidents in other industries, both financial and industrial. Thus, the bankruptcy of a bank can lead to risks of non-payment on the part of the bank's clients, due to the fact that the bank does not pay for its obligations. [3]

Financial risk management in an enterprise requires constant monitoring and control over the conduct of operations to reduce them. In this regard, internal control occupies a special place as one of the methods of financial risk management at the enterprise.

Internal control in the financial sphere of an enterprise solves such problems as: [2]

- ensuring the break-even of the financial and economic activities of the enterprise;

- carrying out a set of measures to ensure effective asset management;

- implementation on an ongoing basis of effective risk management of the enterprise, which includes: identification and assessment of risks, determination of an acceptable level of risks taken for the company's own retention, measures to maintain the level of risks that do not threaten its financial stability and solvency;

- the balance of the financial resources of the enterprise and the financial risks of the enterprise with its financial results, etc.;

Enterprises independently develop an internal control system. [1]

Let's consider the first element of the internal control system (ICS) - the control environment. This element is the essence of the views of the owner and management of the enterprise about what the system of internal control of the enterprise or internal audit should be. The formation of the control environment is influenced by the organizational structure of the enterprise, personnel and motivational policies in relation to personnel, the mission of the enterprise, as well as the style of enterprise management. The control environment is formulated and formed without fail and taking into account the scale of the enterprise's activities, because the construction of any workable system requires costs. But it is important to remember that the cost ratio must be adequate to the efficiency with which the ICS will operate. Competence and leadership style is also an integral part of the control environment.

The second element of the internal control system is the risk assessment by an economic entity. From this point of view, the company will be interested in those risks that are related to the accounting (financial) statements. Of course, in the classical understanding of risk management, an enterprise must identify these risks, rank them in order of importance and find ways to minimize them, if not completely eliminate them. But in

practice, not all risks associated with accounting (financial) reporting can be influenced. For example, a change in the regulatory environment is one of these less manageable risks if it is generated by the government in a short time and takes effect almost immediately. With a sudden change in the regulatory framework, many enterprises are not ready to work in the new environment, especially if their activities are not too diversified. In this case, it is advisable that the business community demanded joint responsibility from the legislator for the consequences of such political decisions.

The next third element of ICS is the information environment in which the company operates. At the present stage, it is at the same time an element, the use of which greatly facilitates the commercial activities of any enterprise, but it is also a high-risk link in commerce and in the generation of enterprise reporting. The use of information systems greatly facilitated the registration of all facts of economic life, made it possible to classify operations, assets, liabilities in more detail, analyze information for any time periods, but at the same time created the danger of losing large amounts of information, unauthorized entry into the accounting and storage system from the outside. Timeliness of information and its qualitative presentation to the user greatly contributes to adequate analysis and correct decision-making based on the information provided. [4]

Control actions or internal control procedures are the element of the ICS system, which is aimed at minimizing the risks of misstatement of financial statements. At this stage of building an enterprise's internal control system, the whole variety of methods and techniques of control is implemented: documentary, factual, analytical. The development of control procedures at this stage depends on the scale of the enterprise, its types of activities.

Analytical procedures hold a special place among financial control procedures. Analytical procedures allow drawing conclusions about the activities of the enterprise, development trends or stagnation of activities. Also, analytical procedures allow diagnosing and predicting threats to an enterprise, analyzing the competitive environment, analyzing the sales market for the company's products, analyzing the company's personnel potential, analyzing the legal status of the enterprise, analyzing the management processes and information structure of the enterprise, as well as analyzing the corporate structure, etc. The main responsibility for the information provided lies with the top management, management and owners of the company. It is their responsibility to prevent and detect errors, as well as unfair and fraudulent actions. [4]

Monitoring of controls is an important element of the internal financial control system. Its essence lies in the constant scanning of all control pro-

cedures in time for their compliance with the current activities of the enterprise, the regulatory framework and the external environment. Monitoring of controls allows you to receive timely information indicating shortcomings and problems encountered in the internal control system at the enterprise. Monitoring ICS allows you to adjust the procedures of controls, making them more relevant based on the analysis of changes in current activities. But we must remember that, like any system, ICS has limitations of both objective and subjective nature. The deliberate actions of the personnel to bypass the means of control cannot be ruled out.

In general, an adequate system of internal control at the enterprise will certainly minimize the risks affecting the activities of an economic entity and contributes to an increase in the efficiency of its activities.

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A SYSTEMATIC APPROACH TO MODELING INTERREGIONAL TIES

Ivanova Natalia Alexandrovna
Candidate of Economic Sciences, Associate Professor
Saint Petersburg State Academy of Aerospace Instrumentation

Abstract. The proposed article examines the process of transformation of social and economic relations, since without leveling the socio-economic development of the regions, it is practically impossible for a stable growth of the country's economy as a whole. The huge scale of the territory, the variety of natural and climatic conditions and other factors necessitate the development and implementation of new approaches to the effective use of regional factors and the study of interregional relations in Russia. The novelty of the research lies in the study of the socio-economic characteristics of the situation in the regions of the country and the formation of regional markets. The relevance of this study reflects a problematic nature due to the presence in the regional economy of Russia of various unresolved issues related to the specifics of the socio-economic development of the country's regions, the formation of regional factors and ensuring the effective development of a single economic space open to international economic cooperation.

Keywords: region, interregional ties, transformation of relations, system of interconnections.

The management of the regional economy, as a complex system that unites many objects and subjects, connections and aspects, requires the development of adequate scientific tools.

These opportunities are largely realized with the help of economic and mathematical modeling of socio-economic processes.

As one of the main methods of cognition of the surrounding reality in modern science, a systematic approach is used, which makes it possible to form universal knowledge about system objects, their qualitative definiteness, about the laws of existence, the mechanisms of interaction of components that form integrity, about the nature and content of their connections and relationships.

The concept of *"system modeling"* is used in modeling the economy not as a homogeneous object, but as a multilevel and multidimensional system, in which important elements and economic mechanisms connecting them are characterized by special mathematical models, that is, a system of models is an integrating research tool.

System analysis is the leading methodological direction in scientific research of regional problems and makes it possible to compare different approaches to solving problems of the regional economy and choose the best variants for their practical use in the interests of the country's economy as a whole.

A distinctive feature of the system methodology is that it connects specialized knowledge about heterogeneous and diverse subjects that make up the system into a single whole.

In comparison with analytical approaches, the purpose of which is to gain knowledge about individual properties of objects, this theory plays a unifying, connecting role in scientific knowledge [1].

At the same time, its goal is to bring the scattered and different-quality knowledge about the object, obtained by various sciences, into one generalized picture.

Thanks to the application of the system methodology, a complex chain of transition of knowledge about individual parts of a system object to obtaining integral ideas about it is built. As a result of applying a systematic approach, integrative models are created that satisfy the needs of society in combining specialized and differentiated knowledge.

The central place in the general theory of systems is occupied by the category of "systems".

The concept of *"system"* implies, in a broad sense, an ordered set of interrelated and interacting elements that perform a certain specific function and are not subject to further division from the point of view of the considered process of the system functioning.

At the same time, the division of the objects under study into elements and systems is relative, since each system can be an element (subsystem) of a system of a larger scale, and any element can be represented as a relatively independent system consisting of corresponding elements.

Thus, a system is a set of elements and / or relations that are naturally connected into a single whole, which has properties that are absent in the elements and relations that form it.

Moreover, each system object has certain systemic features, only these features show that it can be attributed to system objects.

The fundamental signs of the systemic nature of an object are delimita-

tion, autonomy and integrity.

The internal structure of a system can be described through its components, which are structural units in the form of subsystems, parts and elements.

Along with the internal constitution, the structure also presupposes the presence of strictly defined connections and relationships between all its components, in which the formation, development and functioning of the system takes place. Any changes in these connections (the order of interaction of parts and elements or the intensity of their flow) indicate transformations in this system, and sometimes about its transition to another quality.

Thus, a necessary condition for the normal functioning and development of systems is the stability of the structure, the destruction of which leads to the disintegration of the object and its transition to a qualitatively different state.

The central link of the system is a dynamic intersectoral model, which was used to determine the summary indicators of the development of the national economy for the future in the sectoral context. In this system of models, the main attention is paid to district and inter-district models, the principles of matching individual models under certain assumptions.

A.G. Granberg developed and uses an intersectoral and interregional model, the main content of which is to determine the specialization of each region, the volume of import and export of products, and optimal transport and economic links between regions.

The model takes into account the development of non-productive consumption in each of the regions included in the system [2].

Thus, the distinctive features of a systematic approach to the study of the regional system are as follows:

• when studying an object in a systemic study, knowledge from various fields is used, which is necessary for its holistic cognition. Therefore, the study is based on knowledge in the field of economics, ecology, medicine, demography, sociology;

• the ultimate goal of systemic research is the formation of a holistic, integrative model of the object under study. In the course of the study, the analysis of individual components is carried out not for the sake of their own knowledge, but for the purpose of their subsequent reduction into a single whole, clarifying the role of these components in the formation of an integral object, maintaining its resistance and stability;

• systemic research analyzes the relatively independent objects isolated from the environment. Therefore, cognition has a divided, two-

fold orientation. Internal connections and dependencies characterizing a given object (regional system) as an autonomous whole are subject to research. On the other hand, its structure, regularities of functioning and development are being studied;

• systemic research, in contrast to analytical research, involves dividing an object into its component parts and analyzing its components not infinitely deep. The criterion is such a depth of penetration into the structural components, which is necessary for the scientific explanation and description of the object as a certain integrity. The finite element is indivisible not because it does not have its own structure, but because it is not necessary from the point of view of studying the integrity of the object;

• systemic research achieves its goal only when the cognitive process itself is organized according to the laws of integrity, subordinated to the acquisition of integrative knowledge.

The methods of system analysis allow solving major socio-economic problems within the region, including:

• tasks of formation and development of diversified and territorial production complexes,

• development of new areas and the formation of new industries,

• integrated use of mineral raw materials and rational use of labor, financial and material resources,

• raising the standard of living of the population.

At the same time, local optima should coincide with global ones, i.e. the plan of each region should be optimal for self-development and correspond to the optimum throughout the system of regions, of which it is an element.

The modern theory of interregional economic interactions (or interaction of regional economies) includes particular theories of the location of production and production factors, interregional economic ties, and distribution relations [3].

It uses the results of the theory of general economic equilibrium and international economic integration, while maintaining a significant similarity between the theories of interregional and international economic interactions. Therefore, this theory has found wide application in the analysis of interactions between regions within one national economy (regions) and new national economies (CIS countries), and regional economies of interstate unions (countries of the European Union).

The construction of models of economic interaction is based on the following theoretical concepts:

- the economy is viewed as a complex system with a number of

subsystems (regions);

- each subsystem (region) has its own criterion of optimality, which reflects its internal interests;

- the functioning of the economy is the process of interaction of various subsystems, and planning of the economy necessarily includes the process of plan coordinating of the subsystems;

- the interaction of subsystems is carried out by means of an economic mechanism, i.e. is an economic interaction;

- the purpose of the process of economic interaction is to find the best combination of interests of individual subsystems and the system as a whole.

The general model of optimal economic interaction between regions is a model of planning and functioning of an economic system that combines public administration with economic independence and widespread use of commodity-money relations between regions.

With the help of such a model, the optimization of the economy is investigated as a process of interaction between production-technological, social and organizational structures.

Models of economic interaction make it possible to study both individual equilibrium states and the process of functioning of the economic system, which should strive to achieve a sustainable trajectory of balanced development.

The general model of economic interaction between regions of the economy should be dynamic and include a description of the mechanisms of transition from non-equilibrium states to equilibrium states and an exit from equilibrium states during structural changes in the economy.

Any model of economic interaction combines the models of individual regions (including the model of the "central" subsystem) and the conditions for economic development common to all regions. In this case, the model of each region contains a local criterion of optimality (objective function), a description of the set of feasible solutions determined by the internal conditions of the region's development, and a balance of economic relations with other regions. The second part of the model (general resource and technological constraints) is necessary for the coordination (agreement) of economic decisions of the regions.

The dynamic model of economic interaction reflects the change in all conditions in time, including the evolution of the criteria for the optimality of subsystems and the conditions of economic relations.

This model includes not only prices, income rates, etc., but also such dynamic regulators as bank interest, capital investment efficiency stan-

dards, and co-measures of the beneficial effect of consumption at different points in time.

The decisions of the model of economic interaction are dynamically interpreted as certain sets of effective trajectories for the development of the economic system.

The general properties of solutions to models of economic interaction not only do not contradict the principles of the national economic optimum, the theoretical results obtained with their help significantly complement the analysis of optimization models of the economy.

In particular, on the basis of models of economic interaction, the fundamental possibility of maximizing the global target function by means of decentralized actions of individual subsystems within the framework of a certain economic mechanism is proved.

The model of economic interaction of regions is used to describe the process of selection and coordination of development options in a multi-regional system through a market mechanism. This model is based on three fundamental concepts that play an important role in the system analysis of interregional interactions: Pareto optimum, the core of a multiregional system, and economic equilibrium in a multiregional system.

An information base is of great importance for modeling the country's interregional ties: statistical indicators and their systems, building balances and summary indicators of socio-economic development.

However, in the former centralized economy, the region did not have the full status of the economic subsystem of the national economy; regional statistics did not have the opportunity to describe the region's economy systematically and represent the national economy as a system of interacting regional economies.

In particular, at the regional level, the main macroeconomic indicators were not calculated and synthetic economic balances were not built. At the present stage, the main task of improving regional statistics is the creation of a system of regional accounts (SRA) - a logical continuation of the SNA for the regional level.

The methodological principles for constructing an SRA based on SNA and the synthesis of SNA-SRA were developed by the Nobel laureate R. Stone in the 50s of the XX century. Currently, the system of regional accounts is used in many countries [4].

With the transition to economic management methods, the scope of application of models of economic interaction between regions is significantly expanding. Studies of interregional relationships in the economy from the point of view of their consistency include three logical levels:

1) elemental (for each form of interregional ties, for example, analysis of the exchange of products of material production and scientific and technical information, population migration, etc.);

2) systemic regional (from the standpoint of the economy of a separate region as an open system);

3) systemic national economic (from the standpoint of the economy as a system of interacting regions).

Thus, one of the important research methods of the regional economy is the construction of models that reflect the structure, relationships, patterns of processes occurring not only in different regions, but also in countries with different socio-economic systems. To study the economy of the region, modified macroeconomic models are used, but taking into account the greater openness of the region in comparison with the national economy. An important factor in the development of the region's economy is external demand, which is expressed through detailed indicators (coming-out, coming-in, export and import).

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NEURAL NETWORK MODELS AND METHODS IN THE TASKS OF PERSONNEL DEVELOPMENT MANAGEMENT IN COMPANIES

Tretyakov Oleg Vladimirovich
Candidate of Economic Sciences, Head of Department
Perm National Research Polytechnic University
Perm, Russia

Abstract. The article provides a structured analysis of the areas of application of mathematical methods and models in personnel management tasks. A technology is proposed that, together with neural network algorithms for predicting the success of a person in a company, allows the use of fuzzy expert technologies. It is emphasized that the practical use of the proposed methods and models makes it possible to move from solving individual problems of personnel management to a systematic approach to solving a complex of problems of human resource management.

Keywords: management of personnel development, forecasting the success of a person in a company, neural network technologies, fuzzy linguistic technologies.

The neural network is rapidly entering production and management activities. Fierce competition poses problems for modern business that can be effectively solved with modern data analysis tools. Neural network technology allows you to analyze information, predict development and minimize risks when making decisions, which allows you to build a business on a strictly scientific basis competently and effectively.

Neural networks are designed similarly to the human nervous system, but in fact they use statistical analysis to recognize patterns from a large amount of information through adaptive learning [8]. Neural networks are a powerful modeling technique that can reproduce extremely complex dependencies. Neural networks learn by example. A neural network user selects representative data and then runs a learning algorithm that automatically perceives the data structure. Efficiency of work is achieved, firstly, from the parallelization of information processing, and secondly, from the ability to self-learn, i.e. create generalizations [7]. The term generalization refers to the ability to obtain a reasonable result based on data that was

not encountered in the learning process. These properties allow neural networks to solve complex problems that are considered intractable today. However, in practice, when working autonomously, neural networks cannot provide ready-made solutions. They need to be integrated into complex systems [5].

Mathematical models and methods allow making decisions both in conditions when the influencing factors are known, and in conditions of limited availability of information, therefore, the possibility of real application of neural networks and their interaction with the company's information system.

Modern mathematical methods and models open up new opportunities for formalization, constructive development and increasing the efficiency of the company's personnel management methods.

The main areas of application of mathematical methods and models in personnel management problems are shown in Fig. 1.

The personnel development management system is a complex of organizational structures, methods, organizational and economic measures and resources that serve to fulfill the tasks of training, retraining and advanced training of personnel; organization of inventive and rationalization work; professional adaptation; evaluating candidates for a vacant position; ongoing periodic evaluation of personnel; business career planning; work with the personnel reserve.

Neural network models and methods as applied to the task of predicting the success of new candidates in various areas of professional activity in a company is one of the most urgent tasks of recruiting personnel [1]. The task of forecasting when hiring is set as follows: according to the input characteristics of the candidate used in the standard selection, to obtain an assessment of the special criteria of success in professional activity. Parameters of professional knowledge, skills, and abilities are used as input characteristics of candidates; autobiography data; characteristics associated with the peculiarities of the psycho-motivational mechanism of professional activity, purposefulness, activity, performance, cultural level, value orientations in life, value orientations in achieving goals, moral qualities; the level of professional flexibility, mobility, sociability, tolerance, computer literacy, proficiency in a foreign language, the employee's attitude to himself, the ability to establish business relationships, efficiency, discipline, confidence in success.

The general scheme of a neural network algorithm that solves the problem of predicting the success of candidates is shown in Fig. 2 [3, p. 123].

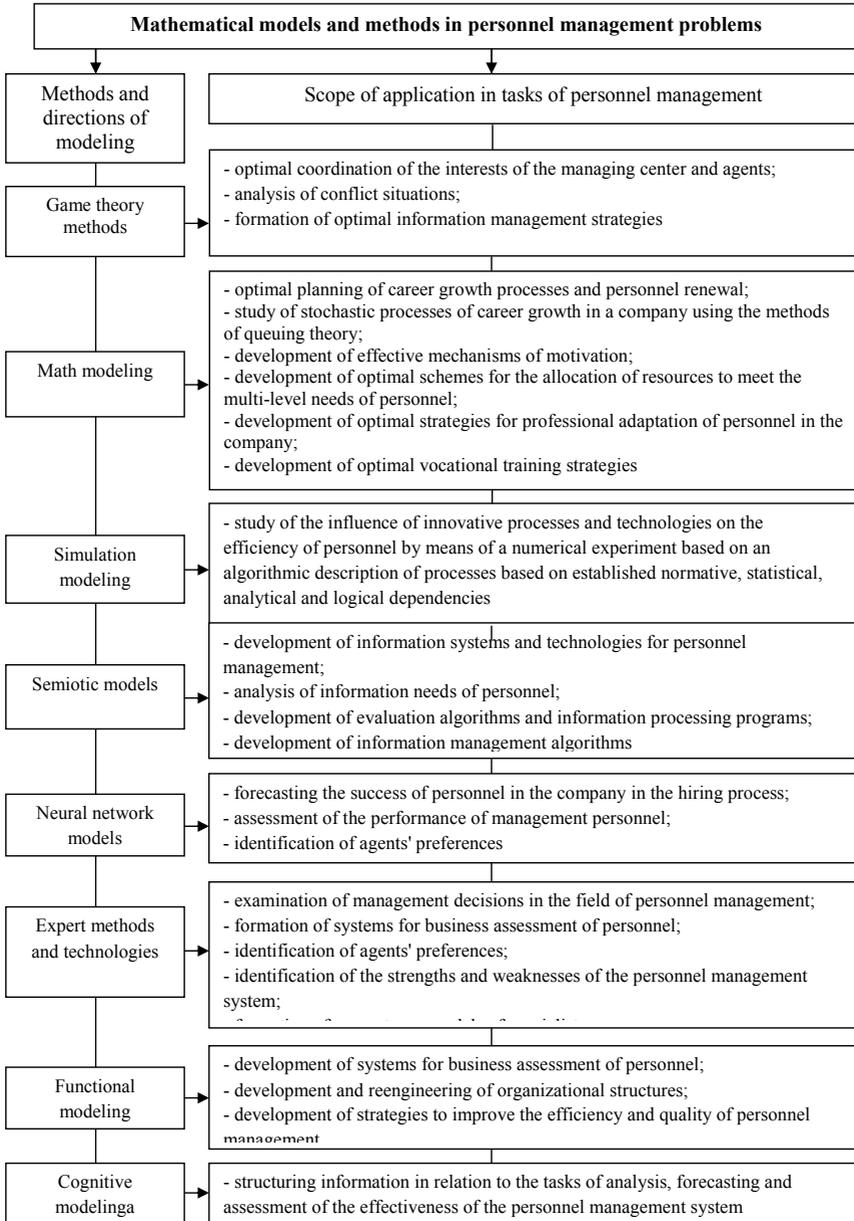| Mathematical models and methods in personnel management problems	
Methods and directions of modeling	Scope of application in tasks of personnel management
Game theory methods	- optimal coordination of the interests of the managing center and agents; - analysis of conflict situations; - formation of optimal information management strategies
Math modeling	- optimal planning of career growth processes and personnel renewal; - study of stochastic processes of career growth in a company using the methods of queuing theory; - development of effective mechanisms of motivation; - development of optimal schemes for the allocation of resources to meet the multi-level needs of personnel; - development of optimal strategies for professional adaptation of personnel in the company; - development of optimal vocational training strategies
Simulation modeling	- study of the influence of innovative processes and technologies on the efficiency of personnel by means of a numerical experiment based on an algorithmic description of processes based on established normative, statistical, analytical and logical dependencies
Semiotic models	- development of information systems and technologies for personnel management; - analysis of information needs of personnel; - development of evaluation algorithms and information processing programs; - development of information management algorithms
Neural network models	- forecasting the success of personnel in the company in the hiring process; - assessment of the performance of management personnel; - identification of agents' preferences
Expert methods and technologies	- examination of management decisions in the field of personnel management; - formation of systems for business assessment of personnel; - identification of agents' preferences; - identification of the strengths and weaknesses of the personnel management system;
Functional modeling	- development of systems for business assessment of personnel; - development and reengineering of organizational structures; - development of strategies to improve the efficiency and quality of personnel management
Cognitive modelinga	- structuring information in relation to the tasks of analysis, forecasting and assessment of the effectiveness of the personnel management system

Fig. 1. Spheres of application of mathematical models and methods in tasks of personnel management (Author's development)

Choosing a type of professional activity

Database for this type of professional activity

Estimation of the complexity of the approximation problem using a neural network:
1) calculation of the sample Lipschitz constant A_t;
2) calculating the Lipschitz constant of the network Λ;
3) if $\Lambda \leq \Lambda_t$, then data preprocessing is carried out

Input parameters characterizing candidate X

Parameters used by the HR department in the selection for this position	Method of obtaining information	Measurement result

Output resulting parameters Y

Parameters characterizing the degree of satisfaction of the employer and criteria for the success of professional activity	Method of obtaining information	Measurement result

Network training by backpropagation of errors on data (X, Y)

Data network testing (X^*, Y^*) for tuning

Evaluating network performance on test data

satisfactory

low

Formation of data blocks for training, tuning and assessing the effectiveness of the network: a set of pairs (X, Y) for training the network; sets of pairs (X^*, Y^*) for network testing; validation set of pairs (X^{**}, Y^{**})

Data network testing (X^{**}, Y^{**}) to evaluate performance

Evaluating network efficiency based on validation set data

satisfactory

low

Selection of the type of activation functions of the network (in the work, two-layer neural networks with sigmoidal activation functions are used)

Symptoms of the following problems:
- insufficient information content of the input parameters;
- insufficient validity of measurement methods;
- insufficient relevance of success criteria

Application of the network to predict the success of a candidate in a chosen type of professional activity:
1. Entering characteristics X.
2. Interpretation of Y's answer.

Data coding according to the type of activation functions

Defining network parameters

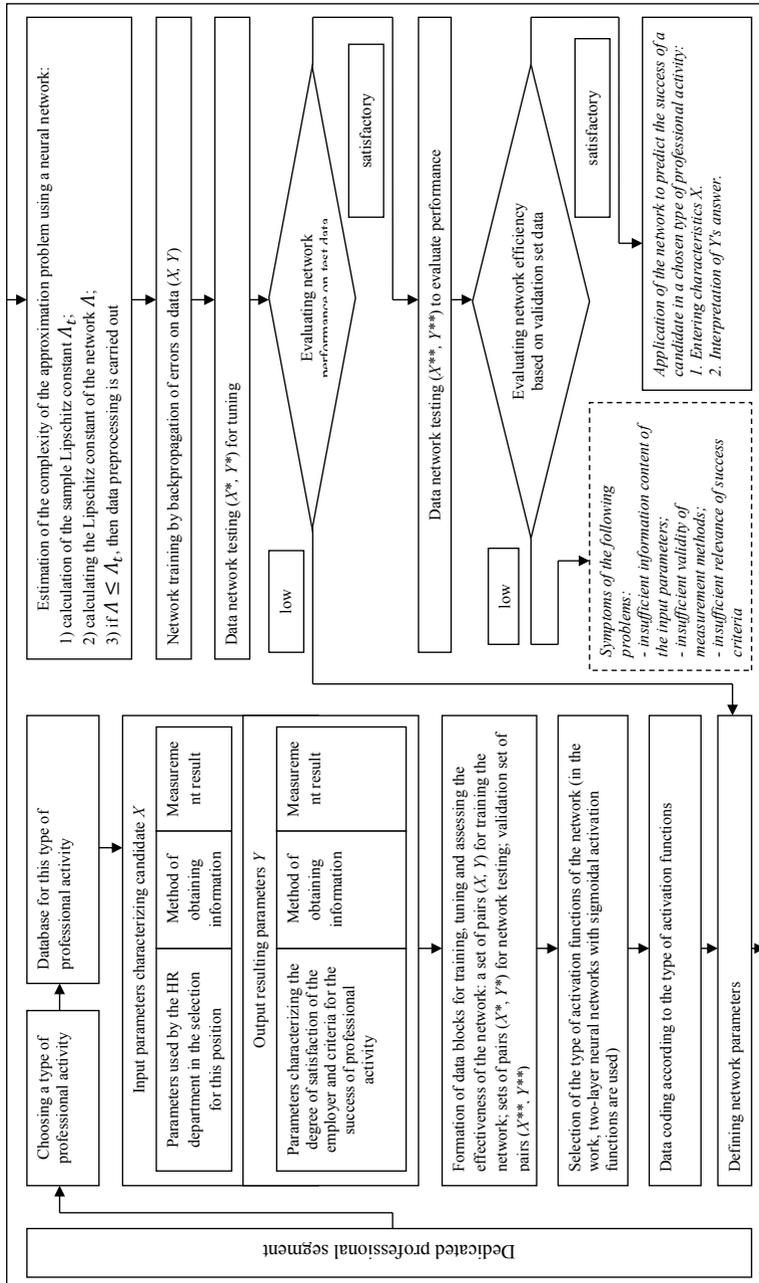Dedicated professional segment

Fig. 2. General scheme of the neural network mechanism

Along with neural network algorithms, fuzzy expert technologies can be used to predict the success of a person in a company [4]. This article proposes one such technology. It is assumed that the company assesses a set of specific competencies in the recruitment process. All competencies are represented as linguistic variables. Three models based on the competence database are introduced into consideration: the employer model, the applicant model and the evaluation model. The models of the employer and the applicant are sets of assessments of the linguistic importance of the analyzed competencies, and the assessment model is the level of expression (term) of each competence in the applicant.

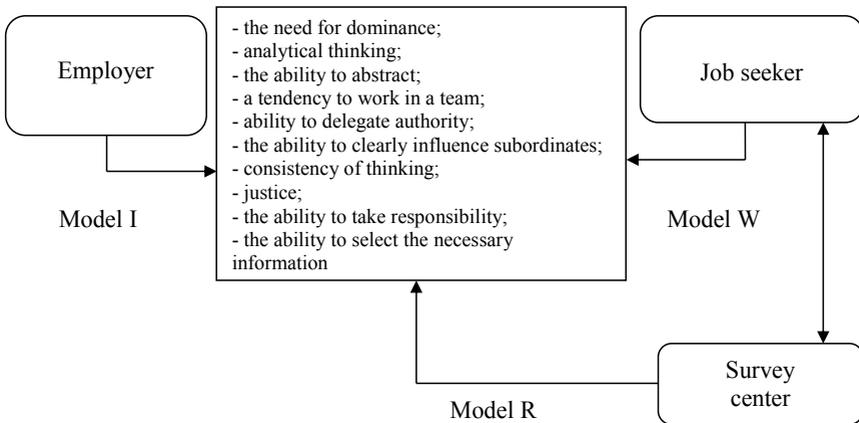The structure of models for the manager profession is shown in Fig. 3 [3, p. 126].

Fig. 3. The structure of the model for predicting the success of a person in a company

Linguistic correlations between different models are calculated, for this the components of the models are ranked in a special way. On the basis of the obtained linguistic correlations, the rules of fuzzy inference are built and the success of a person in the company is assessed [3, p. 126].

Evaluation models in personnel management are the certification and business assessment of personnel, which can be further used in personnel development tasks. The task of using highly qualified personnel is especially important in the formation of the staff of innovative companies [9].

Consider an expert mechanism for the formation of models of competencies of specialists, which allows taking into account the opinion of the

head of the company and a group of experts regarding the importance of various general and nuclear competencies, assessing the consistency within the expert group and consistency with the opinion of the head, building a hierarchical model of competencies and a mechanism for obtaining a comprehensive assessment of competence [2].

Suppose there is some hierarchical model of competencies [3, p. 128]. To obtain a comprehensive assessment of competence in accordance with the hierarchical model, it is necessary to expertly determine the relationship of preference between different competencies. To identify preference relationships, a formalized algorithm for the activities of an expert group headed by the head of the company is used. All experts fill in the matrices of the preference relationship between the competencies of the lower level of the hierarchy in the linguistic scale. Various aspects of the consistency of the opinion of experts are assessed, a group of experts is singled out, co-ordinated with each other and with the opinion of the head. For this group, a group preference relation is built between the competencies of the lower level, and the preference relation between the competences of higher levels is built according to special rules. Linguistic logical convolution matrices are formed in relation to the preference relation between the competencies, and using the complex assessment mechanism, an assessment of the upper level of the hierarchy is obtained - the employee's competence.

There is a set of competencies $X = \{x_1, x_2, ..., x_n\}$.

Each competence corresponds to the degree of significance of the inclusion of this competence in the analysis from the position of the leader $W = \{w_1, w_2, ..., w_n\}$, expressed in a linguistic scale. In this case, the $V = \{V_1, V_2, ..., V_7\}$ scale will be used to assess the importance of including competencies in the analysis from a manager's perspective. Competencies are assessed according to their importance by a group of experts $E = \{e_1, e_2, ...e_p\}$, each of which is characterized by their competence g_k, also expressed in the linguistic scale V. The head of the company is considered as an e1 expert, he is assigned a special role in the examination.

Each expert e_k forms his opinion in the form of a linguistic preference relation P_k, according to which any pair of competencies (x_i, x_j) is associated with a term of a linguistic variable C (term-set $S = \{S_1, S_2, ..., S_9\}$), reflecting superiority in importance from the point of view of an expert of competence x_i in comparison with competence x_j. The preference relationships compiled by different experts may differ. To assess the closeness of the opinions of two experts, a special table of proximity D, is used, the elements of which $d(S_i, S_j)$, given in the linguistic scale V, show how close the terms S_i and S_j of the S scale are.

The main stages of the considered algorithm are given in [3, p. 127-129]. The algorithm partially uses the approach of assessing the consistency of expert judgments proposed by domestic researchers [6]. The competency model, built in accordance with the approach described above, allows long-term planning and forecasting of the necessary human resources, quickly and efficiently forming a personnel reserve. Training planning is also systematized and becomes more focused, a transition is made from solving individual problems to real human resource management.

Thus, the introduction of the latest intelligent systems in personnel management allows us to make a qualitative leap in management and increase the efficiency of personnel selection for productive work in the company.

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QUALITY ASSURANCE FOR JOINT EDUCATIONAL PROGRAMS

Makolov Vasily Ivanovich
Candidate of Economic Sciences, Associate professor
Russian State University for the Humanities, Moscow, Russia

Abstract. The article studies the development of quality assurance systems for joint educational programs on the example of ten leading universities in Russia (with the status of a federal university) and a similar number of European universities. The content-analysis showed the degree of use of European standards ESG in universities, as well as the practical application of various quality assurance tools.

Key words: joint educational programs, quality assurance system, ESG ENQA standards and recommendations.

INTRODUCTION

Joint educational programs as part of transnational higher education began to develop rapidly since the 1980s. XX century based on the increased mobility of students and teachers, the growth in the number of higher educational institutions and educational programs at different levels, the development of new forms and technologies for the implementation of educational services (opening foreign campuses, the introduction of distance and e-learning, etc.). Note that the main driver of the development of transnational higher education in general, and joint programs in particular, is the massiveization of higher education and the development of a distance format for receiving educational services. Thus, the admission of students to higher education institutions at the global level in 2000 was 97 million people, and in 2025, according to forecasts, it will reach 263 million people.

Since the mid-90s of the twentieth century. higher education is included in the framework of the World Trade Organization (WTO) and the General Agreement on Trade in Services (GATS). In this context, transnational education has become a commercial product that increases international trade in educational services.

Along with this, cross-border education has come to be seen as a tool for finding talent around the world. In the scientific works of European sci-

entists, it is noted that increasing the mobility of students and graduates of universities in the European Union is considered as an important factor in strengthening the highly intellectual labor market in the context of the development of a knowledge-based economy. The scientific literature substantiates the thesis that global competition for talents is becoming the most important condition for the development of human potential in the country. And student mobility is one of the most effective options for attracting talent. At the institutional level, attracting foreign students helps to improve the quality of higher education at universities and the level of research in PhD programs.

The theoretical background of the research presents a various range of foreign and Russian researchers: Abella, M., Machado Dos Santos S, Stella A., Gu J., Parey M., Waldinger F., Kuptsch C., Pang E., Lepori B., Oleinikova O.N., Starozhuk E.A., Vatolkina N.Sh., Evelyn Chiyevo Garwe, Lovemore Gwati, Harvey L., Cardoso S., Rosa M. J., Stensaker B., e.t.c.

MATERIALS AND METHODS

Quality is a dynamic concept that is constantly changing. So, if in the 80-90s of the twentieth century. the focus was on the concepts of "fitness-for-purpose" and "value-for-money", then at the beginning of the XXI century. in connection with the development of the Bologna Process in Europe and the increasing attention to the specific results of higher education, quality is seen as comparability and consistency. In this regard, comparable criteria and methodology for quality assurance (ESG standards and recommendations) have been developed for the participants in the Bologna process.

Scientists S. Cardoso, M. J. Rosa and B. Stensaker proposed three approaches to quality assurance in higher education: 1) quality as culture; 2) quality as conformity; and 3) quality as comparability and sustainability.

Brennan and Shah presented four types of quality assurance in higher education institutions (Table 1).

Table 1. Classification of types of quality assurance in higher education institutions

Type	Focus
Academic quality assurance	Educational program, curricula and disciplines
Managerial quality assurance	Institutional policies, systems and procedures
Pedagogical quality assurance	People skills and competencies
Employment/ output Focused quality Assurance	Outputs, characteristics of graduates, educational outcomes

Teachers play a key role in higher education. They are responsible for the design, implementation and quality assurance of educational programs. Therefore, the opinion of teachers about quality and its provision is very important.

An important result of this study: 80% of joint programs are based on activities implemented within the internal quality assurance systems existing in the partner university (including fixing the results of intermediate certification, feedback from students and alumni); external international quality assurance and accreditation are rarely used.

Different stakeholder groups may have different understandings of the content of education quality. Thus, according to R. Mishra, students can define the quality of education as the quality of their learning experience, their parents - as the return on investment in education. The university can view quality in terms of compliance with the requirements of educational authorities. Also, graduates, employers and society may have their own ideas about the quality of education.

The modern classification of joint educational programs is presented by Oleinikova O.N. Starozhuk E.A., & Vatolkina N.Sh. suggest integral classification of joint educational programs:

1. The program of two (or more) diplomas is a joint educational program, based on the results of the development of which, each partner university issues a diploma of education.

2. The program of double (joint) diplomas, based on the results of the development of which a single diploma of education is issued on behalf of all partner universities

3. The program of one diploma is a joint educational program, based on the results of the development of which the diploma is issued only by the basic university. May be accompanied by a certificate from partner universities or on behalf of a consortium of universities.

The main characteristics of joint programs are the following seven blocks:

1) the institutional structure of the partnership - from weak interaction to strategic partnership;

2) design and implementation of programs - from fragmented approach to real integrity;

3) student mobility - from one-time visits to structured trajectories;

4) recognition of studies received abroad - from non-recognition or partial to full recognition;

5) types of qualifications and degrees - joint or double diploma, certificate;

6) program management - from individual (isolated) management of a separate program to full integration into institutional arrangements;

7) quality assurance - internal and external subsystems.

The continuous growth in the number of universities and other providers of national and cross-border higher education significantly actualizes the issues of quality assurance.

In order to assess the level of formation of quality assurance systems within the framework of international joint programs of leading Russian universities in comparison with foreign universities, we conducted a study using the content analysis method. The choice of Russian universities is due to the following factors:

- the status of a federal university;

- the presence in the university development program of the task related to the formation (improvement) of the system of ensuring the quality of education;

- availability of international joint programs.

The choice of European universities is due to the following reasons:

- availability of international joint programs.

- entering the TOP-100 according to QS (World University Rankings);

- the priority of tasks related to the formation (improvement) of the education quality assurance system.

The author assessed educational programs posted in the section "Information about the educational organization" on the official websites of Russian universities and sections on the quality of education of foreign universities.

Categories and units of content analysis for universities are allocated in accordance with the key elements of the quality assurance system, on the basis of which the protocol was drawn up (Table 2).

Table 2 - Content analysis classifier

Analysis categories	Analysis units	Account unit
Focus on the implementation of an international joint program (JP)	Availability of JP	+/-
	Link to ESG ENQA standards and guidelines in key university documents	+/-
	Link to document "European Approach for Quality Assurance of Joint Programs" in key documents of the university	+/-

Organizing Quality assurance	Indication of the development of a culture of quality	+/-
	Statement of responsibility (officials) for quality	+/-
	Availability of a specialized structural unit for quality / responsible person	+/-
	Indication of the need to adapt the quality assurance system at the faculty level	+/-
Quality assessment and student engagement	Indication of student participation in quality improvement activities	+/-
	An indication of the systematic nature of quality assurance activities	+/-
	Evaluation of educational programs	+/-
Education quality assurance tools	Rating assessment of students' knowledge	+/-
	Independent assessment of the quality of training of students	+/-
	Case studies of different stakeholder groups	+/-
	Internal audits	+/-
	Professional and public accreditation of educational programs	+/-
	International accreditation of educational programs	+/-

RESEARCH RESULTS AND THEIR DISCUSSION

Content analysis made it possible to establish that the vast majority of federal universities in Russia implement international joint educational programs (8 out of 10 universities), and to one degree or another are guided by the standards and recommendations of ESG ENQA (7 universities). However, the European approach is not mentioned in university documents. A qualitative analysis showed that ESG standards are presented mainly in the context of external accreditation of educational programs.

Unlike European universities, the key documents of the reviewed Russian universities do not explicitly mention the development of a culture of quality and student participation in quality improvement activities. In other words, a technocratic and centralized approach to quality assurance with a low emphasis on "soft" aspects and total involvement in systematic work to

improve the quality of education prevails in domestic practice. This is also confirmed by the fact that, on the one hand, the universities have defined responsibility for quality (in 7 universities), there is a specialized unit for quality (in 6 universities) and a review of quality assurance processes at the institutional level is carried out, and on the other On the other hand, in the documents of universities there is no mention of the need to adapt the system at the level of educational units (taking into account the specifics of the program). Five universities evaluate educational programs; the practice of evaluating individual courses is not common. There are no clear criteria for assessing quality in the documents, only general criteria for state accreditation are indicated.

Next, we identified the composition of the collateral instruments. All universities use a rating assessment of knowledge, sociological surveys of students to assess their satisfaction with studying at a university, and professional and public accreditation. International accreditation is also widespread in universities (9 universities). Most universities also use tools for independent assessment of the quality of training of students (7 universities) and sociological surveys of teaching staff to assess their satisfaction with professional activities at the university (6 universities). And alumni polls are less common (3 universities). Four universities operate a certified quality management system and conduct internal audits. One institution uses self-assessment according to the EFQM model.

In educational programs developed taking into account the requirements of the Federal State Educational Standard 3 ++, we identified the following quality assurance tools: systematic survey of employers (10 universities); international quality certification and accreditation with the involvement of professional international associations and agencies (9 universities); conducting a survey of graduates (6 universities); development of a strategy to ensure the quality of graduate training (3 universities); examination of assessment tools by external experts - employers, teachers of related educational fields, specialists in the development and certification of assessment tools (2 universities); monitoring the quality of the implementation of the training program (1 university); use of WorldSkills standards in student certification (2 universities); regular self-examination and comparison with other educational organizations with the involvement of representatives of employers (1 university).

Content analysis conducted for European universities showed the existence of separate quality assurance procedures for international joint programs (8 universities), the use of ESG standards (9 universities) and the European approach (3 universities). Unlike Russian universities, the key

documents of universities mention the need to develop a culture of quality (8 universities) and student participation in activities to improve the quality of education (9 universities). Education quality assurance systems are more decentralized, with documents from eight universities indicating the need to adapt the quality assurance system at the faculty level. An important place is given to the assessment of processes at the institutional level, program and the level of individual courses (9, 10 and 10 universities, respectively). Most universities have clear criteria for assessing quality (8 universities). The universities surveyed use a wide range of quality assurance tools: a survey of students, including foreign students, teachers, employers and graduates (10 universities); self-assessment (10 universities); international accreditation (10 universities); external review (10 universities), etc. British and Belgian universities use External Examiners (3 universities).

CONCLUSION

The comparative analysis showed that universities in the framework of international joint programs primarily use ESG ENQA standards. The European approach is used in only three EU universities surveyed. The range of implemented quality assurance tools in Russian and European universities is generally comparable (with some greater diversity in EU universities). However, the use of the considered quality assurance tools is not tied to specific terms, which indicates their possible non-systematic application. The quality assurance systems of Russian universities are more centralized and more inclusive of the institutional level. European universities are focused primarily on the formation of these systems at the program level.

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ASSESSMENT OF CORRELATION BETWEEN MENTAL DEVELOPMENT PARAMETERS AND INDICATORS OF VESTIBULAR STABILITY OF PRIMARY SCHOOLCHILDREN WITH MENTAL RETARDATION IN ADAPTIVE PHYSICAL EDUCATION

Khaustova Elena Gennadevna
Postgraduate

Martynov Alexander Alexandrovich
Candidate of Pedagogic Sciences, Associate Professor

Borisenko Elena Georgievna
Candidate of Pedagogic Sciences, Associate Professor

Volgograd State Physical Education Academy

Abstract. The article deals with the search for effective methods of providing timely correctional assistance to primary schoolchildren with mental retardation. This category is the largest and most heterogeneous group of children with learning difficulties. The authors believe that the experience of working with abnormal children, already accumulated in the field of neuropsychology, neurology, psychology, defectology, speech therapy, etc. can and should be used in adaptive physical education of primary schoolchildren with mental retardation. We consider the parameters of vestibular stability in correlation with the mental development of children. The results were obtained that allow stating the relationship between the parameters of mental development and the indicators of vestibular stability of younger schoolchildren with mental retardation. Effective vestibular function improves brain efficiency and reduces behavioral and learning problems.

Keywords: primary schoolchildren with mental retardation, mental development, vestibular stability.

Introduction

A particularly relevant, fundamental coordinating capacity of a person in the process of controlling motor activities is vestibular capacity (sustainability). One of the common causes of learning difficulties in children with mental retardation is dysfunction of the vestibular system and subcortical sections of the brain. Without timely correction, this will constitute a barrier

to effective learning and the success of the child. It is scientifically proven that the use of specially selected coordination tools has a positive impact on the development of the mental processes of children, including those with developmental disorders [1]. This is what we have focused our research on in the area of adaptive physical education.

Methodology and organization of the research

Our study was carried out in schools of Volgograd with students of the 3rd grade (9-10 years) who have the decision of the psychological-medical-pedagogical commission with recommendations for teaching on the educational program of AGEP FSES PGE, options 7.1 and 7.2. Eighty people (40 boys and 40 girls) [3] were examined. A correlation analysis was conducted (on Brave Pearson) on the basis of data from a recognition experiment that revealed the mental development characteristics and indicators of vestibular resistance of primary schoolchildren with mental retardation to determine the relationship between the parameters being studied and to identify those indicators of mental health that are directly related to those that characterize the vestibular resistance of primary schoolchildren with mental retardation.

Research results and their discussion

A statistical analysis was made between mental development and vestibular resistance. The following tests were chosen to determine the vestibular stability: Phirileva test, going 1 m straight after three rolls forward; distance throwing; dynamic balance testing: bench balancing (P. Hirtz), gymnastics bench turns (P. Hirtz); static balance testing: Romberg test and Yarotsky test. The results of the statistical processing are presented in tables 1 for girls and 2 for boys.

Table 1 - Levels of correlation between mental development parameters and vestibular resilience indicators of primary schoolchildren with mental retardation (girls)

Indicators	Attention	Thinking	Memory	Perception	Imagination
Phirileva test	0,4	0,1	0,3	0,2	-0,2
three rolls forward	0,3	0,1	-0,1	0,3	-0,1
distance throwing	0,2	0,0	0,0	-0,1	0,0
bench balancing	0,0	0,3	0,1	-0,1	-0,1
gymnastics bench turns	0,3	0,0	0,2	0,0	0,3
Romberg test	0,2	-0,1	-0,1	0,4	0,1
Yarotsky test	0,2	0,1	-0,1	0,3	-0,1
Note– for n = 40, $r_{кр}$ = 0,273 at P < 0,05					

Tabular analysis shows that girls have the most significant, statistically reliable relationships, present with cognitive processes such as attention and perception: in the Phirileva test, 1 m straight after three rolls forward, turns on a gymnastic bench, Romberg test, Yarotsky test (from 0.3 to 0.4). A moderate correlation is also present in the execution of: balancing on a gymnastic bench with thinking, Phirileva test, turns on a gymnastic bench with imagination. The analysis of the relationships of long-range throwing with all mental development parameters has not been as significant.

Table 2. Levels of correlation between mental development parameters and vestibular resistance of primary schoolchildren with mental retardation (boys)

Indicators	Attention	Thinking	Memory	Perception	Imagination
Phirileva test	0,3	0,2	0,4	0,3	-0,1
three rolls forward	0,3	0,0	0,1	0,2	-0,2
distance throwing	0,3	0,1	0,3	0,1	0,1
bench balancing	0,2	0,1	0,0	-0,2	-0,2
gymnastics bench turns	0,1	0,2	0,1	0,0	0,2
Romberg test	0,3	0,2	0,0	0,3	0,0
Yarotsky test	0,3	0,1	0,3	0,2	-0,2
Note– for n = 40, $r_{кр}$ = 0,273 at P < 0,05					

Tabular analysis shows that boys have the most significant, statistically reliable relationships with cognitive processes such as attention and memory: when performing the Phirileva test, 1 m straight after three rolls forward, distance throwing, Romberg test and Yarotsky test. Also, a moderate correlation of perception is present in the Phirileva test, and Romberg test. Analysis of correlations of values in performing balancing and rotations on a gymnastic bench with all parameters of mental development has proved to be of little importance.

Conclusions

The results of the study confirm the indisputability of corrective work to increase vestibular stability as a means of stimulating the development of brain structures and forming the intellectual sphere of primary schoolchildren with mental retardation. By developing vestibular stability, we can create the preconditions for grading the violations of the mental parameters of children with mental retardation.

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CORRELATION-REGRESSION ANALYSIS IN EXCEL WHEN SOLVING PROBLEMS

Smirnova Anna Sergeevna
Candidate of Pedagogic Sciences, Associate Professor
Sholem Aleichem Priamursky State University

Abstract. The article discusses the application of the methods of correlation and regression analysis to the description of the relationship between the area of a store and the volume of its annual sales; a linear model has been built that makes it possible to predict store income, determined by its area.
Keywords: statistics, correlation-regression analysis, Pearson's test, paired linear regression, coefficient of determination.

Statistical methods of information processing are used in physics, chemistry, biology, economics, psychology and other sciences. Analysis and forecast of socio-economic phenomena, planning of production of goods and services is based on statistical methods [2]. To organize and present statistical data, statistical series and graphs are used.

For the convenience of calculations, spreadsheets are used. The main advantage and difference of spreadsheets is the ease of use of data processing tools. Data processing tools in their capabilities can be compared with databases; working with them does not require special training in programming from the researcher. You can enter any information into tables: text, numbers, dates and times, formulas, pictures, diagrams, graphs. All entered information can be processed using special functions [3]. MS Excel for Windows has a powerful mathematical statistics tool that allows you to do statistical modeling.

The *r*-Pearson correlation coefficient is used to study the relationship of two metric variables measured on the same sample. The coefficient characterizes the presence of only a linear relationship between the features, usually denoted by the symbols *x* and *y*.

Problem. To assess the relationship between store size (in square feet) and annual sales, consider a sample of 14 stores. The question is - is there a relationship between the area of the store and the volume of its annual

sales [1]?

Solution. x - store area (thousand square feet), y - annual sales (million dollars).

Hypotheses:

H_0: The correlation between variables x and y does not differ from zero.

H_1: The correlation between variables x and y is significantly different from zero.

№	1	2	3	4	5	6	7	8	9	10	11	12	13	14
x	1.7	1.6	2.8	5.6	1.3	2.2	1.3	1.1	3.2	1.5	5.2	4.6	5.8	3
y	3.7	3.9	6.7	9.5	3.4	5.6	3.7	2.7	5.5	2.9	10.7	7.6	11.8	4.1

To advance a hypothesis, Insert / Diagrams are used: Point. Let's build a scatter diagram (fig. 1). It can be assumed that there is a linear positive correlation, therefore, the Pearson correlation coefficient can be applied.
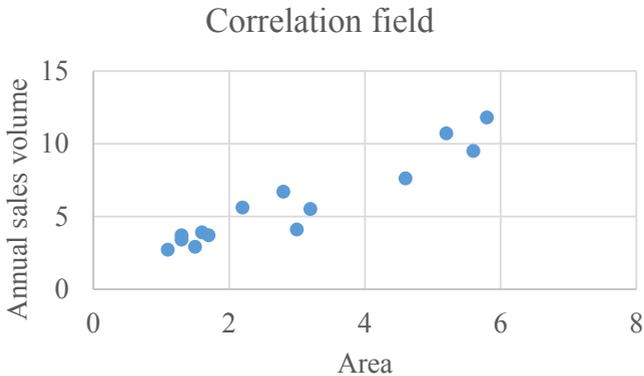
Figure 1 – Scatter diagram

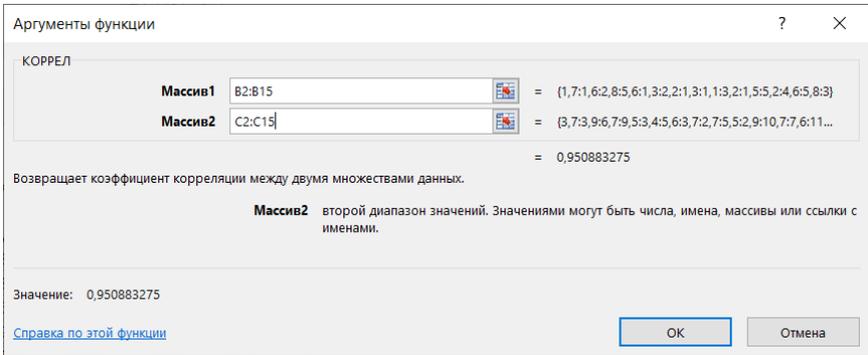Calculation of the Pearson correlation coefficient using the CORREL statistical function (fig. 2)

Figure 2 – Calculating the Pearson correlation coefficient

We determine the critical values and the construction of significance from the table (fig. 3).
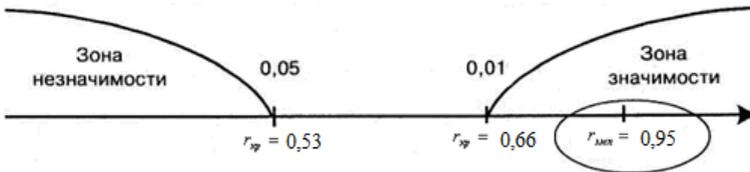

Figure 3 – "Significance axis" built for Pearson's criterion

Value $r_{эмп}$ =0.95 falls into the zone of significance, an alternative hypothesis is accepted at a significance level of 1%, i.e. There is a strong positive correlation between the area of a store and its annual sales. The resulting directly proportional relationship suggests that the larger the store area, the greater the volume of its annual sales, and vice versa.

The study of the problem can be continued using regression analysis. The main task of which is to find the coefficients of a_0, a_1 and the regression equations of $y = a_0 + a_1 \cdot x$. The regression coefficient a_1 shows how much, on average, the value of one variable changes when the measure of another variable changes by one unit.

Continuation of the task. Determine if a 1 square foot increase in store floor space will increase the store's annual sales.

Decision. We use paired linear regression analysis to answer the question. Into the constructed correlation floor, we introduce the trend line and the coefficient of determination (fig. 4 and 5).
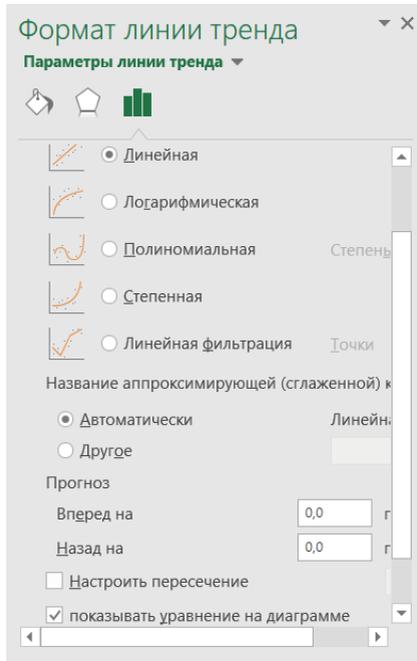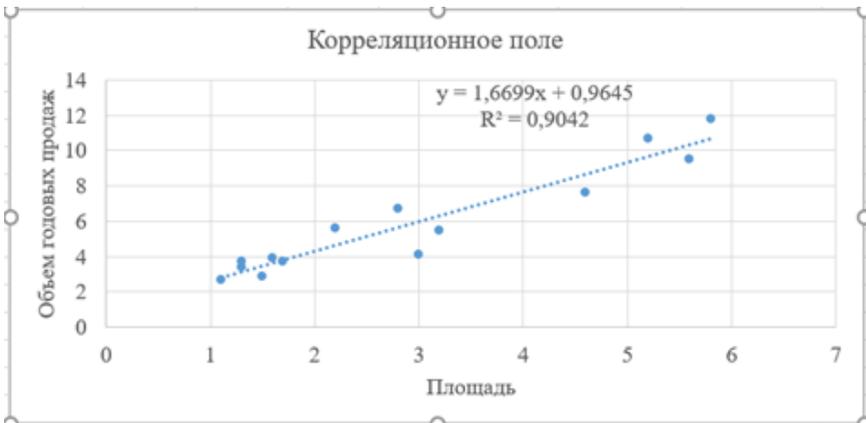
Figure 4 – Trendline format

Figure 5 – Regression equation and coefficient of determination

Regression equation y = 0,96 + 1,67 · x

The calculated slope a_1= +1.67 means that if the store is increased by one square foot, then the annual sales will increase by 1.67 thousand dollars. Therefore, the slope is the proportion of the annual sales as a function of store size. The shift a_0= +0.9645 million dollars) determines the average value of the variable y at x = 0. But the store area cannot be equal to zero, which means that the shift can be considered a share of the annual income, depending on other factors [1].

The coefficient of determination R2 shows what proportion (in%) of the change in the effective attribute is caused by the change in the factor attribute x. In the problem, R^2=0.9 means that 90% of the differences in annual sales of stores are explained by the difference in their total area, and 10% - by other unaccounted factors.

Models with a coefficient of determination above 80% can be considered quite good. Therefore, you can use a linear regression model to predict annual store sales based on store size. Let the store area be 4,000 square feet. Let's predict the average annual sales by substituting the value x = 4 (thousand square feet) in the linear regression equation of y = 0,96 + 1,67 · x = 0,96 +1,67 · 4= 7,64 million dollars. So, the projected average annual sales in a store with an area of 4000 sq. feet is 7.640 million dollars [1].

Thus, the methods of correlation and regression analysis can be used to identify links between several factors of financial and economic activity and to assess the closeness of interdependence of the factors selected for analysis.

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METHODOLOGY FOR DETERMINING THE LEVEL OF PHYSICAL ACTIVITY READINESS OF FIRST-YEAR STUDENTS

Minibaeva Elena Dmitrievna
Senior Lecturer
Samara State Technical University

Abstract. This paper presents methodological recommendations for determining the level of physical fitness of first-year students. The conducted research has shown a general tendency in a decrease in the level of development of such physical qualities as speed, general endurance, strength and speed-strength qualities. The methodology of conducting classes aimed at changing this situation is given.

Keywords: improving the quality of education, physical culture, control standards for physical culture, physical qualities.

In modern Russian higher education, the issue of improving its quality is very acute, for which various means are used: updating the regulatory framework, giving broad powers to supervisory bodies and public organizations that are called upon to monitor the level of general education.

To improve the quality of education, new educational programs are being developed, the number of hours is changing, additional disciplines are being introduced, much attention is paid to the independent and scientific work of students.

This tendency is present in universities in all areas of training, but, unfortunately, it does not always lead to positive changes.

As modern researches show, "the level of physical fitness of students entering the first year is steadily decreasing" [1]. Testing of first-year students, conducted at the beginning of each academic year, also shows low results when passing control standards.

All this testifies to the insufficiency of the work carried out in schools in physical education classes.

To determine the level of physical fitness of students who entered the first year of the Samara State Technical University (SamSTU), 4 test tasks were used, which revealed the degree of development of basic physical qualities:

1. Speed, was assessed by the result in the 100 meters sprint. The run was carried out in a stadium with asphalt, from a low start, the result was recorded with an accuracy of a tenth of a second.

2.Endurance, determined by the result in running 1000 meters. The race was carried out on an asphalt stadium from a high start. The result was recorded in minutes and seconds.

3. Speed-power qualities were assessed according to the results in the long jump from the spot. The test was carried out on a rubber cover, the result was recorded in centimeters.

4. Strength was assessed according to the result in boys in the exercise of flexion-extension of the arms in the hanging on the crossbar, the number of repetitions was recorded with the correct technique, in girls, the number of repetitions was recorded for lifting the trunk from a prone position, with fixed legs in 30 seconds, in girls.

Both boys and girls passed the tests. For a more accurate analysis, all students were divided according to the profile of study.

The economic and humanitarian profile included students studying in the direction of training: economics, management, state and municipal administration, etc.

All engineering and technical specialties were included in the engineering and technical profile: oil and gas business, automation, information technology, architectural and construction activities, electrical engineering and energy, mechanical engineering.

In just the last three years, 1210 students who belong to the main medical group have been tested. As a result, the following results were obtained (tab. 1).

Table 1.
The results of physical fitness of students,
enrolled in the I year SamSTU

Profile	Sex	Running 100m (sec)	Running 1000m (min sec)	Long jump (cm)	Force (number of times)
2019					
Economic and humanitarian	W	19.1±1.5	4.46±18.2	161.8±12.4	27.2±3.2
	M	14.2±1.8	4.12±20.2	188.6±10.1	8.6±1.9
Engineering and technical	W	17.6±3.2	5.12±10.8	165.6±15.1	26.2±1.8
	M	13.8±0.9	4.10±10.1	205.4±12.6	12.4±3.1

2020					
Engineering and technical	W	17.2±1.8	4.57±28.6	163.4±21.6	24.3±2.6
	M	14.2±2.0	4.32±11.2	220.4±22.6	9.5±2.8
Economic and humanitarian	W	17.8±1.4	4.42±14.0	162.5±12.8	23.2±3.4
	M	14.2±0.5	4.24±2.2	212.2±14.5	8.3±1.2
2021					
Economic and humanitarian	W	18.4±2.6	4.35±12.6	172.4±8.6	28.2±1.6
	M	14.7±1.8	4.18±8.7	206.2±15.4	10.2±2.1
Engineering and technical	W	20.2±2.1	4.24±15.2	169.6±7.4	26.4±3.6
	M	14.3±1.7	4.12±5.6	212.5±12.5	11.4±3.2

To analyze the data obtained, the norms of the All-Russian Physical Culture and Sports Complex (VFSK) "GTO" can be used, according to the age of the students. This is stage VI - the age is from 18 to 29 years old, or rather the riser is from 18 to 24 years old.

Parameter "100 meters run" - for men the result is 14.4 seconds, according to the test standards of the VFSK "GTO", and for women - 17.8 seconds.

Comparing the results obtained, we can conclude that almost all men, regardless of the profile of training, met this result.

Among women, the majority of groups of female students also met this standard.

However, analyzing the qualitative characteristics of the obtained parameters, it should be concluded that the students have insufficient development or almost complete absence of the sprint running technique.

The technique is present only in those involved in athletics. The bulk of students run sprints with gross mistakes - they do not know how to start correctly and gain starting acceleration, they have gross errors in the work of their legs and arms, they also do not know how to finish and do not know running tactics. All this ultimately leads to low results when passing control standards.

Parameter "Running for 1000 meters" - here men run 3000 meters, women run 2000 meters. In this case, the extreme result was obtained for men - 4.50 minutes, and for women - 6.35 minutes, which, of course, is a very bad result.

The data obtained indicate a low level of development of general endurance, this is due to the fact that students do not like to perform long

monotonous work, they do not have stable skills for such work. In addition, they are not always proficient in long-distance running technique. High results are shown only by those students who are involved in any kind of sport (athletics, swimming, cross-country skiing, martial arts).

The parameter "Long jump from a spot" - according to the standards, the extreme result for men is 210 cm, for women - 170 cm.

Comparing these standards with the results obtained, one can also note an insufficient level of development of speed-strength qualities.

There is also another negative factor - the overweight of some students and female students, which does not allow jumping as far as possible.

The parameter "Flexion-extension of the arms while hanging on the bar" - here men must lift the torso from a supine position in 30 seconds, for women this standard is passed in 1 minute.

Comparison of these standards with the results obtained shows that most groups of men did not cope, and all women showed very high results, since they are familiar with this exercise, and they perform it perfectly.

As a result, we can conclude that in men there is an insufficient development of strength abilities, this is due to the overweight of a significant number of students.

In addition, very often during testing, the following picture is observed: one part of the subjects performs the test exercise 15-18 or more times, and the other part of the subjects could not pull up even once. As a result, the average group indicators are very low.

Thus, the main task of physical education teachers in the classroom with first-year students is to increase their level of physical fitness, help in successfully passing control standards, as well as strengthening the health of young people and preparing them for service in the Armed Forces of the Russian Federation.

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FORMS AND METHODS OF ENHANCING THE COGNITIVE AND MENTAL ACTIVITY OF STUDENTS

Izguzhina Regina Ravilievna
Undergraduate

Skorobogatova Olga Nikolaevna
Candidate of Biological Sciences, Associate Professor

Pogonysheva Irina Aleksandrovna
Candidate of Biological Sciences, Associate Professor

Nizhnevartovsk State University, Russia

Abstract. The article discusses the importance of using a complex of pedagogical techniques for enhancing the mental and cognitive activity of students in order to improve the quality of knowledge. Variants of the combination of active components of educational activity are proposed. The author reveals the importance of dynamic forms and techniques in teaching methods that allow students to form a conscious attitude to learning activities.

Keywords: education, active forms of learning, play, non-standard methods.

Modern education is undergoing a period of dynamic renewal. At the moment, many innovative technologies, various organizational forms and content are being improved. Particular attention is paid to the ability to imagine and simulate a particular situation, to master communication skills and gain experience in conducting discussions and dialogue. Creative activity plays an important role in the education system [1].

Certain requirements are currently imposed on students: it is necessary to have not only certain knowledge, skills and abilities, but also to have great potential that allows them to realize themselves in life, independently learn and develop their life positions. Fundamental changes also affected the role of the teacher in the educational process. He is no longer viewed as an informant, but becomes a real stimulator of thinking [6-8].

Statistics indicate a significant decline in students' interest in the learning process. Intellectual passivity is a problem on the way to improving the

educational system. Cognitive activation is an important aspect in education. The provision of ready-made material in most cases causes difficulties for students, which consist in the inability to apply knowledge in certain situations [2].

The relevance of this topic is explained by the updating of federal state educational standards, an emphasis is placed on the formation of skills among students, which allow not only to assimilate, but also to implement the acquired knowledge in practice; to form the ability to navigate in the existing non-standard situations; form the ability to independently solve educational problems; information processing skills, its search, structuring and interpretation; carrying out mental operations associated with data analysis, comparison and comparison [3].

The aim of the study is to study, develop and implement a complex of pedagogical techniques for enhancing the mental and cognitive activity of students in order to increase the level of learning.

An experimental study was carried out at the Department of Ecology FSBEI HE Nizhnevartovsk State University (NVSU), in which 3-year students of the direction "Ecology and Environmental Management" (6 semesters of 2020 and 2021 of study) and students of municipal secondary schools of Nizhnevartovsk who were preparing for the USE and the BSE took part at the Quentin training center.

In the course of our work, we used methodological developments, techniques and forms, the main purpose of which is the practical orientation of the students' activities in the classroom, the creation of conditions for their motivation, aimed at independent educational work. Thus, students form an active life position, develop motivation for self-education, master the skills and psychological attitudes to independent search, selection, analysis and use of information.

For schoolchildren were offered two forms of control on the topic "Cytology and microscopy".

In the first version, the students completed test tasks for 15 minutes, in the second they performed tasks in a playful way. In the context of distance learning, a multifunctional service for testing in Google forms was used as a knowledge test. Questions with different levels of difficulty were selected for testing. The content of the test is expressed in one of four basic forms of tasks: tasks with the choice of one or more correct answers from among the proposed ones; tasks of an open form, where the subject writes the answer himself; assignments to establish compliance; assignments to establish the correct sequence of actions.

The game took place in two stages: Stage I – "Guess". During this

stage (15 minutes), the student pulled out a card with an assignment on which the statement is presented. Assignment: to give an answer "true" or "false" for a given statement. If the answer was correct, a point was awarded to the respondent's team, the right to answer questions is transferred to the next student. In case of an incorrect answer, the team loses the right to answer the question and skips the move. At the end of this stage of the game, points are entered into the score sheets. Stage II - "Find". There is a general view of the microscope on the board. Each of the participants draws out a card with the name of individual parts of the microscope and locates it on the general view. Points were awarded for correctly found parts of the microscope and then summed up.

Experimental results and their discussion. The level of absolute knowledge of schoolchildren after testing was 53-80%. Based on the results of processing the test results, the formed concepts, representations, as well as residual knowledge were checked.

The level of quality knowledge as a result of testing after the game was 80-100% (fig. 1.).
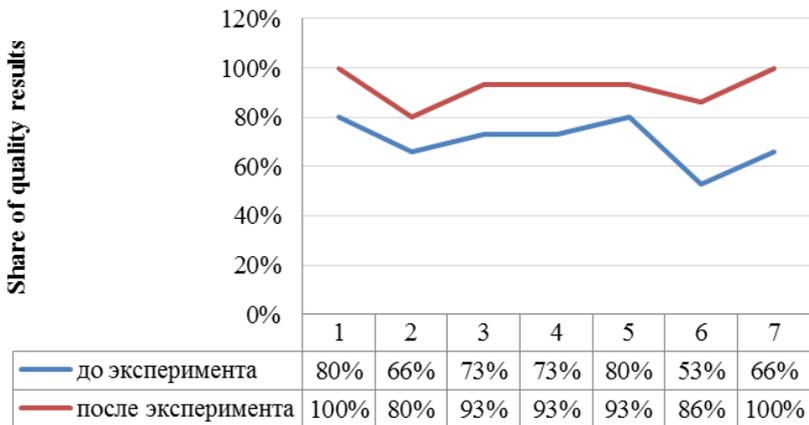

	1	2	3	4	5	6	7
до эксперимента	80%	66%	73%	73%	80%	53%	66%
после эксперимента	100%	80%	93%	93%	93%	86%	100%

Fig. 1. The results of testing schoolchildren before and after the experiment,%

The data obtained indicate that the effectiveness of the lessons, in which the students were in motion and performed practical work with the elements of the game, turned out to be higher. The average indicator of the effectiveness of the quality of students' knowledge during passive testing was 70%, after an active experiment (game) - 92%.

Upon completion of the game, students were surveyed. Analysis of the questionnaire shows a positive attitude of respondents to the use of didactic games (tab. 1).

Table1
Results of student questionnaires,%

Reasons for a positive attitude towards the game	Number of positive answers, %
Classes are more interesting	100
Found out new additional material	67
The material is better remembered	89
There is an opportunity to express your opinion	23
Welcoming atmosphere	78
Using the knowledge gained in other lessons	23

In another experiment, 2 groups of 3rd year students of the NVSU "Ecology and Nature Management" direction took part.

With them were held 3 practical seminars on the discipline "Fundamentals of geochemistry and geophysics of the environment." The purpose of the seminars is the acquisition of new knowledge, skills and abilities by students, necessary for professional activity, the development of their humanitarian thinking and intellectual abilities as a means of individual development of the academic discipline, and all this requires careful preparation for classes.

The first group of 3-year students (control) of the E&P direction (6 semester 2020) studied the discipline using standard methods (conversation), in a distance format in the context of the Covid-19 pandemic.

The second group of the 3rd course of the direction of E&P (experimental) studied the discipline in offline conditions. Assignment: students in the allotted time presented certain questions of the seminar lesson. To consolidate the studied material, a game was conducted in the form of crosswords and a survey on the conceptual apparatus (glossary). Checking the effectiveness of the students' work at the experimental seminar was carried out by the testing method.

The obtained results of learning were compared using the methodology for calculating the SLD (student's learning degree), the quality of knowledge, academic performance (absolute and qualitative) [5].

Based on the results of a comparative analysis of the quality of academic performance and the quality of knowledge in the control and experimental groups, it should be noted that the effectiveness of training in the control group is lower than in the experimental one (tab. 2.).

Table 2

The results of academic performance, the quality of academic performance and learning in the control (contr.) and experimental (exp.) groups

№ of seminar	3'th seminar		4'th seminar		5'th seminar		Averaged, %	
№ of group	Contr.	Exp.	Contr.	Exp.	Contr.	Exp.	Contr.	Exp.
Academic performance, %	48.15	61.54	37.04	42.31	40.74	61.54	41.97	55.13
Knowledge quality, %	25.93	46.15	25.93	26.92	37.04	39.23	29.63	37.43
Trainedness, %	32.30	38.15	26.81	27.38	35.11	38.46	31.40	34.66

The average percentage of progress in the experimental group increased by 13%. The indicators of the quality of knowledge and the level of training, respectively, are 8% and 3% higher in the experimental group.

According to the results of the third seminar lesson, the analysis of progress is the highest in the experiment, the difference with the control group is 13%. The quality of the knowledge gained and the level of training in the experiment, when compared with the control, increases, respectively, by almost two times by 6%. The results of the experiment of the following stages confirm the earlier results.

Distance learning leads to a weakening of the contact between the subject and the object of the educational process, the psychoemotional connection between the teacher and the student, the deterioration of the ability to objectively assess the knowledge and the level of formation of the student's competencies. Therefore, the forced remote form of work during a pandemic should not supplant the traditional form of work when coming out of a state of self-isolation.

An unconventional form of conducting classes is one of the methods, or technologies, that make it possible to increase the activity, independence and interest of students in the learning process, make educational activities personally significant, and significantly facilitate the process of acquiring new knowledge and skills.

Learners who take part in forms close to practice gain important and especially valuable skills. They can simulate different situations and gain experience. Students are told the rules of the game, the tasks and other important aspects of entertainment are explained, which will help to achieve the goal and come to the desired result [4]. Performing practical work and being on the move, students memorize basically all the material studied in class.

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EDUCATION FOR SUSTAINABLE DEVELOPMENT: THE EXPERIENCE OF THE REPUBLIC OF TATARSTAN

Yao Lubov Markelovna
Doctor of Sociological Sciences, Full Professor
Kazan (Volga region) Federal University

Abstract. The article discusses the problems of education, which is designed to promote the idea of sustainable development of society, to form an ecocentric consciousness aimed at protecting the environment. The future of the country depends on the state of education for sustainable development. The research results confirm the existing contradiction between the needs of society in the field of education for sustainable development, and its real state. Despite the fact that students are well aware of what needs to be done for the sustainable development of society, the case study showed a significant discrepancy between intentions, and real actions, and everyday environmental practices of young people.
Keywords: sustainable development, education for sustainable development, sociological research, environmental awareness, greening education, environmental practices.

Introduction

In the second half of the XX century, mankind faced a contradiction between its growing needs and the biosphere's ability to provide them. After the Second World War, the planet's economy grew 7 times, but the gap between the poor and the rich countries not only did not decrease, but grew more and more. The concept of sustainable development, which was developed in 1987 by the International Commission on Environment and Development under the leadership of the former Prime Minister of Norway, Gro Harlem Brundtland, is intended to reduce anthropogenic pressure on nature. According to the Commission's definition, sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their needs. "Today it is vitally important to understand that the logic of the entire history and development of human society warns us of the possibility of a new global ecological crisis if ... humanity follows this logic and does not change its

behavior, does not find the strength to form a new development paradigm and a new morality, - wrote the outstanding mathematician and the deepest thinker of our time Nikita Nikolaevich Moiseev. - And there will be a change of both: the social structure of society, and worldview universals! " [1, p. 158].

Research methods

To study the value of sustainable development in the minds of students of a higher educational institution in 2017, a sociological survey was conducted using the method of a formalized written interview. In total, 105 students from three groups of the final fourth year of the specialty "State and Municipal Management" of the Kazan National Research Technological University took part in the survey, who attended the course "Social Ecology". Students answered the questions: 1. "What do you mean by the term "sustainable development"; 2. "What are you personally ready to take to improve the environment, and which of the above actions have you taken during the year"; 3. "What, in your opinion, needs to be done for the country's transition to sustainable development."

The answers showed that the students correctly answered the question what is "sustainable development", since the topic "Concept of sustainable development" was included in the course "Social ecology". The ratio of answers to the question of what students are willing to do to improve the state of the environment turned out to be interesting, and what specifically they did for this over the past year:

Tab.1
The ratio of intentions and actions
(in% of the number of respondents)

What are you personally ready to take to improve the environment	%	Which of the following actions did you take during the year	%
Refuse to use harmful chemicals in the household and in summer cottages	7,31	Stopped using chemically harmful substances in the household, in the country, in the garden	19,9
Boycott food with questionable properties	70,1	Refused to eat foods with questionable properties	25,7
Voluntarily participate in actions to clean up the territory from garbage and waste	52,2	Participated in actions to clean up the area from garbage and waste	8,2
Conserve water, gas, electricity	37,3	Purposefully conserved water, gas, electricity	10,5

Vote for candidates with an environmental program	32,8	Voted for candidates with an environmental program	1,2
Participate in the work of environmental organizations	28,4	Took part in the work of environmental organizations	18,7
Take part in the improvement of the local area	13,4	Took part in the improvement of the local area	12,9
Transfer certain amounts for nature protection	6,0	Contributed certain amounts to nature conservation	1,8

As can be seen from the above table, environmental values are rather declarative in nature - they do not pass into everyday environmental practices: almost all actions, except for refusal to use harmful chemicals, are much lower than intentions. There are especially large differences between the intention to boycott food of dubious quality and the real refusal to consume food with dubious properties - 70.1% and 25.7%; the intention to participate in actions to clean up the territories from accumulated garbage, and real participation in such actions - 52.2% and 8.2%. But if the refusal to boycott goods with dubious properties can still be explained by the financial situation of the majority of students, then the refusal to participate in actions to collect garbage in parks, city gardens, on the banks of rivers and lakes cannot be explained by anything, especially since 18.7% of students answered that they took part in the work of environmental organizations, and the main goal of such organizations is educational and organizational. Nevertheless, the movement for preserving the cleanliness of the environment among young people is gaining momentum: according to the Ministry of Ecology and Natural Resources of the Republic of Tatarstan, in 2020, within the framework of the federal project "Preservation of Unique Water Bodies", over 100 thousand young people took part in the cleaning of river banks, they cleaned 1.5 thousand kilometers of territory [2]. Answers to the third question, what needs to be done for the country's transition to sustainable development, showed that students are quite well aware of all the "pain points" of the modern environmental situation and offer reasonable ways to achieve sustainable development of the country. So, for example, understanding of the global nature of environmental problems was expressed in the desire "to pay more attention to foreign experience" (the answers retained the authors' style). Understanding of the dependence of the future of the country on the awareness of all citizens of the state of the environment is manifested in the answers: "always remember about the future generation and about the inheritance for them"; "to love nature, constantly think about what we will leave to descendants, whether they will

see the clear sky, whether they will hear the joyful sounds of nature". The students suggested "to engage in security in earnest, and not on paper", "to create expeditions and examine the ecological situation in all regions of the republic, attracting specialists from institutes and universities and the necessary laboratories to cooperation"; "it is necessary that the laws are respected by all without exception"; "we need clear legislation and strict implementation"; "more penalties".

Research results and conclusions

The goals and values of sustainable development do not coincide with the goals of a market economy, therefore they are brought in from outside - from civil society, which self-regulates by creating environmental public organizations. So, for example, in the Republic of Tatarstan already in 2001 there were 25 environmental organizations. In 2015, the environmental youth movement "Will be clean" was created, for 2020 it had 8666 members. For 5 years, they have given 530 lessons in environmental knowledge, the guys - members of the organization - have won a grant from the President of the Russian Federation for holding ecological holidays "Clean Games". Since 2018, 103 Environmental Education Centers have been operating in the republic, 2000 schoolchildren participate in the Young Naturalist movement [2]. The state and the international community have the right to establish environmental and ethical boundaries for the expansion of the economy into nature, which was demonstrated at the world conference under the auspices of the United Nations at the Conference on Environment and Sustainable Development in Rio de Janeiro (1992). It was attended by 18 thousand delegates from 179 countries, heads of 100 states and governments. The slogan of the conference was proclaimed by the Secretary General of the conference, Maurice Strong: "We must save the whole world, or none of us will be saved." The special role of the state and international organizations is determined by the fact that only they have the right and are able to ensure that business entities comply with environmental laws and norms that meet the criteria of sustainable development.

In the Russian Federation, the Concept of Transition to Sustainable Development was adopted by Presidential Decree № 440 of April 1, 1996. In the preamble of the Concept it is written: "Following the recommendations and principles set forth in the documents of the UN Conference on Environment and Sustainable Development (Rio de Janeiro, 1992), and being guided by them, it seems necessary and possible to carry out a gradual transition to sustainable development in the Russian Federation, ensuring balanced solution of socio-economic problems and problems of preserving a favorable environment and natural resource potential in order to meet the

needs of present and future generations of people."

Among the main directions of Russia's transition to sustainable development are such as "the formation of an effective system for promoting the ideas of sustainable development and the creation of an appropriate system of education and training." As VI Danilov-Danilyan and KS Losev, famous Russian scientists and public figures, believe, "education should acquire a clearly expressed humanitarian and environmental connotation. All natural science, technical and humanitarian disciplines must be "green". Only after this can we expect a significant greening of practical activity" [3, p. 325]. Achieving sustainable development is impossible without changing the guidelines of public consciousness, establishing a new paradigm of social development and replacing the technocratic type of thinking with the ecological one. Creating an acceptable future involves a fundamental shift in the scale of values. This shift is based on the transition from the ideology of ruling to the ideology of mutual partnership - partnership between countries with different levels of economic development, different cultures, religions, between different social groups, between men and women, between people and nature. The awareness that man is an integral part of nature should underlie all human activity [4].

To promote the idea of sustainable development in the country's higher educational institutions, special departments have been opened: for example, in Moscow, 33 universities are engaged in professional environmental training; in the Russian Chemical-Technological Institute named after D.I. Mendeleev, the departments "Industrial Ecology" and "Sustainable Development of Society" worked, and since 2000, the Institute for Problems of Sustainable Development was opened, which included the departments of sociology, basics of life safety, sustainable development, college energy and resource saving. At the Lomonosov Moscow State University, 42 departments with a specialization in ecology work at 8 faculties, the Ecology Council of the UMO of the university has been created. The Center for Theory and Methods of Environmental Education was opened at the Russian Academy of Education, and the Federation for Environmental Education was opened in St. Petersburg [5, p.145].

In the Republic of Tatarstan, students of all universities receive environmental knowledge on the subject "Fundamentals of Life Safety" for up to 100 hours; the first department related to nature conservation was opened at Kazan State University in the 70s of the XX century. In 1989, the first environmental faculty was opened at KSU; Since 1976, the Department of Engineering Ecology has been functioning at the Kazan National Research Technological University, which annually graduates 50 people with

a degree in environmental engineering. Kazan State Power Engineering University graduates environmental engineers of heat and power systems. At the Kazan State Construction Academy, the Department of Landscape Architecture is engaged in education for sustainable development, which has been transformed into the School of Landscape Design [5, p.145]. In addition to academic work, students participate in research competitions and receive grants. In 2020, students of Tatarstan took part in the competition of scientific research works on environmental topics, in total 37 reports were sent to the competition [6].

Conclusion

The interconnection of social, economic and environmental problems has now become obvious to everyone. The governments of all developed countries of the world are making efforts to contain irreversible processes in the environment. One of the main directions of changing the ecological consciousness of people is the promotion of education for sustainable development, that is, education that gives students a clear understanding of personal responsibility for the preservation and restoration of the natural environment, the careful use of its resources, as well as for the formation of appropriate norms of behavior. The same principles underlie the concept of sustainable development, which presupposes such a development of society in which the satisfaction of the needs of the present generation does not jeopardize the satisfaction of the needs of future generations. This means, first of all, the preservation of resources, untouched economic activities of human lands, reduction of energy consumption, consumption of fresh drinking water, preservation of biodiversity by all people living on the planet. However, as sociological studies show, the environmental practices of young people do not correspond to their intentions, young people are limited to participating in subbotniks, planting trees and shrubs near their homes. In fact, today there is a rather acute contradiction between the demands of young people in the environmental sphere, and the real state of education for sustainable development.

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AGE FEATURES OF CONCOMITANT SEVERE CRANIOCEREBRAL TRAUMA

Muhitdinova Hura Nuritdinovna
Doctor of Medical Sciences, Full Professor
Center for the Development of Professional Qualifications of Medical Workers

Abstract. It was revealed that in the most severe injuries caused by combined severe traumatic brain injury in patients of group 1 on the ISS scale (50.2 ± 5.6 points), the severity of the condition and impaired consciousness did not differ significantly from those in groups 2 and 3. A direct correlation was found between the depth of the coma and the overall severity of the initial state in the injured group 3. A negative effect of excess body weight on the effectiveness of treatment, an increase in the duration of mechanical respiratory support (MRS) (0.59), intensive therapy (0.76) and the total duration of treatment (0.77) in the hospital in patients over 61 years old was revealed.

Keywords: combined severe craniocerebral trauma, age.

Relevance. The growth of injuries increases not only the frequency, but also the severity of traumatic brain injury (TBI), which is 50–70% associated with extracranial injuries. The mortality rate from concomitant traumatic brain injury (CTBI) ranges from 12 to 69%. In the general structure of peacetime injuries, the proportion of combined and multiple injuries ranges from 5 to 12%, and among the most severe - up to 40%. An almost constant component of severe associated injuries is TBI, which occurs in such cases with a frequency of 50-72 to 80-82%. The limbs are injured in 22.9% of cases, the chest - in 31%, the abdomen - in 25-29%. Multiple extracranial injuries in combination with TBI occur in 15% of cases [1-6]. Due to the lack of information in the literature on the age characteristics of injuries associated with severe traumatic brain injury (STBI), we tried to identify the distinctive characteristics, especially in different age groups, on the basis of a retrospective analysis. The division into groups was dictated by the well-known features inherent in each age group, described in detail in the literature.

Purpose of the work: to study and assess the age-related characteristics of combined severe craniocerebral injuries.

Material and research methods. The indicators of a comprehensive examination of 27 patients with concomitant severe craniocerebral trauma (STBI) who were admitted to the ICU of the CDPQMW neurosurgical department in the first hours after an accident - 25, catatrauma of 2 patients were studied. According to the indications, 26 patients on admission started invasive mechanical respiratory support (MRS), 1 patient, due to the lack of direct indications for (mechanical lung ventilation) MLV, intensive therapy was carried out with spontaneous breathing. Monitoring was carried out by complex hourly registration of parameters of body temperature, hemodynamics, respiration. Mechanical respiratory support was initiated by mechanical ventilation (MLV) for a short time followed by transfer to SIMV. The assessment of the severity of the condition was made by scoring methods according to the scales for assessing the severity of concomitant injuries - the GPAMS scale (1982 S.P. Gormican). Interpretation of the CRAMS scale: when, in the total assessment of the patient, he gains 10 points, then his condition is assessed as satisfactory, from 9 to 6 points - a state of moderate severity, less than 6 points - a serious condition, with a mortality rate of up to 90%. Injury Severity Score (ISS) assessment scale. Analysis of the severity of injuries on the ISS scale: 1-9 points - mild injury; 10-15 points - moderate severity; 16-24 points - heavy; over 24 is extremely heavy. At admission, impaired consciousness in 26 injured patients was assessed on the Glasgow Coma Scale (GS) (GCS - Teasdale G., Jennett B., 1974) 8 points or less. Patients were considered in three age groups: group 1 - 19-40 years old, group 2 - 41-60 years old, 3 - 61-84 years old. After recovery from shock, anesthetic, anti-inflammatory, antibacterial, infusion therapy, correction of violations of protein, water-electrolyte balance, surgical early correction, as far as possible, syndromic, symptomatic therapy were carried out.

Results and discussion.

Table 1
**Characteristics of patients
with concomitant severe traumatic brain injury**

	Group 1	Group 2	Group 3
	19-40 years	**41-60 years**	**61-84 years**
Number of patients	12	8	7
Open STBI	50% (6)	37% (3)	28% (2)
Closed STBI	50% (6)	62% (5)	56% (4)

Severe CC	100% (12)	71% (6)	85% (6)
Epidural hematoma	8% (1)	0	0
Intracerebral hematoma	25% (3)	15% (1)	28% (2)
Subdural hematoma	25% (3)	15% (1)	37% (3)
SAH	50% (6)	37% (3)	71% (5)
Fracture of the base of the skull	25% (3)	0	28% (2)
Dislocation syndrome	8% (1)	37% (3)	15% (1)
Operation resection-decompressive craniotomy	25% (3)	37% (3)	56% (4)
Removal of intracerebral hematoma	25% (3)	0	0
Spinal injury with partial dysfunction of the spinal cord	25% (3)	25% (2)	15% (1)
Spinal injury with complete dysfunction of the spinal cord	16% (2)	0	0
Fracture of limbs with displacement of bone fragments	25% (3)	37% (3)	37% (3)
Damage to the abdominal organs	8% (1)	25% (2)	15% (1)
Fractured chest bones	25% (3)	15% (1)	30% (2)

As presented in table 1, the first group differed from the older 2 and 3 age groups by the prevalence of OSTBI cases, CC of severe degree was detected in 100% of patients, the number of patients with spinal injury with complete (16%) and partial in 25% of those injured with dysfunction of the spinal cord. In 25% of patients of the first group, an operation was performed to remove an intracerebral hematoma. In groups 2 and 3, there were slightly more patients with CSTBI by 12% and 6%, respectively. In the older two groups, there were 12% more fractures of the extremities with displacement of bone fragments, which required surgical correction. Operation resection-decompressive craniotomy was performed in 25% in group 1, in 37% in group 2, and in 56% in group 3. The latter character-

izes the initial more pronounced severity of injury in patients over 61 years of age. In addition to the central mechanisms of acute respiratory failure, the severity of the condition was aggravated by the fracture of the bone skeleton of the chest in 25% in group 1, in 2-15% and in group 3 in 30% of patients, which significantly influenced not only the overall severity of the condition, but also the performance of mechanical respiratory support for adequate oxygenation of vital organs and the body as a whole.

Table 2
Assessment of the severity of the condition by age

Parameters	Group 1	Group 2	Group 3
age in years	29,5±4,3	51,6±4,8	72,3±9,1
CRAMS, points	4,5±0,6	4,4±0,8	4,8±0,6
ISS, points	50,2±5,6	43,3±7,1	46,2±9,1
GS, points	7,3±0,5	7,9±1,3	7,8±1,5

It was revealed that with the most severe injuries in patients of group 1 (50.2 ± 5.6 points), the severity of the condition and impaired consciousness did not differ significantly from those in groups 2 and 3 (tab. 2).

Table 3.
Duration of respiratory support

Parameters	Group 1	Group 2	Group 3
SIMV, number of days	8.6±3.9	11.8±5.5	17.8±16.9
BIPAP, number of days	4.5±5.3	3.2±1.7	1.4±1.7
CPAP, number of days	5.8±7.1	7.0±0.6	7.6±7.5
Number of mode switching	3.5±2.5	2.5±0.8	3.0±0.8
MRS, duration of respiratory support in days	14.7±8.2	16.5±5.1	26.8±16.5
Number of days in ICU	21.3±11.8	23.0±6.5	36.0±23.0
Total number of days in hospital	25.4±13.1	26.7±9.9	46.5±21.8

As presented in Table 3, in the absence of significant differences in the severity of injuries, the level of dysfunction of the central nervous system, the overall severity on admission, the most prolonged intensive therapy in the ICU (36.0±23.0 days) and the total number of days in the hospital (46, 5±21.8 days) in the oldest group 3 of patients. Also, this group underwent the longest MRS (26.8±16.5 days). The SIMV mode (17.8±16.9 days) turned out to be the most preferable due to its greater efficiency. It should be noted that in group 1, MRS was carried out for a longer period in the BIPAP mode (Biphasic positive airway pressure - ventilation of the lungs in two phases of positive pressure) in 7 patients (4.5±3.3 days).

Correlation between age and severity of concomitant severe traumatic brain injury
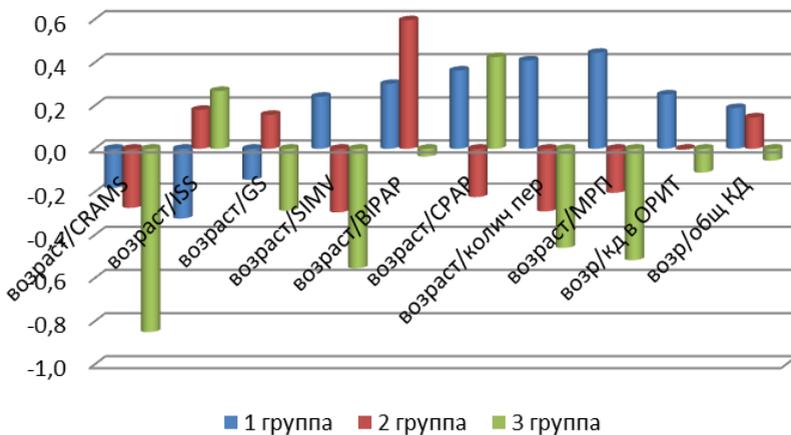
Fig.1

The revealed negative correlation between age and GPAMS level (-0.83) indicates that the older the age, the more difficult the initial state of the patients of group 3 was (fig. 1).

Correlation between body weight and severity of patients' condition depending on age
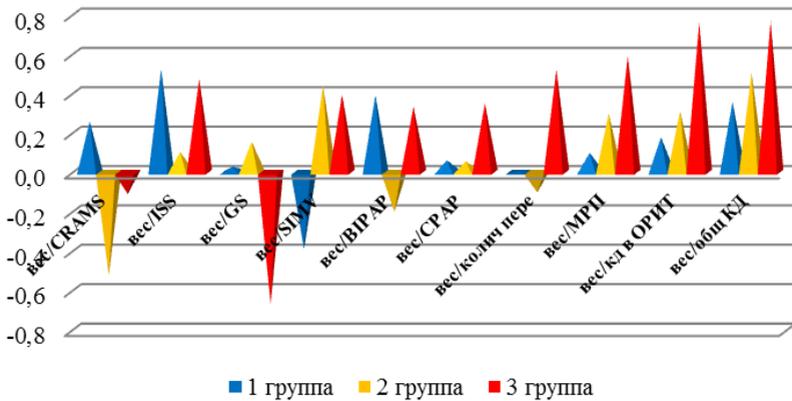
Fig.2

A negative effect of excess body weight on the effectiveness of treatment was revealed, increasing the duration of MRS (0.59), intensive therapy (0.76) and the total duration of treatment (0.77) in the hospital in group 3 (fig. 2). There was a correlation between the depth of a coma and an increase in body weight in patients over 61 years of age (-0.67).

Correlation between the severity of the condition upon admission and the dynamics of the condition
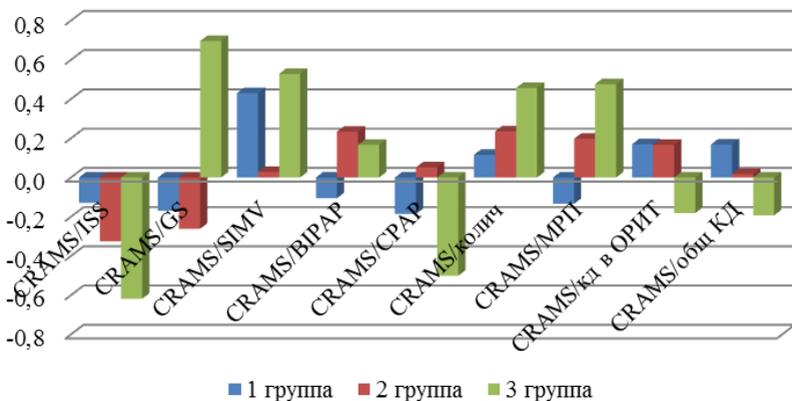
Fig.3

A direct correlation was found between the depths of the coma and the overall severity of the initial state in the injured group 3 (fig. 3).

Correlation between the severity of injuries and the dynamics of the condition by age
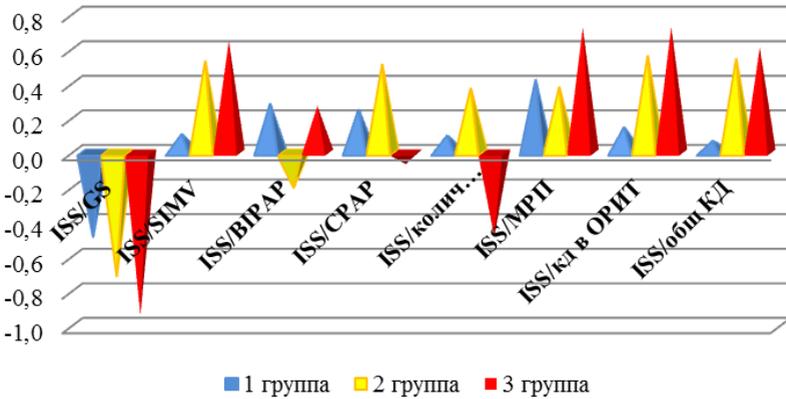
Fig.4

The more severe the traumatic injury, the more effective the use of MRS in the SIMV mode was (fig. 4).

Correlation of coma depth on the dynamics of the state depending on age
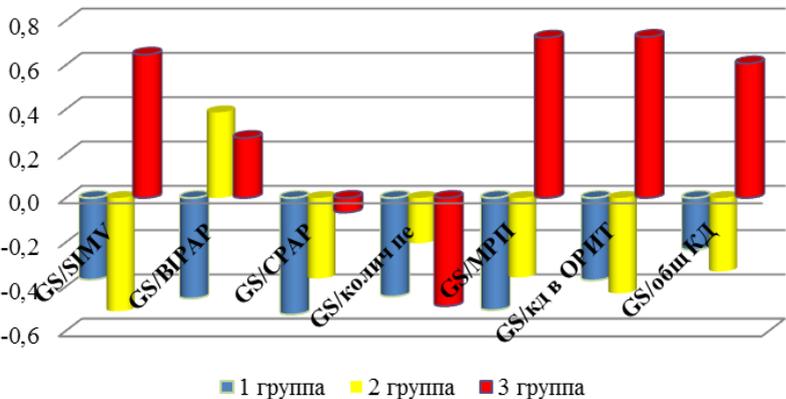
Fig.5

A direct correlation was found between the severity of CNS dysfunction and the duration of MRS in the SIMV mode, the duration of intensive care in the ICU and the duration of inpatient treatment in group 3.

Conclusion. It was found that with the most severe injuries in patients of group 1 (50.2 ± 5.6 points), the severity of the condition and impaired consciousness did not differ significantly from those in groups 2 and 3. A direct correlation was found between the depth of the coma and the overall severity of the initial state in the injured group 3. A negative effect of overweight on the effectiveness of treatment was revealed, increasing the duration of MRS (0.59), intensive therapy (0.76) and the total duration of treatment (0.77) in the hospital in patients over 61 years of age.

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CLINICAL, ANAMNESTIC AND DIAGNOSTIC ASPECTS OF COVID-19 IN CHILDREN

Samigullina Natalya Vladimirovna
Candidate of Medical Sciences, Assistant
Bashkir State Medical University
The Emergency Hospital city Ufa
Fayzullina Rezeda Mansafovna
Doctor of Medical Sciences, Full Professor
Bashkir State Medical University
Viktorov Vitaly Vasilyevich
Doctor of Medical Sciences, Full Professor
Bashkir State Medical University

Annotation. We examined 95 hospitalized children diagnosed with COVID-19. It was found, that asthenic syndrome and fever prevailed in clinical symptoms. Moderate ARVI prevailed among the clinical forms of the disease.
Keywords: children, COVID-19, viral pneumonia, clinical variants.

The new coronavirus infection in children is accompanied by a milder clinical course than in adults [1, 4, 8, 10]. Pneumonia and acute respiratory distress syndrome develop in children less often than in adults [2, 5, 9]. However, against the background of comorbid pathology, children may develop severe forms of the disease and death [3, 6, 7].

For 4 months, the Emergency Hospital functioned as an infectious diseases hospital, which included 7 adults and 1 children's infectious diseases departments. In total, 95 children with COVID-19 were treated during this period. Children were referred for treatment in connection with a suspicion of a new coronavirus infection. The hospitalization of children was carried out according to the approved indications.

According to the age structure, children of school age prevailed 36 (37.9%), a third were children of early age 26 (27.4%), children of preschool age - 16 (16.8%) and adolescents - 17 (17.9%) were less likely to fall ill (Fig. 1).
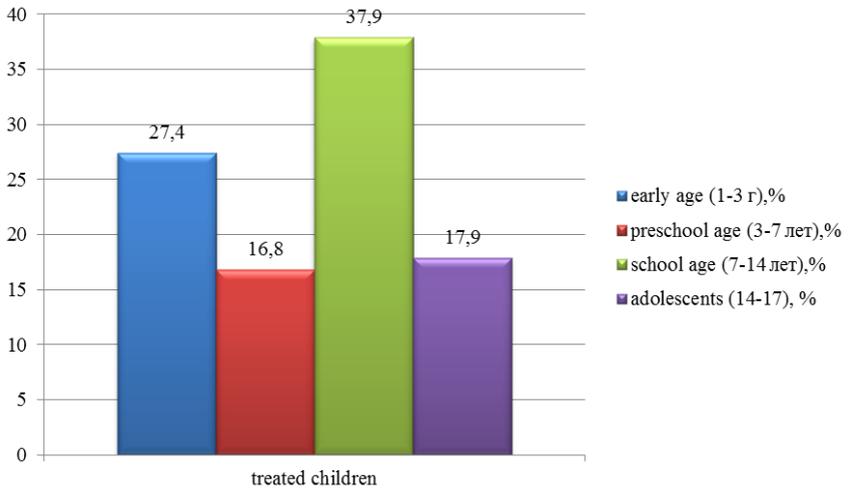
Fig. 1. Age structure of patients of the children's infectious diseases department

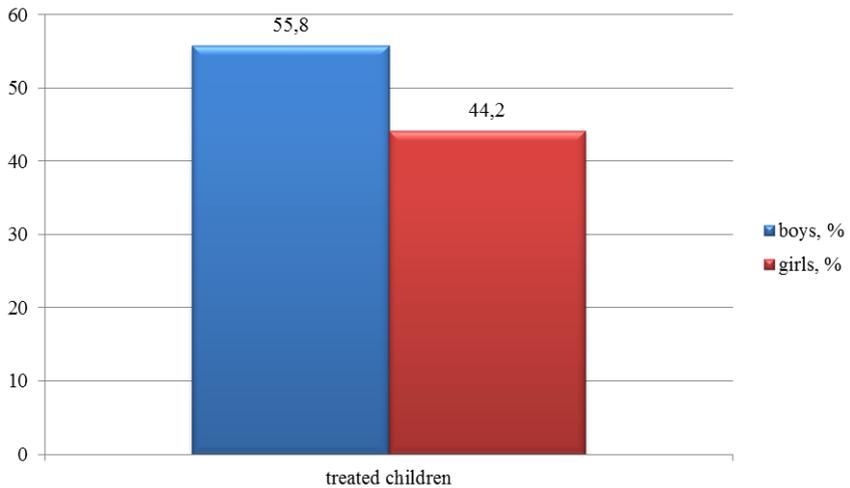By gender, boys slightly prevailed - 53 (55.8%), girls accounted for 42 (44.2%) (Fig. 2).

Fig. 2. Gender structure of patients of the children's infectious diseases department

According to the epidemiological history, in 86 (90.5%) children, close family contact was established as a source of infection, and in 9 (9.5%) children, the source of infection was not identified.

The predominant clinical symptoms in children were asthenic syndrome - in 91 (95.8%) children, fever - in 88 (92.6%) children, cough - in 74 (77.9%) children, dyspnea was less common - in 34 (35.8%), headache - 22 (23.1%), diarrhea - 13 (13.7%), sore throat - 12 (12.6%), nausea, vomiting - 10 (10.5%) %), abdominal pain - 4 (4.2%) (Fig. 3).
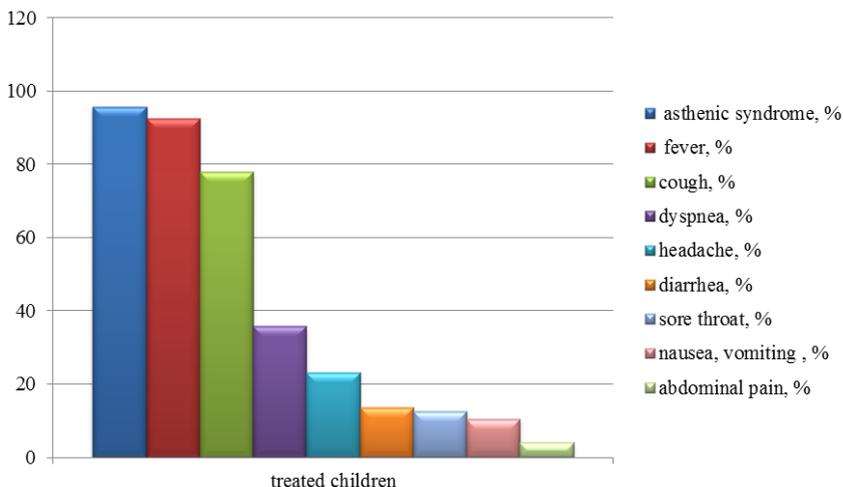
Fig. 3. Clinical symptoms in patients of the children's infectious diseases department

Among the comorbidities in 12 (12.6%) children had evidence of iron deficiency anemia, in 7 (7.4%) children with vegetative dystonia, 6 (6.3%), hematologic disorders (acute lymphoblastic leukemia), 3 (3,2%) children - obesity, 3 (3.2%) - diabetes mellitus, 2 (2.1%) - cancer (sarcoma), 2 (2.1%) - mental illness (autism).

Out of 95 children, the new coronavirus infection was confirmed by PCR test in 60 (63.2%) children, in 35 (36.8%) children, the diagnosis was established by ELISA results (PCR test was not confirmed) (Fig. 4).
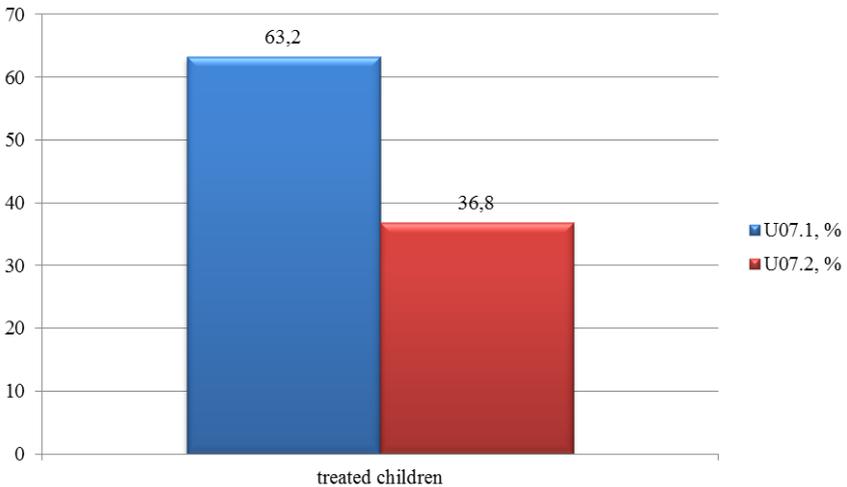
Fig. 4. The structure of the main diagnosis in patients of the pediatric infectious diseases department

According to modern requirements, physical examination of patients included:

• Evaluation of the visible mucous membranes of the upper respiratory tract;

• Auscultation and percussion of the lungs;

• Palpation of lymph nodes;

• Examination of the abdominal organs with the determination of the size of the liver and spleen;

• Thermometry;

• Assessment of the level of consciousness;

• Measurement of heart rate, blood pressure, respiratory rate;

• Pulse oximetry with SpO2 measurement to detect respiratory failure and assess the severity of hypoxemia.

All children underwent computed tomography of the chest organs. According to the examination results, in most children, the infection proceeded without damage to the lung tissue - CT-0 (in 36 (37.9%). In children with pneumonia, the area of lung tissue damage in the majority of children was CT-1 (in 33 (34, 7%)), less often there were more extensive lung lesions: CT-2 in 14 (14.7%), CT-3 in 7 (7.4%) children and CT-4 in 5 (5.3%) children (Fig. 5).
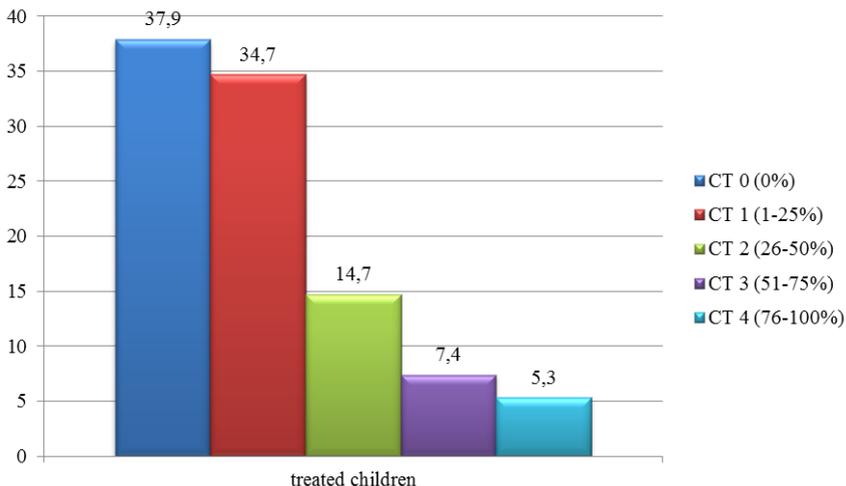
Fig. 5. The structure of the area of lesion of the lung tissue in patients of the pediatric infectious diseases department

According to clinical forms, the largest proportion was children with ARVI-36 (37.9%), pneumonia without respiratory failure was noted in 25 (26.3%), pneumonia with signs of respiratory failure was in 32 (33.7%) children, the most severe the course of infection was observed in 2 (2.1%) children with signs of ARDS (Fig. 6).
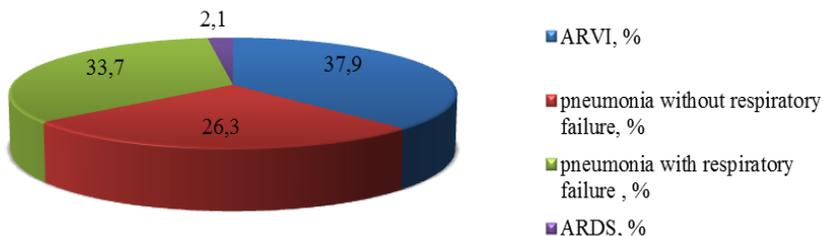

Fig. 6. Structure by clinical forms of COVID-19 in patients of the children's infectious diseases department

In terms of severity, 78 (82.1%) children with a moderate course of infection prevailed, a severe course was noted in 17 (17.9%) children. Unfortunately, 2 (2.1%) children died. Both children had severe comorbidities (Acute Lymphoblastic Leukemia) (Fig. 7).
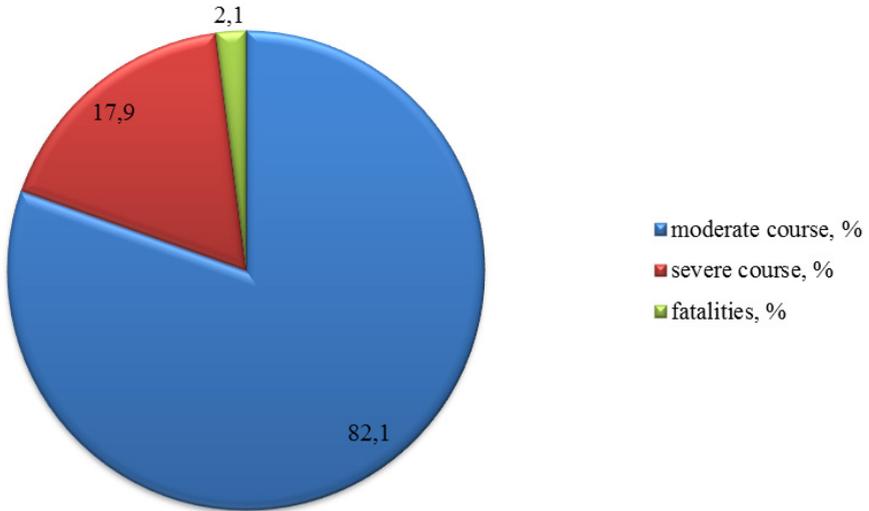

Fig. 7. Distribution by severity in patients of the pediatric infectious diseases department

The treatment of children was carried out according to the Methodological Recommendations [1, 5]. All children were prescribed antiviral therapy: drugs of recombinant interferon alfa-2b intranasal/ rectal or oral umifenovir 95 (100%), symptomatic therapy - antipyretic drugs 95 (100%). According to indications, children were prescribed antibiotic therapy (increased markers of inflammation - leukocytosis, increased ESR, increased CRP, increased procalcitonin) - in 88 (93%) cases. Also, according to indications, anticoagulant therapy was prescribed (under the control of a coagulogram, the level of D-dimers) - in 79 (83%) cases (Fig. 8).
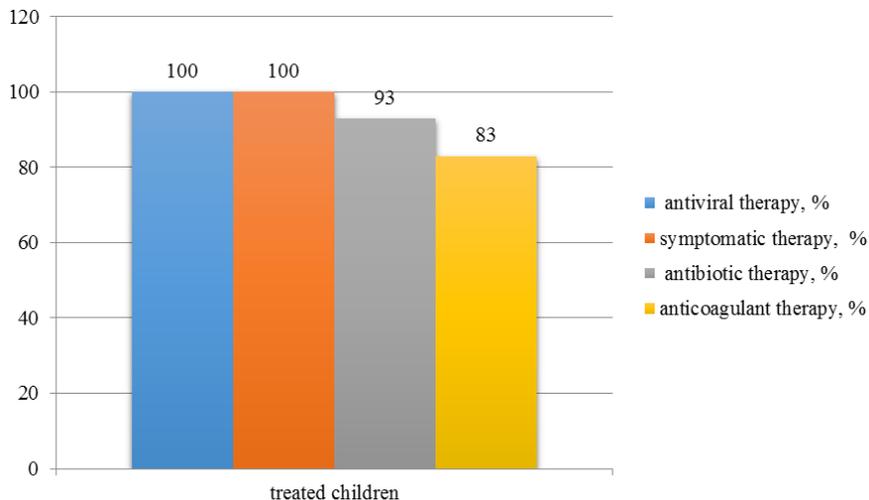
Fig. 8 The structure of drugs used in patients of the pediatric infectious diseases department

Conclusions:

1. School-age boys predominated in the structure of patients in the children's infectious diseases department.

2. The predominant clinical symptoms in children were asthenic syndrome (95.8%) and fever (92.6%).

3. Among the concomitant diseases in children prevailed iron deficiency anemia and vegetative dystonia.

4. According to the examination results, the majority of children had infection without damage to the lung tissue (37.9%) and with minimal damage to the lung parenchyma (34.7%).

5. In terms of clinical forms, the largest proportion of patients with COVID-19 were children with ARVI (37.9%) with a moderate course of the disease (82.1%).

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TO THE SURGICAL TREATMENT OF THE MEMBRANOUS FORM OF DUODENAL ATRESIA AND THE "ANNULAR" PANCREAS GLANDS IN CHILDREN

Baygozhinova Zhanar Baygalievna
Student
ORCID: 0000-0002-0975-9043

Orumbayeva Zhanar Kaisarzhanovna
Student
ORCID: 0000-0002-9492-3644

Aubakirov Maratbek Tokanovich
Candidate of Medical Sciences, Assistant

"Semey" Medical University

Abstract. In the structure of intestinal obstruction in children, congenital is about 15-20%. Surgical treatment of congenital intestinal obstruction is multifaceted and complex. Postoperative mortality is quite high (10-25%). Improving the methods of surgical treatment of congenital intestinal obstruction is the primary task of neonatal surgery.

Keywords: annular pancreas, brilliant-like anastomosis, membranous atresia of the duodenum.

Relevance of the work

Malformations and premature birth are major causes of childhood death, chronic disease and disability in many countries. The WHO estimates that 303,000 newborn babies die each year within 4 weeks after birth worldwide due to congenital anomalies [1]. In Kazakhstan, in the structure of infant mortality, congenital malformations take the second place (from 22.9% to 24.4%) [2]. Over the past 5 years, the number of congenital anomalies has remained stable and amounts to about 1100 cases per 100 thousand of the child population [3]. Improving surgical tactics, anesthetic management and postoperative care are important tasks to reduce mortality from this group of diseases. In recent years, there has been a steady increase in gastroenterological diseases in childhood. Parallel to this trend, the frequency of pathological conditions of the pancreas is also increasing.

The purpose of our research - improving the results of treatment of membranous form of atresia of the duodenal ulcer and annular pancreas in children.

Research results

The main clinical symptoms of duodenal obstruction were: vomiting with bile, swelling of the epigastric region, weight loss, dry skin, retraction of the fontanelle, and decreased skin turgor. On the general X-ray of the abdominal cavity and during the contrast study of the gastrointestinal tract, the "Double-bubble" syndrome was found (Fig. 1).

Preoperative preparation lasted from 12 hours to 2 days. Since 2012, we have introduced the Kimura method of duodeno-duodenoanastomosis (diamond-like anastomosis) at the clinic. A transverse incision is made in the proximal part of the duodenum 1.0 cm above the site of atresia and a longitudinal incision in the distal part of the same length, opposite the mes-entery. An anastomosis is created, with a single-row suture, with the res-toration of the patency of the duodenum. The duration of the operation is 40-50 minutes. The postoperative period was uneventful. All children were discharged with recovery. In the long-term period, the patients showed no complaints, did not lag behind in physical and psychological development, the passage of the intestines in children was satisfactory.

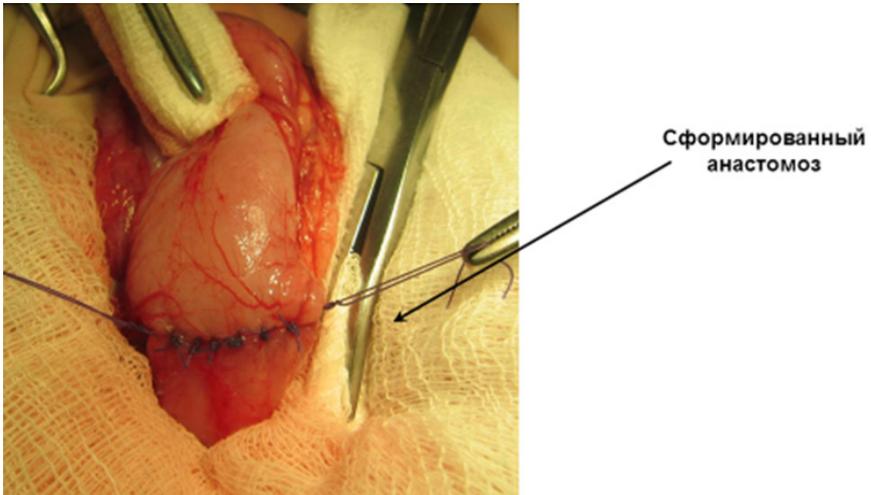**Fig. 1. Plain X-ray of the child. Defined "double-bubble" - a pathognomonic symptom of duodenal obstruction**
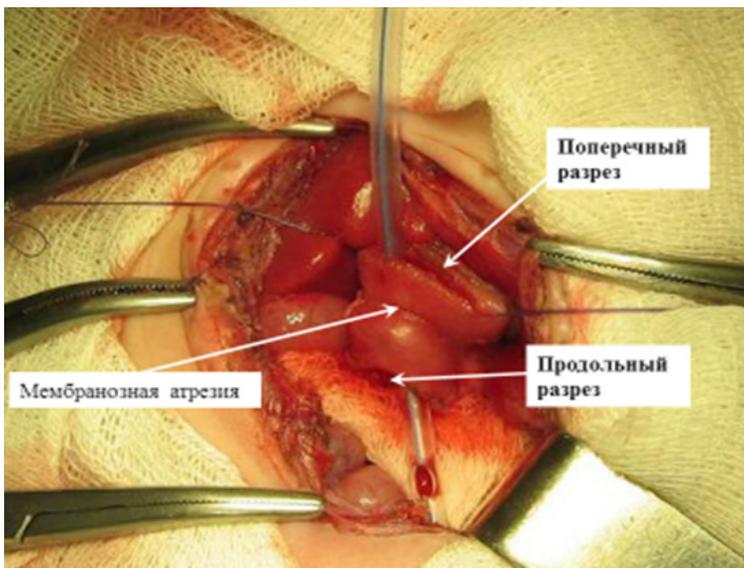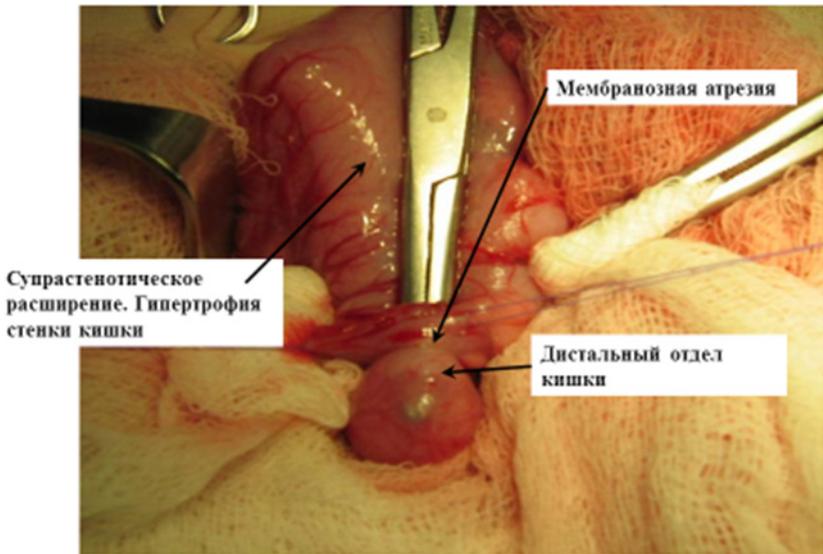
Fig. 2. Intraoperative picture. Membranous duodenal atresia

Conclusion

1.   In case of congenital duodenal obstruction, the "brilliant-like anastomosis" is applied with single-row sutures, which is not technically difficult to perform.

2.   Duodeno-duodenoanastomosis according to Kimura is the operation of choice for membranous atresia of the duodenum and annular pancreas.

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OPTIMIZATION OF SURGICAL TREATMENT OF SPLEEN INJURY IN THE LIGHT OF LONG-TERM CONSEQUENCES AND IMMUNOLOGICAL DISORDERS IN CHILDREN

Shaimurat Yerkebulan Dautkanuly
Student
ORCID: 0000-0002-0645-4244

Dalelkhanov Berik Aidarbekovich
Student
ORCID: 0000-0001-9096-3414

Sanbayev Mahmutbay
Candidate of Medical Sciences, Assistant
"Semey" Medical University
ORCID: 0000-00032-9690-3698

Abstract. Among the closed injuries of the abdominal cavity in children, the most common injury is the spleen, it accounts for about 50% of all parenchymal injuries. Until recently, splenectomy for spleen injury was considered the main operation [1],but most researchers adhere to the tactics of preserving the organ in childhood due to a decrease in resistance to infections [2,3,4]. In our case, we analyzed changes in the immune status in 29 children who underwent splenectomy and splenectomy with autotransplantation. The studies were carried out in the early and late postoperative period.

Keywords: splenectomy; damage to the spleen; autotransplantation; post-splenectomy hyposplenism; children.

Relevance of the work

Splenectomy is an immunocompromising operation, since an immuno-competent cell suffers at this time, which indicates the need for organ-preserving surgery in case of damage to the spleen in children. More and more researchers are in favor of organ-preserving tactics, especially in childhood [2,3],which is due to the appearance of a large number of publications on a decrease in the body's resistance to infections and their malignant course in children who have undergone extirpation of the spleen.

Recently, information has appeared in publications about the replacement of the removed spleen with autografts of its tissue into the omental bursa, the mesentery of the intestine, into the muscles of the anterior abdominal wall and retroperitoneal space [2,4]. A systematic analysis of domestic literature over the past 10 years has shown that little attention is paid to the importance of immunological disorders in the follow-up after splenectomy in traumatic injuries of the spleen in children [5].

The purpose of our research - to optimize the method of surgical treatment of patients with traumatic injuries of the spleen, taking into account the long-term consequences and changes in the immunological status.

Research results

The study is of a clinical nature and was based on the study of long-term results of splenectomy for traumatic injuries and the effect of autotransplantation of spleen tissue on changes in the immune status in children. This work is based on the observation of 29 children aged 9 to 14 years with a diagnosis of "closed spleen injury". There were 18 boys and 11 girls. Splenectomy was performed in 27 patients, including autotransplantation in 7, in two cases superficial spleen ruptures were sutured. Autotransplantation of spleen tissue was performed as follows: a decapsulated fragment of the spleen of a cubic shape with a side of 8 mm, treated with warm saline, was implanted into the greater omentum 2 cm in the transverse colon closer to the left corner. The patients were divided into three groups. The main group consisted of 7 who underwent splenectomy - autotransplantation of spleen tissue into the greater omentum. The comparison group consisted of 7 patients of the same age and sex who were admitted to the hospital on a planned basis for surgical treatment for inguinal hernias and 20 patients who underwent splenectomy.

The vast majority of patients (60%) were admitted within the first 2 hours after injury. In addition to generally accepted laboratory studies, the following methods were used to assess the immune reactivity: the micromethod of the reaction of blast transformation of lymphocytes (RBTL) with phytohemaglutinin (PHA), the level of immunoglobulins A, M and G in blood serum according to Manchini, the phagocytic activity of leukocytes with counting the phagocytic number (PN), phagocytic index (PI) and index of completed phagocytosis (ICP). Statistical processing of the data obtained was carried out according to the standard method. The study was conducted with the consent of patients to conduct it.

Upon admission to the clinic, damage to the spleen was recognized in 70% of patients within 5 hours, and in 30% - at a later date. 4 children were operated on with an unspecified diagnosis (intra-abdominal bleeding). On

palpation of the abdomen, there was local pain in the left hypochondrium in 20, diffused in 9 patients. Tension of the muscles of the anterior abdominal wall was observed only in 5 children, bloating was observed in 60% of patients. The Shchetkin-Blumberg symptom was positive in 30% of patients, the Kulenkampf symptom in 60%, and the "vanka-vstanka" symptom in 10% of patients.

In the dynamics of observation, the victims revealed an increase in heart rate and a decrease in blood pressure in 95% of patients, a sharp decrease in the level of hemoglobin and erythrocytes immediately in the first 2-3 hours upon admission in 45% of patients. The most informative, accessible and simple method for diagnosing laparocentesis was a closed abdominal trauma in 15 patients. The anti-shock measure began immediately after the patient was admitted to the clinic and was carried out in parallel with the surgical intervention, since the operation aimed at stopping bleeding was the most important element of anti-shock therapy.

In our materials, the main operative access was the upper median laparotomy access (25 patients), in 4 cases it was supplemented with an incision to the left. Extensive multiple ruptures of the spleen were noted in 15, deep single rupture of the spleen in the vascular pedicle in 6, crush injuries in 4 patients. All patients underwent splenectomy. Long-term results were studied in 19 children.

Among the patients of the comparison group, only two did not present any complaints in the long term after the operation. The remaining 16 children noted various complaints, which undoubtedly can be attributed to the manifestations of postsplenectomy hyposplenism, a symptom complex described by M.M. Rozhinsky.

16 examined children complained of recurrent abdominal pain. Apparently, the occurrence of abdominal pain is associated with compensatory hypertrophy of the lymphoid tissue and an increase in lymph nodes of all groups, including the mesentery of the intestine, in response to removal of the spleen.

In 6 patients, recurrent headaches were noted, which appeared in the middle of the day and intensified in the evening. They reported physical mental fatigue and declines in school performance.

Two fell ill with an acute form of pneumonia, and they are on the dispensary for chronic bronchitis. 1 patient suffered from recurrent otitis media. Within a year after splenectomy, 3 children underwent viral hepatitis, one had an autopsy of lymphadenitis of various localization. One child suffered from furunculosis. In the examined group, chronic tonsillitis was registered in 2 patients. We did not observe severe septic complications.

The obtained results of assessing infectious morbidity in children who underwent splenectomy in childhood were confirmed by the data of immunological examination. (tab. 1).

Table 1.

Indicators	Healthy children n=7	After splenectomy n=20	Spleen tissue autotransplantation after splenectomy n=7
Ig A	1.25 ± 0.08	1.18 ± 0.11	1.23 ± 0.12
Ig M	1.08 ± 0.03	↓ 0.45 ± 0.02	1.00 ± 0.09
Ig G	12.1 ± 0.6	↓ 6.7 ± 0.37	11.09 ± 0.55
TI	1.02 ± 0.06	1.23 ± 0.13 ↑	1.24 ± 0.15 ↑
Th	1.43 ± 0.09	1.35 ± 0.21	1.44 ± 0.17
Ts	1.67 ± 0.12	↓ 1.43 ± 0.15	1.65 ± 0.07
VI	2.32 ± 0.2	↓ 2.01 ± 0.21	2.34 ± 0.25
RBTL	4.66 ± 0.11	↓ 1.63 ± 0.27	4.68 ± 0.11
PN	6.75 ± 0.56	↓ 5.65 ± 0.12	6.80 ± 0.48
PAL	6.97 ± 0.43	↓ 5.01 ± 0.15	6.97 ± 0.33
PI	72.44 ± 0.4	↓ 47.4 ± 0.71	71.5 ± 0.71

The latter revealed a significant decrease in the concentration of serum immunoglobulins of classes A, M, G - unreliable, M, G - a decrease in both the absolute number of T- and B-lymphocytes. The indices of the reaction of blast transformation of lymphocytes (RBTL), phagocytic activity of leukocytes (PAL), phagocytic number (PN), phagocytic index (PI) are significantly reduced in comparison with healthy children.

In the experimental group, where, according to this technique, splenic tissue autotransplantation was performed in 7 cases with forced splenectomy due to organ trauma. The postoperative period was uneventful. None of them had post-splenectomy hyposplenism syndrome. In the erythrocytes of peripheral blood, Jolly's bodies were not detected, there was a normal number of platelets, which is the most important parameter of the functional state of the reimplanted spleen. Our clinical observations confirm a decrease in infectious complications. So, out of 7 victims with spleen trauma, who underwent splenectomy with splenic tissue autotransplantation, infectious morbidity took place only in one case, during the follow-up period of 3-5 years.

Summarizing the results of the study, it is possible to trace the correlation between complications in the postoperative period and the dynamics of the immune response in the main group of patients, which makes it possible to assess positively the autotransplantation of the spleen into the omentum in traumatic injuries. Thus, the greatest suppression of the immune defense was observed in patients with splenectomy, which requires restorative therapy.

Ultrasound after autotransplantation of spleen tissue in 2 patients showed an increase in the autograft in the amount of 3x4 cm in the period after surgery 2 years later; in one patient, during relaparotomy for late adhesive intestinal obstruction, a transplanted spleen in the size of 3x3.5 cm was revealed in the omental bursa.

Based on the analysis of the data after the splenectomy operation, it can be said that the infectious morbidity is higher than in healthy children. The method of autotransplantation of spleen tissue into the greater omentum is technically simple and applicable in an urgent surgical department.

Result and discussion

In the research group, in 7 patients who underwent autotransplantation of spleen tissue, the postoperative period passed without complications.

*The syndrome of postsplenectomy hyposplenism was not registered in any child.

*In splenectomy performed in connection with trauma of the spleen after autotransplantation of spleen tissue, an infectious disease was noted only in one case, this examination takes a period of 3-5 years.

*Based on the analysis of the data after the splenectomy operation, it can be said that the incidence of infectious diseases in patients of this group is higher than in healthy children. Autotransplantation of spleen tissue into the greater omentum after splenectomy for its injury has shown high efficiency in the prevention of post-splenectomy hyposplenism and disorders of immunological reactivity.

Conclusion

1. The incidence of post-splenectomy hyposplenism syndrome after splenectomy due to spleen injury is 51.0%.

2. Carrying out a duplicate with autotransplantation of spleen tissue into the greater omentum after splenectomy gives good results in the postoperative period in the prevention of infectious diseases, post-splenectomy hyposplenism and helps to restore laboratory parameters and immunoglobulins in the peripheral blood.

3. All children who have undergone splenectomy for damage to the spleen need constant monitoring by an immunologist, regular debridement

of chronic foci of infections and immunocorrection. Also, they must be constantly monitored by a pediatrician to prevent infectious complications.

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HYDATID CYST OF THE RIB (CLINICAL CASE). ANALYSIS OF PUBLISHED CASES

Myrzakhanov Yerik Kanatovich
ORCID: 0000-0002-6546-037X

Zharkimbayeva Almira
ORCID: 0000-0003-3487-0170

Gamzaeva Esmira
"Semey" Medical University
ORCID: 0000-0003-3094-0151

Abstract. Echinococcal disease is one of the current zoonoses discovered in the Republic of Kazakhstan. This parasitic disease caused most often Echinococcus Granulosus is a flat worm. Due to the large number of registered cases of diseases of people and animals of the Republic of Kazakhstan, as well as due to the prevalence of the occurrence of the disease in some regions, the country is considered to be endemic. [1].

Echinococcal cysts are affected by the liver and lungs, but less than 100 cases of echinococcosis edges are registered in the literature. [2, 3]. We observed a casuistic case of an isolated echinococcal defeat of the edge of the 17-year-old patient, which led us to a deeper study of this pathology. Based on our retrospective analysis, the first similar described case was registered in Germany [9]. We analyzed published cases on the PubMed and Elsevier platform, we found in the total number of 18 patients with this pathology over the past 20 years of published materials.

The diagnosis of the disease of the affected organs is relatively simple, however, cases of nonypical localization of the cyst may be complex in diagnosis, as in the case of the echinococcosis of the rib. Methods of diagnostic visualization can differentiate pathology, but in rare cases the diagnosis remains uncertain to operation, as in our case.

Keywords: Echinococcosis of the rib; Cyst ribs; Echinococcosis; Cestodoz bones; Echinococcus cyst; Isolated defeat of the ribs;

Introduction

According to clinicians in recent years, a significant number of echi-

nococcosis cases has been marked in the Republic of Kazakhstan with a tendency to increase. In the southern region of the Republic of Kazakhstan, Echinococcosis is one of the most common zoonotic diseases[4]. According to statistics, in 2016, 806 cases of echinococcosis disease were registered in Kazakhstan, in 2017 - 788, 2018- 742, 2019 - 681 cases, with the result that Kazakhstan took 3rd place in the Eurasian Union with the Middle An indicator of 0.48 per 100000 registered cases[1, 5].

There is a tendency to spread echinococcosis not only among people engaged in animal husbandry, but also among the urban population, which is due to a large extent with the insufficiently high awareness of the population, especially rural, about the ways of transmitting this disease, neglect of the disease prevention, incomplete coverage of the contingent of people with preventive medical inspections. The asymptomatic flow of the disease determines the increase in cases of heavy and complicated forms of damage to echinococcosis [4].

Among the complications of echinococcosis is the most severe and dangerous is the suppuration of echinococcal cyst, which is 17-26% and, as a rule, is accompanied by a severe violation of the functions of vital organs. Also in 1-4% of cases there is a primary defeat by echinococcosis of the human musculoskeletal system [2, 3]. Many important aspects: mechanisms of occurrence, ways of damage to organs and diagnostic methods have so far remain controversial and not fully studied, which requires a deeper and comprehensive study.

Materials and research methods

Based on the retrospective analysis carried out by us, 18 cases with echinococcal defeat of the ribs were found. Descriptions found in the Medline database were retrospective analysis. PubMed Platform, Scopus Electronic Base from Elsevier Corporation, and Scholar.Google.com is used to search for data.

Clinical case

A seventeen-year-old college student was hospitalized in a planned manner in the department of children's surgery of the university hospital of the city of families, with complaints of a long-lasting wound of the chest right, periodic pain separated from the wound. In the history: In 2016, a stupid injury was noted by a spike of a representative of a cattle in the region VIII edge, after which the fracture of the VIII rib was noted on the right, gematoma of soft tissues followed by suppuration. For a long time was treated outpatient. Due to the duration of the disease, with a periodic

recurrence of the suppuration, the diagnosis of the ribs on the right to form a fistula in the regression stage was put up. Next was surveyed outpatient. It was planned to be carried out under the supervision of the front segment of the VIII edge, followed by the drainage of soft tissues.

Fig.1. A targeted radiograph of the chest. On the radiograph of the right half of the chest, the deformation of the front segment VIII edges is determined, the cystoid enlightenment with dimensions of 2.0x1.0 cm and 3.0x1.5 cm (indicated by the arrow)

According to clinical, laboratory and instrumental data, the inclusion of pulmonary, pleural or closer lying muscular-intestinal structures was not observed in the process. After the preoperative preparation of the patient, in the position on the left side, a cut in the projection of VIII ribs with a length of about 5.0 cm. Macroscopic: VIII periosteum ribs thinned, the structure of the bone fragile, the presence of cavities. When attempting resection of the rib, in the field of cystic expansion, along the inner wall of VIII edges, echinococcal brushes with chitinic shells and with child cysts were found.

Numerous daughter cysts were removed. The cavity is repeatedly processed by glycerol, hypertensive solution and formalin 1% in the amount of 200 ml. Produced under the supervisory resection of the front cut VIII rib.

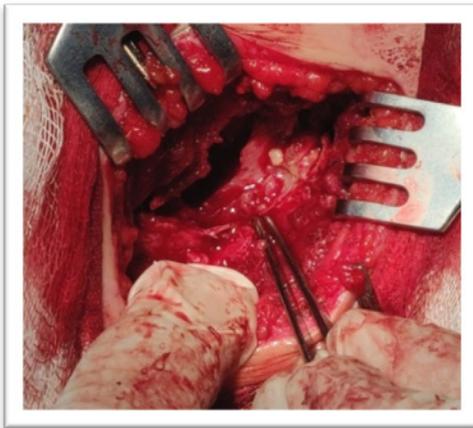**Fig 2. Intraoperative snapshot. Chitinova shell with daughter cysts**

Fig 3. Intraoperative snapshot. Numerous daughter cysts in the cavity of the thinned rib.

Fig 4. Macropreach. Chitinova shell.

To verify the diagnosis, a histological study of the macro production was carried out, the conclusion-echinococcosis of the rib with suppuration. The postoperative period was carried out antiparasitic chemotherapy with Albezol 400 mg for 2 tablets per day, a course of three months with a break of 14 days between cycles; Antibiotic therapy, antihistamines, painkillers. The postoperative period proceeded smoothly, without complications. The soreness in the field of postoperative wound decreased significantly on the second day. If the patient is discharged from the hospital for 7 days, the test surveys of the abdominal ultrasound, chest radiography, craniography, showed the absence of any cystic formations. One month after the postoperative wound statement without features. Currently, the patient is under the supervision of a family physician at the place of residence.

Results

Analysis of published clinical cases on this pathology revealed the following patterns and indicators:

• The average age of patients was from 17 to 47 years. The prevalence of gender type was not observed. The general condition of all patients was described as satisfactory.

• In 12 cases, the echinococcal defeat of the ribs was described as a primary disease.

• The clinical picture was characterized in 11 cases, a sense of discomfort in the localization of the process. In 7 cases, local changes in

the form of edema were observed. In the radiography of the chest, there was a descriptive picture of a lithic damage to the ribs. In addition, during the radiography of the chest, there was an involvement in the process of neighboring structures. In 5 cases, the pathological process was distributed to the spine.

• With an MRI study, in 3 cases, the degree of intraositive distribution was demonstrated and in 2 cases, the involvement of the bone marrow was excluded in the formation of echinococcal cyst.

• Serological analysis was positive in 6 cases.

• The volume of operations carried out patients - resection of affected ribs. In addition, in 5 cases, the scraping of the affected vertebra is made, in 4 cases resection of the transverse process of the vertebra.

• Histological studies of macro production in all cases confirmed the diagnosis of echinococcosis.

• In 11 cases, patients were conservative therapy with albandazole drug.

• On average, all patients were examined for 2 years. Treatment forecast in all cases is indicated as favorable.

Conclusions

In medical practice, echinococcal cysts can affect all chest departments, including an isolated lesion of the ribs. Echinococcosis of ribs is a very rare disease, however, the cases described by the authors demonstrate the significance of this disease for the differential diagnosis.

As in the case of the described clinical cases analyzed by us, the echinococcosis process of the ribs is a random surgical find. Differential diagnosis is difficult due to anamnesis of the disease. A thorough study of chest radiographs with additional computed tomography helps determine the presence of this pathology. According to the results of our study, the X-ray picture may be atypical, and interpretation is difficult.

According to the analysis of the analysis, the treatment of patients included full resection of affected edges, up to the scraping of the affected vertebra, with resection of the transverse process. In our case, an operation was carried out - under the supervisory resection of the affected edge in combination with drug therapy, which also gave a positive result of treatment.

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CHARACTERISTIC OF THE STATE OF SPRUCE PLANTATIONS IN THE AREA OF SOUTHERN TAIGA FORESTS OF THE TAIGA ZONE IN THE UDMURT REPUBLIC[1]

Bukharina Irina Leonidovna
Doctor of Biological Sciences, Full Professor,
Director of the Civil Protection Institute
Udmurt State University
Pashkova Anna Sergeevna
Candidate of Biological Sciences, Research Officer
Udmurt State University
Svetlakova Olesya Alekseevna
Postgraduate
Izhevsk State Agricultural Academy

Abstract. The results of studying the state of coniferous plantations and describing forest stands in the region of the southern taiga forests of the taiga zone within the Udmurt Republic (on the territory of Yakshur-Bodyinsky, Igrinsky and Kezsky forestries) are presented. Studies have shown that the cellulose-decomposing activity of the forest litter depends on its moisture content, which is associated with the values of the absolute density of forest stands on the studied sample plots. The analysis of physiological and biochemical parameters of Siberian spruce (*Pícea ováta* Ledeb.) Was carried out and their comparison was carried out in individuals of good and satisfactory vital state, which did not show statistically significant differences in the content of chlorophylls and carotenoids in needles. It has been shown that, in general, the potential of Siberian spruce specimens associated with the biochemical level of the formation of adaptive reactions is highest in plants in the northern regions of the republic, i.e. in areas with more extreme growing conditions. Materials have been obtained, on the basis of which it is possible to develop a program for monitoring plantings and restoring forest stands.

Keywords: adaptation, spruce stands, photosynthetic pigments, needles, tannins, tree stand

A sharp reduction in the area of dark coniferous boreal forests in the European part of Russia and the forecast of forest pathological situation due to the weakening and pest infestation of the remaining forests, of course, have a negative impact on the development of the entire forest industry [1], threatens the integrity of forest ecosystems, entails the destruction of habitats of organisms, and also causes the development of insect pests and diseases of the stand.

Thus, the problem of preserving spruce plantations and improving the ecological methods of their restoration is of significant importance for the economy and ecology of not only the Udmurt Republic, but also the Russian Federation as a whole. In addition, large industrial centers located near them affect the condition of coniferous plantations. However, despite the presence of a complex of negative factors, certain species and individual individuals of woody plants exhibit a high adaptive potential, which is of great interest in the study of adaptive responses and genetic diversity of plant individuals.

At the present time, it has become urgent to study the state of forest litter in spruce stands, subject to complex drying out and damage by the bark beetle-typographer, since the forest litter in the forest biogeocenosis is very important. It is not only a product of the forest and its component, but also a factor that determines the state of the forest [2].

In the present study, the analysis of the influence of a complex of environmental factors on the plant was carried out on the basis of the biochemical characteristics of spruce shoots - according to the content of photosynthetic pigments, ascorbic acid and tannins in needles and shoots.

Photosynthetic pigments play a significant role in the system of plant adaptive reactions. For example, the content and ratio of pigments is an indicator of resistance to stress. With water deficit and high air temperatures, the content of the sum of chlorophylls a and b decreases to 40% [3–6]. One of the possible reasons for this is a reduction in the size of leaf cells under conditions of water deficiency, i.e. there is an increase in the number of cells per unit area (or mass) [3]. Drought suppresses the intensity of plant photosynthesis, causing changes in chlorophyll content and damage to the photosynthetic apparatus [4-8].

In the formation of adaptation to stress factors, it is important to have substances with antioxidant properties, which include ascorbic acid, which is involved in the enzymatic activity of the plant [5]. Some scientific studies are aimed at determining the participation of ascorbic acid in the formation of the immune system of plants. In particular, its intensive production is considered one of the manifestations of active plant immunity, i.e. repre-

sents the response of plants to many of their lesions through enhanced biosynthesis of ascorbic acid. Ascorbic acid also plays an important role in photosynthesis, especially in the stabilization of the photosynthetic apparatus, increasing the photochemical activity of plants [9].

The importance of tannins in the formation of the stability of tree plantations is essential. Their content in leaves is influenced by the degree of technogenic load and the peculiarities of the climatic conditions of the growing season. In addition, condensed tannins are active participants in the adaptation processes in woody plants under conditions of technogenic stress and high air temperatures [10-12].

Purpose of the work

Purpose of the work — study of the state of plantations and physiological and biochemical characteristics of Siberian spruce growing within the Udmurt Republic.

Materials and methods

The studies were carried out on the territory of Yakshur-Bodinsky, Igrinsky and Kezsky forestries in the taiga (boreal zone of southern taiga forests) zone of the Udmurt Republic. The object of the study is coniferous stands of Siberian spruce (*Pícea ováta* Ledeb.).

To assess the taxation parameters and the state of spruce plantations, test plots (TP) with a size of 100×100 m were laid on the territory of three investigated forestries. In each forestry, there is one TP in stands with a predominance of spruce, in places of their active drying up and in oxalis types of forest.

According to their vital state, woody plants were divided into three groups: 1) good condition (dense or slightly thinned crown, green/light green needles; some branches withered); 2) satisfactory (openwork crown; needles light green, matte; weakened growth, less than half of the usual); 3) unsatisfactory (drying of branches up to 50%; presence of mechanical damage on the trunk, detection of signs of primary damage by xylophages and/or wood-destroying fungi).

The analysis of forest litter was carried out on accounting plots 10×10 cm using a template in the amount of 10 pcs. per one TP (as a result, 10 individual samples were formed) with division into fractions and layers [13]. The activity of destructors of forest litter was determined by analysis for cellulose-decomposing activity [14].

To study the biochemical characteristics of shoots and needles, five model individuals of a good and satisfactory life state were selected at each TP. Model individuals had a middle-aged generative ontogenetic state (g_2).Mixed samples were taken and formed from model individuals,

from which samples were prepared for analysis in three- and four-fold repetition. For the analyzes, the shoots of the current growing season were selected. The analysis of the content of photosynthetic pigments in needles was carried out by the spectrophotometric method in alcohol extracts using a PE-5400UF spectrophotometer; calculation of the concentration of pigments - according to the Holm - Wettstein equations. The content of ascorbic acid was determined according to GOST 24556–89 (titrometric method), the content of tannins was determined spectrophotometrically at a wavelength of 277 nm [15].

Results and discussion

The climate of Udmurtia is moderately continental with long cold and snowy winters, warm summers and well-defined springs and autumn. However, the significant length of the territory from north to south and the heterogeneity of its relief determine significant differences between the northern and southern parts of the republic in temperature and humidity, wind regime, amount of precipitation and duration of sunshine. Kezsky , Igrinskoe and Yakshur-Bodinskoe forestries are located in the southern taiga forests of the taiga zone of the European part of the Russian Federation [16].

The considered southern taiga forest zone is characterized by a moderately cold humid climate. The average annual air temperature ranges from +4°C to + 7-16°C. In addition, 2020 was distinguished by some climatic features recorded in the study areas.

Table 1 shows the taxation characteristics of the spruce stand on the studied TP. Plantations are of the same age, I and II bonitet, the highest indicators of absolute completeness are typical for TP Yashkur-Bodinsky forestry.

Table 1

Taxation characteristics of spruce stand on test plots of Yakshur-Bodinsky, Igrinsky and Kezsky forestry

Forestry	Trial area number	Wood composition	Average values			Wood stock, m³/ha	Completeness, m²/ha		Bonitet
			Age, years	Barrel height, m	Trunk-diameter, cm		Abso-lute	Rela-tive	
Yakshur-Bodyins-koe	1	7E1P1B1Os	77	18	22.2	109.1	3.3	0.2	II
	2	9E1Os+P	74	23	26.8	191.2	8.3	0.5	II
	3	8E2P	74	21	30.8	375	2.4	0.8	I

	1	8E2P	69	19	22.9	182.2	2.9	0.5	II
Igrinskoe	2	9E1P	70	19	23.9	27.7	1.7	0.7	II
	3	8E2P	64	20	21.9	222.1	2.2	0.6	I
	1	8E2P	62	19	21.1	196.6	2.0	0.6	II
Kezsky	2	9E1P	63	21	21.4	225.9	2.2	0.6	I
	3	8E2P	65	21	22.3	213.	1.9	0.5	I

The analysis of the cellulose decomposing activity (CDA) of the forest litter (tab. 2) showed that the Yakshur-Bodinskoe forestry is distinguished by low CDA values at TP № 2 and TP № 3. In Igrinskoye lesnichestvo, no differences were found for this indicator between TP. The highest CDA values are characteristic for TP № 1 of the Kezsky forestry, with some of the lowest absolute stand density values (1.9 m^2/ha) and the highest litter mass. The moisture content of the forest floor was 54.9%.

Table 2

Component composition and cellulose-decomposing activity of forest litter in spruce stands of Yakshur-Bodyinsky, Igrinsky and Kezsky forestries

Forestry	Trial area number	Cellulose decomposing activity,%	Morphological appearance of forest litter (weight of layers, g)		
			L ($A_0^{'}$)	F ($A_0^{''}$)	H ($A_0^{'''}$)
Yakshur-Bodyins-koe	1	60.83 ± 8.07[1] 48.00…73.67[2]	174.72 ± 39.42 111.98…237.45	75.47 ± 10.37 58.97…91.97	838.38 ± 60.98 686.89…989.88
	2	42.49 ± 2.05 39.23…45.75	126.45 ± 18.22 97.46…155.45	141.53 ± 25.06 101.66…181.40	195.38 ± 44.41 85.06…305.71
	3	28.08 ± 4.13 25.11…33.93	77.18 ± 20.43 44.67…109.70	37.54 ± 11.74 18.86…56.23	656.69 ± 30.26 608.53…704.86
Igrinskoe	1	24.56 ± 2.46 18.46…30.66	40.51 ± 6.97 29.42…51.60	46.07 ± 18.05 17.35…74.79	313.15 ± 3.16 305.31…320.99
	2	48.88 ± 9.00 34.55…63.12	110.29 ± 25.38 69.91…150.67	90.36 ± 26.40 48.35…132.37	281.95 ± 22.34 226.45…337.45
	3	30.28 ± 8.62 23.67…42.46	187.21 ± 9.84 171.55…202.86	45.93 ± 7.57 33.86…57.98	106.21 ± 19.90 74.54…137.88

Kezsky	1	86.76 ± 4.23 80.03…93.49	249.75 ± 23.43 212.42…287.09	150.54 ± 25.10 110.60…190.48	495.93 ± 23.70 458.21…533.64
	2	56.61 ± 1.42 54.35…58.87	242.14 ± 36.82 183.55…300.73	103.16 ± 28.93 57.13…149.18	233.23 ± 14.37 210.37…256.09
	3	53.00 ± 12.03 36.98…66.00	108.65 ± 44.62 37.65…179.65	97.29 ± 12.25 77.79…116.78	129.28 ± 25.30 89.01…169.54

1 - Average value of the indicator ± standard deviation; 2 - confidence interval for the mean at $P < 0.05$; the values with significant differences are highlighted in bold (similarly for tab. 3).

The results of the biochemical analyzes of the shoot of Siberian spruce are presented in table. 3. When comparing the parameters of the content of photosynthetic pigments in individuals of good and satisfactory life state in different forestries, it was found that statistically significant differences in the content of chlorophyll *a* and *b* and carotenoids were not revealed. The exceptions are individuals of different life states from the trial TPs of the Igrinskoye forestry, where the content of photosynthetic pigments in individuals with a satisfactory life state is significantly lower than in individuals with a good life state, and all spruce individuals have a high stress resistance index (the sum of chlorophylls *a* and *b*). Similar results were obtained for the content of ascorbic acid in needles.

Table 3

Content of physiological and biochemical parameters of Siberian spruce in Yakshur-Bodinsky, Igrinsky and Kezsky forestries

Forestry	The vital state of plants	photosynthetic pigments in needles, mg/g				ascorbic acid, mg/100 g	tannins,%	
		Chloro-phyll a	Chloro-phyll b	Carot-enoids	Stress toler-ance, a+b		Nee-dles	Stem part
Yakshur-Bodyins-koe	Good	**4.21 ± 0.35**[1] 3.65… 4.76[2]	0.55 ± 0.07 0.45… 0.66	1.71 ± 0.16 1.45… 1.96	4.76 ± 0.42 4.10… 5.42	214.90 ± 29.57 167.85… 261.95	4.48 ± 0.18 4.19… 4.77	**3.10 ± 0.21** 2.78… 3.43
	Satisfac-tory	3.35 ± 1.47 1.01… 5.69	0.54 ± 0.11 0.36… 0.72	1.37 ± 0.62 0.38… 2.36	4.82 ± 1.42 2.55… 7.08	260.21 ± 17.54 232.30… 288.12	4.09 ± 0.76 2.88… 5.30	**2.24 ± 0.34** 1.70… 2.77

Igrinskoe	Good	**6.97 ± 0.07** 6.86… 7.07	**1.29 ± 0.06** 1.20… 1.38	**2.68 ± 0.06** 2.58… 2.77	**8.26 ± 0.01** 8.24… 8.27	**151.21 ± 7.66** 139.02… 163.39	**6.62 ± 0.22** 6.27… 6.98	**1.76 ± 0.11** 1.58… 1.94
	Satisfactory	**5.82 ± 0.37** 5.24… 6.40	**0.95 ± 0.08** 0.83… 1.08	**2.34 ± 0.16** 2.08… 2.58	**6.77 ± 0.44** 6.07… 7.48	**129.31 ± 2.70** 125.01… 133.61	**5.12 ± 0.35** 4.57… 5.67	**2.27 ± 0.07** 2.17… 2.38
Kezsky	Good	4.06 ± 0.28 3.63… 4.50	0.68 ± 0.05 0.60… 0.76	1.82 ± 0.11 1.64… 2.00	4.74 ± 0.33 4.22… 5.26	240.07 ± 19.57 208.93… 271.21	4.69 ± 0.30 4.21… 5.16	2.59 ± 0.52 1.76… 3.42
	Satisfactory	4.69 ± 0.63 3.69… 5.69	0.89 ± 0.06 0.78… 0.99	2.07 ± 0.17 1.81… 2.34	5.58 ± 0.63 4.58… 6.58	286.49 ± 13.25 265.40… 307.58	5.39 ± 0.35 4.83… 5.95	2.38 ± 0.56 1.49… 3.28

Individuals with a good life state, growing in the studied forestries, differ significantly in the content of photosynthetic pigments and tannins in needles in Igrinskoye forestry - they are significantly higher. It should also be noted that the indicators of the content of chlorophylls and carotenoids in individuals with a satisfactory life state in the Igrinskoye forestry significantly exceeded the indicators for individuals in a good life state in the Kezsky and Yakshur-Bodinsky forestries.

The content of ascorbic acid in needles, on the contrary, had the lowest indices in Igrinskoye forestry, significantly differing from those in Kezsky with the highest content of ascorbic acid and Yakshur-Bodinskoye forestries in individuals of both life states. It can be assumed that ascorbic acid significantly participated in the redox processes of plants in the Igrinsky forestry, which allowed them to preserve the integrity of chlorophylls and photosynthetic apparatus.

A significantly higher content of tannins (tannins) in needles was also noted in Igrinskoye forestry, but only in individuals with a good life state. The highest concentrations of tannins in the stem part of the shoot were noted in individuals with a good life state in the Yakshur-Bodinsky forestry, in individuals with a satisfactory life state in Kezsky.

The features of Siberian spruce, associated with the content of chlorophyll a, tannins and ascorbic acid in the needles, were revealed: a high content of chlorophyll is accompanied by a high content of tannins, while these individuals have a significantly lower content of ascorbic acid in needles.

In general, it can be noted that the potential of Siberian spruce, associated with the formation of adaptive reactions at the biochemical level, is maximum in plants from more northern regions of the republic, characterized by increased extreme growing conditions.

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MONITORING OF DISEASES AND PESTS OF TREE PLANTATIONS IN THE NORTH-EASTERN ADMINISTRATIVE DISTRICT OF MOSCOW

Eremenko Kseniia Vladimirovna
Postgraduate

Zubkova Valentina Mikhaylovna
Doctor of Biological Sciences, Full Professor
Russian State Social University

Abstract. The data of monitoring of tree plantations in the North-Eastern Administrative District of Moscow for 2019-2020 are presented. During the analysis, characteristic plant diseases and injuries were identified, as well as species resistant to parasites and diseases. Severe damage was found by marginal necrosis and powdery mildew, leafhoppers and leaf-gnawing insects.

Keywords: plant resistance, tree species, environmental problems, urbanized environments, urban green spaces, plant diseases and pests.

Introduction

It is impossible to deny the degree of significance of green spaces in the lives of people and the whole planet in general. Forests perform not only nature conservation and biospheric functions, but also largely satisfy various human needs - recreational, social and aesthetic. A particularly significant role is assigned to green spaces that grow in large cities. The positive influence of plants on the physical and psycho-emotional state of the inhabitants of megacities is well known. It should be noted that only healthy forests can fully fulfill their functions [2,5].

One of the reasons for the weakened state of woody plants in the city is their damage by pests and diseases.

A huge number of insects cause significant damage to trees, destroying their leaves, bark, flowers and fruits. Due to the fact that insects destroy foliage and needles, successive changes occur in the life of plants. Thus, trees that have lost their foliage (needles) demonstrate a violation of photosynthesis and water exchange, due to which the growth and their stability

are reduced or completely stopped. As a rule, conifers react more sharply to partial or complete loss of greenery than deciduous ones. As a result of gnawing needles (and with repeated gorging), the growth is very sharply reduced, which leads to drying out. Such plantations are more often attacked by stem parasites [1].

Significant damage to urban plantings is caused by such pests as:

• linden — comma-shaped scale insect, forging, linden aphid, linden felt mite, cobweb mite, moth;

• oak — oak yellow aphid, green oak leafworm;

• poplar — unpaired and ringed silkworms, comma-shaped scabbard, flat poplar aphid, poplar moth;

• elm — elm multiflorum, scoops, elm beetle;

• larch — conifer mite, cap moth.

There are also many pests of all kinds on mountain ash, acacia, lilac, wild rose, hawthorn, cotoneaster, as well as other shrubs and trees [3].

Among the pests, the most dangerous is the narrow-bodied ash emerald, the Ohrid miner is found in the chestnut plantations, the peculiarities of weather conditions can cause outbreaks of aphids and leaf-eating pests.

The green spaces of the city of Moscow most often suffer from diseases such as thyrostromosis (common in linden plantations), rotten diseases, and elms are susceptible to graphiosis.

Tyrostromosis (infectious drying out) of linden is caused by fungi of the genus Thyrostroma compactum, which, penetrating into the tissues of young branches, cause the formation of necrotic areas, then the infection penetrates into larger branches. After the thin branches die off, bunches of shoots are formed in their place, which give the tree an untidy "disheveled" look. Despite the fact that thyrostromosis is not a dangerous disease, it gradually weakens the tree, deforms the crown, and reduces decorative qualities, especially damaging young plants [4].

A large number of phytopathological and entomological studies, including consideration of regional forest plantations, do not contain sufficient information on assessing the resistance of trees to pests and diseases in certain habitats.

Therefore, the purpose of our research was to study the peculiarities of damage to woody plants of the North-Eastern Administrative District of Moscow by pests and diseases, depending on the ecological conditions of the years and places of growth.

Methods

The objects of research were 29 species of woody plants, of which 4 species grew on Mira Avenue, 13 on the Alley of Space Heroes, 14 at

VDNKh, 15 in the park along Malyginsky Proezd and 15 species in the Alekseevskaya Gorka park. The list of investigated species is presented in table. 1.

Table 1 – Species composition of woody plants in research

Peace Avenue	Square on Malyginsky proezd
1. Small-leaved linden (Tília cordáta)	1. Black chokeberry (Arónia melanocárpa)
2. Balsam poplar (Populus balsamifera)	2. Hanging birch (Bétula péndula)
3. Norway maple (Acer platanoides)	3. Elm smooth (Ulmus laevis)
4. Ash-leaved maple (Acer negundo)	4. Tree caragana (Caragana arborescens))
Alley of space heroes	5. Norway maple (Acer platanoides)
1. Ottawa barberry (Berberis × ottawensis)	6. Ash-leaved maple (Acer negundo)
2. Hawthorn (Crataegus laevigata)	7. Small-leaved linden (Tília cordáta)
3. Hanging birch (Bétula péndula)	8. Willow brittle (Sálix fragílis)
4. Elm smooth (Ulmus laevis)	9. Bubble-leaf Vine-leaved (Physocarpus opulifolius)
5. Tree caragana (Caragana arborescens)	10. Mountain ash (Sorbus aucuparia)
6. Horse chestnut (Aesculus hippocastanum)	11. Hungarian lilac (Syringa josikaea)
7. Cotoneaster brilliant (Cotoneaster lucidus)	12. Common lilac (Syrínga vulgáris)
8. Norway maple (Acer platanoides)	13. Snowberry white (Symphoricarpos albus)
9. Tatar maple (Acer tataricum)	14. Japanese spirea (Spiraea japonica)
10. Small-leaved linden (Tília cordáta)	15. Balsam poplar (Populus balsamifera)
11. European larch (Larix decidua)	**Alekseevskaya Gorka**
12. Mountain ash(Sorbus aucuparia)	1. Ottawa barberry (Berberis × ottawensis)
13. Bird cherry (Prunus padus L.)	2. Hawthorn (Crataegus laevigata)
Approaches to VDNKh	3. Hanging birch (Bétula péndula)
1. Hanging birch (Bétula péndula)	4. English oak (Quercus robur)

2. Hawthorn (Crataegus laevigata)	5. Tatar honeysuckle (Lonícera tatárica)
3.Tree caragana (Caragana arborescens)	6. Ginnal's maple (Acer ginnala)
4. Horse chestnut (Aesculus hippocastanum)	7. Ash-leaved maple (Acer negundo)
5. Norway maple (Acer platanoides)	8. Small-leaved linden (Tília cordáta)
6. Tatar maple (Acer tataricum)	9. Willow brittle (Sálix fragílis)
7. Ash-leaved maple (Acer negundo)	10. Mountain ash (Sorbus aucuparia)
8. Small-leaved linden (Tília cordáta)	11. Hungarian lilac (Syringa josikaea)
9. European larch (Larix decidua)	12. Common lilac (Syrínga vulgáris)
10. Mountain ash (Sorbus aucuparia)	13. Balsam poplar (Populus balsamifera)
11. Common lilac (Syrínga vulgáris)	14. Bird cherry Maak (Padus maackii)
12. Golden currant (Ribes aureum)	15. Home apple (Malus domestica)
13. Bird cherry (Prunus padus L.)	
14. Dog rose (Rósa canína)	

In June - August 2019-2020, samples of damaged leaves were taken and the latter were determined to belong to one or another species (genus) of agents that led to the damage.

The selected research sites are lively, intended for city-wide use, and their role is to provide a link between the community center and industrial and transport areas, as well as main streets.

Moscow is a city with a temperate continental climate, but the degree of its continentality, in comparison with other megalopolises in Europe, is an order of magnitude higher. The largest value of the annual amplitude of the temperature difference in Moscow was recorded at the level of 28 degrees. The city is characterized by rather severe and long winters.

The weather and climatic conditions prevailing in Moscow in 2019 were favorable for vegetation. In the winter season from January to March, the amount of precipitation exceeded the norm, due to which the plants were not subjected to temperature stress, and a sufficient moisture reserve was formed in the soil. No frosts were observed after the snow melted, the beginning of summer (June) was very warm and humid, so the vegetation was able to gain significant phytomass.

In July and August, the amount of precipitation was below normal, but if in June there were rather high temperatures (which could lead to a mois-

ture deficit), then in July and August there was no heat. There were no outbreaks of insect pests during the 2019 growing season.

In 2020, the following temperature indicators were recorded: the minimum air temperature in January is 6.6 °C; the maximum air temperature in July is 20.1 °C.

Depending on the month, the humidity varied in the range from 66% to 86%. At the same time, the minimum humidity in Moscow was observed in April, the maximum - in December.

According to the Hydrometeorological Center, the anomalous months in terms of precipitation were June and July 2020, when about 200% of the norm fell, as well as August, which did not reach the norm of 60% of precipitation.

Results

The following pests were recorded at the facilities of the North-Eastern Administrative District of Moscow: aphids, leaf-eating, leafhoppers, miners, sawflies (tab. 2).

The most common tree pests on Mira Avenue both in 2019 and in 2020 were spider mites, slimy sawflies and miner fly. In 2019, a large number of spider mites and leafhoppers were observed on the Alley of Heroes of Space. In 2020, the championship went to other types of pests: slimy sawfly, aphids, spruce-larch hermes.

In 2019, plantations at the facility next to the arch of the VDNKh main entrance were affected by leafhoppers, and in 2020 by aphids. At the same time, during the observation period from 2019 to 2020, the following pests were observed in the same amount: mining sawfly, spider mite, sprucelarch hermes, felt mite, Ohrid miner.

In the park on Malyginsky passage from 2019 to 2020, a large number of leafhoppers, leaf-gnawing, spider mites were found on plants. Moreover, most of the plantings in 2020 were affected by aphids.

Plantings in the Alekseevskaya Gorka park zone in 2019 were characterized by the presence of a large number of spider mites and leafhoppers. In 2020, plants in this area were attacked by aphids.

In addition, at the greening objects, near the arch of the main entrance to VDNKh and in the park "Aleseevskaya Gorka", minor lesions of trees and shrubs were revealed by a three-rayed mite, a felt mite, a mining sawfly, a thick-walled sawfly, a sawfly rosary, a mountain ash moth, a poplar mite.

Table 2 - Species diversity of pests on trees and shrubs in urban green spaces of the North-Eastern Administrative District of Moscow.*

Views	Peace Avenue		Alley of Heroes of Space		Approaches to VDNKh		Square on Malyginsky Avenue		Alekseevskaya Gorka	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Spider mite	1/25	1/25	2/15	1/8	2/14	2/14	4/27	4/27	3/20	2/13
Slimy sawfly	1/25	1/25	1/8	1/8	-	-	-	-	1/7	1/7
Aphids	-	-	2/15	2/15	1/7	4/28	1/7	3/20	1/7	5/33
Cicadas	-	-	6/46	4/31	5/36	3/21	4/27	4/27	6/40	3/20
Spruce-larch hermes	-	-	1/8	1/8	1/7	1/7	-	-	-	1/7
Ohrid miner			-	-	1/7	1/7	-	-		1/7
Miner front sight	1/25	2/50	-	-	-	-	2/13	2/13	-	-
Cap moth	-	-	-	1/8	1/7	1/7	1/7	1/7	-	-
Leaf-eating	-	-	3/23	5/38	1/7	3/21	9/60	10/60	-	3/20
Weevils	-	-	-	-	1/7	1/7	4/27	2/13	-	-

*In the numerator – the number of damaged tree species, in the de-nominator -% of the total number of trees and shrubs

During the observation period in 2019-2020, 5 main types of diseases were identified for 29 species of woody plants (tab. 3).

Table 3 - Diseases of trees and shrubs in urban green spaces of the North-Eastern Administrative District of Moscow*

Views	Peace Avenue		Alley of Heroes of Space		Approaches to VDNKh		Square on Malyginsky proezd		Alekseevskaya Gorka	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Powdery mildew	2/50	2/50	3/23	5/38	5/36	6/43	8/53	8/53	3/20	4/27
Marginal necrosis	1/25	3/75	2/15	2/15	4/28	4/28	3/20	2/13	1/7	-

Phylostic-tosis	1/25	1/25	2/15	-	2/14	2/14	1/7	1/7	1/7	1/7
Chlorosis	-	-	-	-	2/14	1/7	1/6	2/13	1/7	1/7
Marsiniosis	1/25	1/25	-	-	-	-	1/7	1/7	-	-

*In the numerator – the number of damaged tree species, in the denominator -% of the total number of trees and shrubs

Among them, in all the years of research, powdery mildew was absolutely dominant in all areas; it affected more than 80% of all surveyed trees.

A large proportion of trees were also found with leaf lesions with marginal necrosis (up to 35%).

In 2019 and 2020, at the facility near the arch of the main entrance to VDNKh, a tendency was revealed for plantings to be damaged by tirastramosis and cytosporosis (7% of trees). in the public garden on Malyginsky proezd - black spot, rust, scab (6%). In the Alekseevskaya Gorka park, cases of scab and rust were detected only in 2019 (6%).

The most vulnerable to diseases were the small-leaved linden, balsam poplar and ash-leaved maple.

Unfavorable living conditions in an urban environment lead to premature death of trees. Thus, the number of fallen trees in the North-Eastern Administrative District of Moscow in 2019 increased compared to 2018 by 6%, and in 2020 decreased compared to 2019 by 65% (table. 5).

Table 5 – The number of fallen trees in the NEADM

№	Year	NUMBER OF FALLEN TREES, PCS
1	2018	659
2	2019	698
3	2020	247
	Total:	1604

Conclusion

Urban street plantings of trees are characterized by a low level of species diversity, and the similarity with forest communities is minimal. They grow in conditions of a high level of technogenic air pollution and maximum changes in light and temperature conditions. The life span of trees is significantly reduced in comparison with that in natural conditions due to the high level of anthropogenic load on soil and plants. In parks and forest parks, diseases of the leaves of shrubs and trees are more common than

in squares and street plantings. Due to chemical air pollutants, the development of phytopathogens and pests can be suppressed.

At the same time, favorable conditions can be created for the development of some diseases, for example, necrosis on weakened trees, resistant to air pollution of pathogens.

The number of pests is also affected by chemical, thermal pollution. It can vary from mild to flash, influenced by weather conditions. At the same time, cyclical fluctuations are less noticeable.

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BIOLOGY OF THE STONE COCKSCOMB FROM THE LITTORAL NEAR NIKOLSKAYA HILL IN 2019

Murasheva Maria Yurevna
Research Assistant
Kamchatka Branch of the Pacific Geographical Institute

Abstract. The article discusses the size and weight indicators of stone cockscomb *Alectrias alectrolophus*, as well as its feed composition. The study area is Avachinskaya Bay. It was found that males with a length of 91.1 mm, weighing 4.2 and females with a length of 79.2 mm, weighing 2.8 predominated. Amphipods predominated among food items.
Keywords: stone cockscomb, littoral, Avacha Bay, size composition, weight composition, nutrition

Cockscombs *Alectrias alectrolophus* is a small group of coastal fish found only in the waters of the North Pacific Ocean. All cockscombs are characterized by an elongated, laterally compressed body and the absence of pelvic fins. They have on their heads a long, tall, skin-like comb, from which their name comes from (fig. 1). *A. alectrolophus* is a typical littoral species that constantly lives during the open water period in the tidal zone, remaining here in shelters under rocks and in puddles at low tide. In the pebble-boulder biotopes of Avacha Bay, stone cockscomb is considered a common species [2, 6, 7]. Since the late 1980s, due to the more than 2-fold reduction in the species composition of the ichthyofauna of the tidal zone of Avacha Bay as a result of anthropogenic impact, *A. alectrolophus* has been the basis of its littoral ichthiocene [3]. However, despite its wide range and easy accessibility for collection, the biology of stone cockscomb is poorly understood. In addition, the habitat in the inter-tidal zone and the massiveness of stone cockscomb make it possible to consider it as a possible biological indicator of the ecological state of the Avachinskaya littoral zone. Our data allow us to get an idea of the dynamics of the dimensional structure and composition of stone cockscomb food in this reservoir in 2019.

Fig. 1. Stone cockscomb Alectrias alectrolophus

The material was collected in June - July 2019 at the littoral near Nikol-skaya hill. This area, subject to significant anthropogenic impact, is located in the very center of Petropavlovsk-Kamchatsky (fig. 2). *A. alectrolophus* was caught by hand under stones in tidal puddles during maximum low tide. The caught fish were fixed in 6% formalin, then measured under laboratory conditions with an accuracy of 1 mm and weighed with an accuracy of 0.1 g. Analysis of the contents of stomachs was carried out in laboratory conditions according to the general method [4].
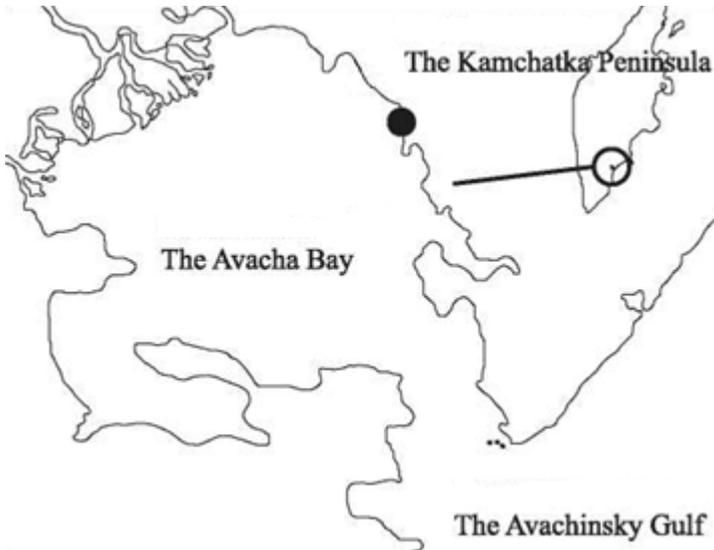
Fig.2 Study area

Stone cockscomb is a small, short-cycle species of this family. Stichaei-dae. The maximum length of fish, according to the information available in the literature, does not exceed 150 mm [2], and the maximum age is 7

years [5]. In 2019, stone cockscomb was represented by individuals rang-
ing in size from 62 to 122 mm and weighing from 1.1 to 10.3 g. The length
of *A. alectrolophus* in males was 67-122 mm (average 91.1), and in fe-
males 62-108 mm (average 79.2), the body weight of males varied 1.3-
10.3 g, and females - 1, 1-6.6 g, on average 4.2 g and 2.8 g, respectively
(fig. 3, 4). In contrast to the previous years of the study [5], in indi-
viduals with a length of 90-100 mm prevailed among males, and 100-110
mm in females. Weight also shifted to lower rates in both females (23%)
and males (28%), individuals weighing up to 2 g dominated.
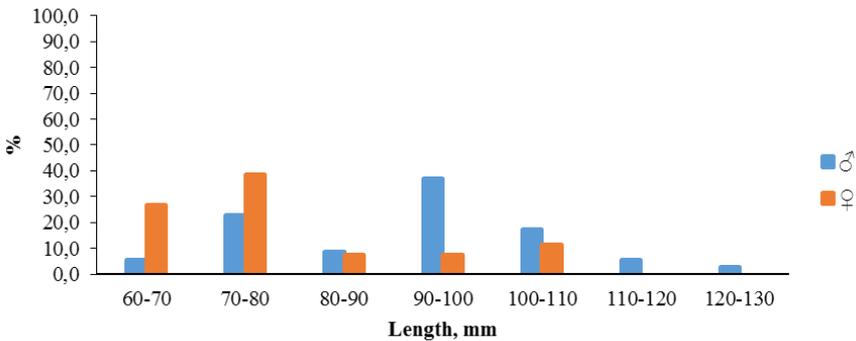
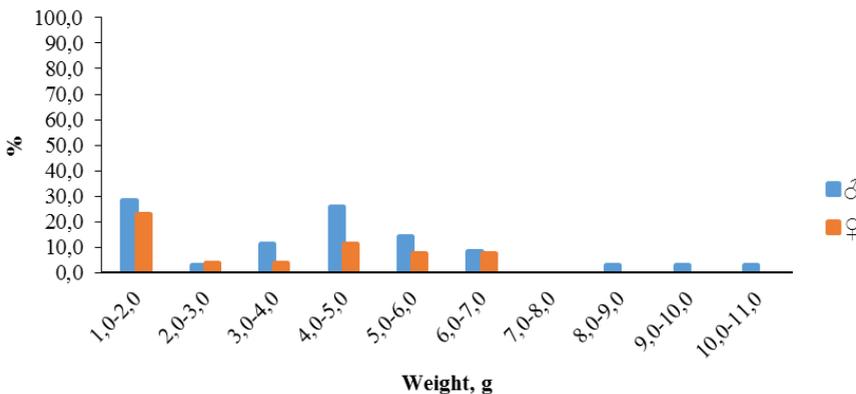**Fig 3. Dimensional composition of stone cockscomb**

Fig 4. Weight composition of stone cockscomb

According to the data available in the literature, stone cockscomb is a benthophage that consumes various small benthic invertebrates, primarily crustaceans, molluscs, and worms [1, 6].

The results of our research indicate that in the summer months the main food of *A. alectrolophus* in the tidal zone of Avacha Bay is amphipoda (60.9% by weight). The larvae of bell mosquitoes (Chironomidae) play a significant role in the study area - 24.1%. The importance of representatives of all other groups of invertebrates is relatively small: mussels (Mytilus) - 7.6%, also gastropods of the genus *Littorina* - 7.4% (fig. 5).
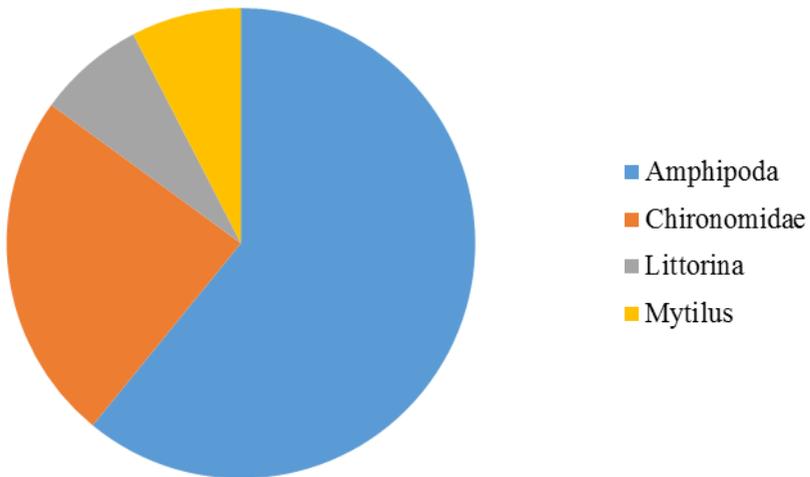
Fig. 5. Feed composition of stone cockscomb

The data available today make it possible to compare the composition of the dominant food organisms of *A. alectrolophus* in Avacha Bay in the first half of the XX century and at the beginning of the XXI century. In the 1930s [2] the main food items of this species here were polychaete worms (mainly Eleone longa) and gastropods (Gastropoda), but at present, the main food items of this species in the surveyed areas of the littoral are side-floats. Polychaeta worms (Polychaeta) were not found in stomachs at all. In our opinion, one of the possible reasons for the change in the dominant food item for the stone cockscomb in Avacha hy6e may be a significant increase in the second half of the XX century in anthropogenic pollution of the coastal zone of this reservoir with organic waste and the resulting increase in the number of amphipods in the coastal waters.

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DEVELOPMENT OF A MODEL EQUATION FOR ESTIMATING PARTICLE OSCILLATIONS IN ELECTROLYTE SOLUTIONS IN THE ION PLASMA APPROXIMATION

Tanganov Boris Badmaevich
Doctor of Chemical Sciences, Full Professor, Lead Research Officer
East Siberian State University of Technology and Management
Ulan-Ude, Russia

Abstract. The aim of the work was to develop a unified model equation that makes it possible to estimate the natural vibrations of ions and molecules in electrolyte solutions in the ionic plasma approximation.

Previously, we have confirmed the analogy of the properties of electrolyte solutions with those of low-temperature gas, solid-state plasmas and semiconductor plasmas, on the basis of which we have shown the possibility of applying the concept of a plasma-like state of ions and molecules (quasi-neutrality condition, density, plasma frequency, Debye screening radius, equilibrium process "Dissociation-association" of electrolytes, the degree of dissociation, etc.), the electrostatic theory of the system of charges (ions) in the transfer processes in solutions of strong and weak electrolytes.

Based on the assumption about the process of "dissociation-reverse recombination into neutral molecules (or the association of hydrated ions)", which takes place in the mode of harmonic oscillations with a certain frequency and mean free path of ions and molecules - the screening parameter (Debye radius), a rather strict a unified and end-to-end model equation for estimating the frequency of natural vibrations of particles in electrolyte solutions using the example of lithium chloride from concentrations of 0.0005 M to 12 M.

Keywords: plasma-like concept, parameters of electrolyte solutions, model for evaluating the vibration frequencies of particles in solutions.

Electrolyte solutions can be considered as a system of charges (cations and anions). For electrolyte solutions, the use of the plasma-like state of ions in solutions is shown to be promising. This was achieved through the use of the formal apparatus of plasma in a stricter sense than in the

electrostatic theory of Debye-Hückel [1], where the concept of plasma was introduced into the theory, but was not disclosed in essence.

Introduction
Some aspects of the plasma-like concept

The fundamental possibility of using the plasma theory of the state of electrolyte solutions was noted in [2-3], which show the characteristic signs of the plasma state of matter: the condition of quasi-neutrality, density, plasma frequency, Debye screening radius, etc.

In [4], the electrodynamics of conducting media with significant spatial dispersion is consistently presented. Such media, first of all, include gas and solid-state plasma (metals and semiconductors) in constant or alternating electromagnetic fields.

Let us compare some characteristics of low-temperature gas plasma, solid state plasma, semiconductors and electrolyte solutions.

Low temperature gas plasma: $T = 10^4…10^5\,K$, degree of ionization $\alpha = 0…_∞$, vibration frequency $10^8…10^{16}\,c^{-1}$, density $\rho = 10^8…10^{20}\,cm^{-3}$, shielding parameter $r_D = 10^{-4}…10^{-3}\,cm$;

Solid state plasma: $T < 10^4\,K$, degree of ionization $\alpha = ~1,0$, vibration frequency $10^{13}…10^{15}\,c^{-1}$, density $\rho = 10^{21}…10^{22}\,cm^{-3}$, shielding parameter $r_D = 10^{-7}…10^{-5}\,cm$,

Semiconductors: $T = <10^2\,K$, degree of ionization $\alpha «1,0$, density $\rho = 10^{16}…10^{18}\,cm^{-3}$. vibration frequency $10^{13}…10^{15}\,c^{-1}$,

Electrolyte solutions: $T = 273…350\,K$, degree of ionization $\alpha = 0…1,0$, vibration frequency $10^{10}…10^{13}\,c^{-1}$, density $\rho = 10^{16}…10^{22}\,cm^{-3}$, shielding parameter $r_D = 10^{-9}…10^{-7}\,cm$.

It can be seen that the main parameters of electrolyte solutions are comparable to those of low-temperature plasma, occupying an intermediate position between gas, solid-state and semiconductor plasma.

Within the framework of this concept, the process of dissociation and reverse recombination in solutions is presented in the form of equilibrium

$$KtAn \cdot ns \leftrightarrow Kt_s^+ + An_s^- \tag{1}$$

where KtAn, Kt_s^+, An_s^- - solvated molecule of electrolyte, cation and anion.

During dissociation (1), ions run a certain distance with a velocity v_1 and return with a velocity v_2, recombining into neutral molecules.

At a fixed concentration, the mean free path of ions is finite, and their motion is finite [5]. According to the general provisions of classical mechanics, any one-dimensional finite motion is oscillatory, with a certain frequency, having limit cycles characterized by the Debye screening parameter (Debye radius). In this case, oscillatory motion is assumed in the harmonic oscillator mode [5].

Let us represent the vibration frequency, taking into account the equation of continuity, the law of conservation of charge, mass and rates of the process "dissociation - recombination of ions into neutral molecules" (eq. 1), by the method of kinetics.

$$\partial\rho/\partial t + div\ \rho V = 0$$

Here $\rho = CN_A/1000$ – charge density.

Let's reveal the divergence

$$\partial\rho/\partial t + V\ grad\ \rho + \rho\ div\ V = 0$$

Note that $(\partial\rho/\partial t + V\ grad\ \rho) = d\rho/dt$ – full derivative, then

$$d\rho/dt + \rho\ div\ V = 0.$$

Introducing $\rho = CN_A/1000$, considering $C_0 - C_M = C$ (concentration of dissociated ions = total - the initial concentration of the electrolyte minus the concentration of undissociated molecules), for weak electrolytes the inequality takes place $C_0 \gg C$.

The rates of forward and reverse reactions of equilibrium can be represented in the form of expressions:

$$V_1 = - d(C_0 - C)/dt = - k_1\ (C_0 - C), \qquad (2)$$
$$V_2 = dC/dt = k_2\ C^2$$

Based on eq. (2) compose the system

$$dC/dt + C\ div\ V_2 = 0 \qquad (3)$$
$$d(C_0 - C)/dt + (C_0 - C){\cdot}div\ V_1 = 0.$$

Comparing system (2) with system (3), we arrive at the form

$$- k_1\ (C_0 - C) + (C_0 - C)\ div\ V_1 = 0$$
$$k_2\ C^2 + C\ div\ V_2 = 0,\ k_2 = - (1/C_0)\ div\ V_2$$
$$k_1 = div\ V_1 \qquad (4)$$
$$k_2 = - (1/C_0)\ div\ V_2$$

American scientist A.J. Lotka (A.J. Lotka) in 1925, and in 1926 independently of him - the Italian scientist V. Volterra (V. Volterra) derived the so-called equation of persistent population fluctuations "predator - prey", which is used in many areas of science:

$$\omega = (k_1 k_2 C_0)^{0,5}, \qquad (5)$$

including the rates (or rather, the rate constants of growth and decrease in the prey population, decrease and increase in the population of predators). With regard to the topic under discussion, eq. (5) can be transformed into an expression:

$$\omega = (k_1 k_2 C_0)^{0,5} = (-div\ V_1 \cdot(1/C_0)\ div\ V_2 {\cdot} C_0)^{0,5}$$

When equilibrium (1) occurs $V_1 = V_2 = V$, which gives the modified equation

$$\omega = [-(div\ V)^2]^{0,5} = div\ V$$

Since ω – the frequency of harmonic oscillations, the *div* operator is

represented as

$$div \equiv i \cdot k = i \cdot (1/r_D),$$

where r_D – Debye radius (penetration depth, ion mean free path from equilibrium coordinates, screening parameter, distance at which the oscillation disturbance is screened by a continuous medium).

Introducing this into the formula for the frequency, we get

$$\omega = V/r_D \qquad (6)$$

It is shown that the vibration frequency of the system of charges (cation-anion) was obtained by the kinetic method.

A system of stationary point charges located at finite distances from each other cannot be stable [5]. And this predetermines the reverse movement of counterions with their subsequent recombination into KtAn (or into a molecular associate).

Thus, the proposed concept confirms the oscillatory nature of the "dissociation-association" process.

Experimental part

No unified end-to-end, model, without adjustable parameters, methods for assessing the vibration frequencies of particles in electrolyte solutions have been proposed. In this work, the complete concept of ω estimation in a wide range of electrolyte concentrations is considered and applied.

Since equilibrium (1) takes place in an oscillatory mode, it is necessary to take into account the frequency and spatial dispersion. This is determined by the Vlasov equation [6]

$$\omega = \omega_L (1 + \frac{3}{2} k^2 r_D^2)^{0,5}$$

$$\omega_L = (4\pi Z e Z_d e n_0 / M)^{0,5}$$

where: ω_L – Langmuir plasma frequency; Ze, $Z_d e$- the charges of the ion and the dipole of the solvent; n_0 – the density of the dipole charges of the solvent molecules, $n_0 = n_s / \frac{4}{3} \pi r_s^3$; M – molar mass of solvent; $Z_d e = p/l$ (l – solvent dipole distance, usually taken as the reduced radius of the solvated ion $r_s = r_{s\,kt} * r_{s\,An} / (r_{s\,kt} + r_{s\,An})$, where $r_{s\,kt}$ and $r_{s\,An}$ – radii of hydrated cation and anion.

The Vlasov equation is the most general dispersion equation for a system of charges (electrolyte solutions).

At $kr_D = 1$ ($0 \leq kr_D \leq 1$) spatial dispersion is maximum, in this case

$$\omega = \frac{5}{2} (4\pi z_s 3 / 4 \; l\pi r_s^3 M)^{0,5},$$

Substituting the values of all constants: $e = 4,8 \cdot 10^{-10}$ e.s.e., Avogadro's number $N_A = 6,023 \cdot 10^{23}$, $r_s = r \cdot 10^{-8} cm$, μ – reduced mass of unsolvated

electrolyte ions ($\mu \cdot 1{,}67 \cdot 10^{-24}$), we write it down in CGS units and obtain an expression for the desired frequencies:

$$\omega = (3{,}23 \cdot 10^{13}/(z_{kt}z_{An}e^2 Cf\alpha/\mu \cdot 1000)^{0,5}) \qquad (7)$$
$$\alpha = \lambda/\lambda_0,$$

α – degree of dissociation; λ_0 – limiting electrical conductivity of lithium chloride, ($\lambda_0 = 115$ $Cm \cdot cm^2/mol$); f – distribution coefficient (activity), estimated according to Davis. The values μ, r_s, $r_{s\ kt}$, rs_{An} are borrowed from works [7, 8, 9].

As an example, in tab. 1 shows the initial parameters for the estimates (eq. 7) of the frequencies of harmonic vibrations of particles(ω, c^{-1}) in a solution of lithium chloride.

Table 1

Initial parameters for calculations and frequencies of harmonic vibrations of particles in a lithium chloride solution, estimated by equation (7)

Cm_{lit}	λ_{lit} [10]	lgf	f	α	ω_{theor}(eq. 7)	ω by eq.(8)
0.0005	97.20	-0.0111	0.9746	0.8452	2.721E+11	2.003E+12
0.0010	96.50	-0.0155	0.9647	0.8391	3.815E+11	2.006E+12
0.0050	93.90	-0.0333	0.9261	0.8165	8.247E+11	2.029E+12
0.0100	92.10	-0.0455	0.9004	0.8008	1.138E+12	2.059E+12
0.0500	86.10	-0.0885	0.8155	0.7486	2.343E+12	2.298E+12
0.1000	82.40	-0.1130	0.7708	0.7165	3.152E+12	2.595E+12
0.2366	77.10	-0.1438	0.7179	0.6704	4.526E+12	3.391E+12
0.5000	71.80	-0.1620	0.6885	0.6243	6.217E+12	4.877E+12
0.9630	63.50	-0.1572	0.6961	0.5521	8.160E+12	7.332E+12
1.0000	61.50	-0.1560	0.6982	0.5347	8.195E+12	7.520E+12
1.2101	57.28	-0.1471	0.7125	0.4981	8.790E+12	8.564E+12
1.4604	55.31	-0.1341	0.7343	0.4809	9.632E+12	9.758E+12
1.9687	51.42	-0.1020	0.7905	0.4471	1.118E+13	1.202E+13
2.4879	47.61	-0.0645	0.8618	0.4140	1.263E+13	1.414E+13
3.0183	43.88	-0.0231	0.9481	0.3816	1.401E+13	1.610E+13
3.5600	40.26	0.0213	1.0504	0.3501	1.534E+13	1.792E+13
4.1131	36.75	0.0683	1.1705	0.3195	1.663E+13	1.961E+13
4.6777	33.35	0.1176	1.3111	0.2900	1.788E+13	2.117E+13

5.2544	30.08	0.1689	1.4755	0.2616	1.910E+13	2.262E+13
6.4461	23.98	0.2772	1.8936	0.2085	2.139E+13	2.525E+13
7.6914	18.53	0.3928	2.4707	0.1611	2.347E+13	2.766E+13
9.0081	13.80	0.5167	3.2867	0.1200	2.528E+13	3.009E+13
10.3826	9.99	0.6475	4.4414	0.0869	2.685E+13	3.278E+13
11.8190	7.25	0.7852	6.0992	0.0630	2.859E+13	3.608E+13
12.2615	6.66	0.8278	6.7280	0.0579	2.932E+13	3.726E+13

Discussion of the results

From the data in Table 1 it can be seen that the frequencies calculated according to the theory (equation 7) are comparable with the parameters of electrolyte solutions $10^{10}\ldots10^{13}$ c^{-1}, given at the beginning of the article when comparing the parameters of plasma and electrolyte solutions. In fig. 1 shows the concentration dependence of the oscillation frequency of an aqueous solution of lithium chloride in a wide range from 0.0005 to 12.000 M. It can be seen that the dependence has a polynomial form and corresponds to the equation:

$$\omega = 2 \cdot 10^{10} \cdot C^3 - 5 \cdot 10^{11} \cdot C^2 + 6 \cdot 10^{12} \cdot C + 2 \cdot 10^{12} \quad (R^2 = 0{,}990) \qquad (8)$$

with a sufficiently high coefficient of multiple regression (0.990), indicating the reliability and high reliability of equation (8).
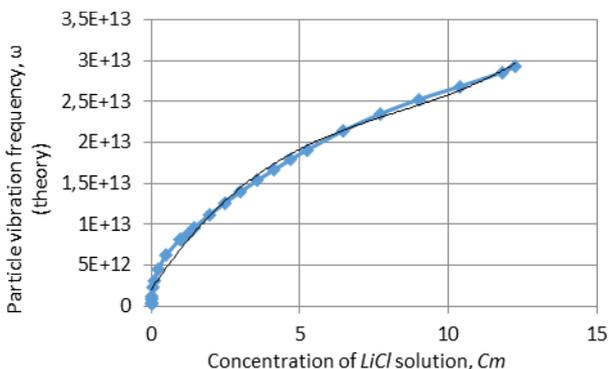

Fig. 1. Dependence of the theoretical vibration frequencies of lithium chloride particles on the concentration of an aqueous solution of LiCl

Note also that equation (7) assumes an almost directly proportional dependence of frequency on concentration, and the graphical dependence (fig. 1) has a curvilinear ascending form. This can be explained by the unequal contribution of the product of $\alpha \cdot f$ by the value of $C \cdot \alpha \cdot f$. This results in a polynomial curve.

In fig. 2 shows the polynomial function of the dependence of the estimated frequency values on the concentration according to equation (8). This is, in essence, an independent way to estimate the vibration frequencies of particles in an aqueous solution of lithium chloride, since the values for eq. (7) and (8), when compared, correlate in a straight line with the slope close to 1.
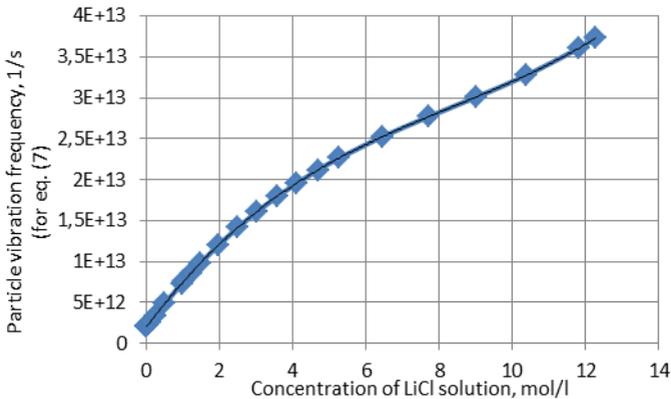

Fig. 2. Dependence calculated by eq. (8) the vibration frequencies of lithium chloride particles on the concentration of an aqueous solution of LiCl

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PROSPECTS FOR ALTERNATIVE WOODY PLANTS IN SIBERIA

Shimova Iuliia Sergeevna
Candidate of Chemical Sciences, Associate Professor

Kositcyna Anna Sergeevna
Candidate of Chemical Sciences, Associate Professor

Lis Elena Valerievna
Candidate of Chemical Sciences, Dean

Reshetnev Siberian State University of Science and Technology

Abstract. The article presents the main results of the study of the chemical composition of greenery and paulownia felt wood and discusses the prospects for complex use in various industries.

Keywords. Paulownia, woody greens, wood, biologically active substances, polyphenols, cellulose, nitrogen-containing substances, extractives.

At present, in connection with the increase in the use of forest resources, the deterioration of the ecological situation, climate change, the problem of reforestation is acute all over the world. In Siberia, this problem is relevant due to the rather low growth rate of coniferous woody plants, annual forest fires, unfavorable anthropogenic factors and harsh climatic conditions. This problem can be solved by using alternative forest resources that have a high growth rate, are resistant to adverse factors and have practical value. One of these trees is Paulownia, a fast-growing tree native to China, which in several years grows up to 30 m in height and up to a meter in diameter. This tree is especially widespread in the United States and European countries, where it is widely used for landscaping urban gardens and squares, preventing erosion and soil pollution. It is noted that paulownia is quite resistant to unfavorable anthropogenic factors, is capable of absorbing heavy metals from the soil, has a developed root system, as well as rather large leaf plates. Along with a high growth rate and a unique ability to repeatedly recover from the root even after felling, it can be considered as a possible element of the landscape architecture of urbanized areas. However, according to numerous literature data, paulownia

grows in a mild climate, in the temperature range from plus 35°C to minus 32°C [1 - 3].

We have not found data that allow us to assess the resistance to a wider temperature range characteristic of our region (according to Roshydromet, the highest temperature noted in Krasnoyarsk is plus 36.4°C, and the lowest is minus 52.8°C.). In addition, despite the great interest shown in this plant, especially in recent years, the chemical composition has been studied fragmentarily, in connection with which it is relevant to study the chemical properties of paulownia felt, characterized by the highest low-temperature resistance, in order to consider the prospects for its further use both in reforestation and in the national economy.

Paulownia leaves, according to chemical studies, are rich in nitrogen and balanced in protein, amino acid and mineral composition. According to various sources, the chemical composition of Paulownia leaves is represented by 18 - 20% crude protein, while researchers note the presence of amino acids such as threonine; cysteine; valine; methionine; isoleucine; leucine; tyrosine; phenylalanine; histidine; lysine. Researchers note that the chemical composition of paulownia leaves corresponds to the chemical composition of alfalfa, which, as you know, due to its nutritional value, is the leader in the world production of feed additives [2 - 6].

Paulownia wood has long been widely used in various sectors of the national economy. The unique combination of such properties as high strength, moisture resistance, fire resistance, lightness allows it to be used in construction, furniture and musical instruments production, and its high carbohydrate content makes it a promising raw material for bioethanol production [2-6].

For the purpose of research, in June 2019, seeds of paulownia felt were planted in indoor ground, after six months it became possible to study the chemical composition of the leaves of grown samples, and a year later - the opportunity to study the chemical composition of paulownia wood. The study of the chemical composition was carried out according to the methods adopted in the chemistry of plant raw materials. The biomass was preliminarily dried and ground to a homogeneous state, samples for analysis were prepared by quartering, all results were statistically processed, the confidence interval is 95%. [7]. To assess the resistance of the grown samples to unfavorable climatic conditions, in June 2020 the plants were planted in open ground.

In the leaves and wood of paulownia, the content of moisture, protein, amino acids, cellulose, the content of extractives, pigments and polyphenolic compounds was determined. Sequential extraction was carried out

with hexane, ethyl alcohol, aqueous alcohol solution, and water.

The content of extractives in the leaves of Paulownia was about 60%, of which in the hexane extract - about 11%, in the alcoholic and aqueous-alcoholic extracts - about 19%, in the aqueous extract - about 13%. The total content of extractives extracted from wood was about 18%, of which hexane, alcohol, aqueous-alcoholic extractant and water were about 4%, 8%, 2%, and 4%, respectively.

Further study of the chemical composition of the extractives of the studied samples showed that the content of polyphenolic compounds is high enough for plant materials and is about 10% in paulownia leaves, and about 6% in wood. This makes it possible to consider paulownia leaves and wood as a valuable source of biologically active substances and opens up prospects for the use of paulownia biomass in such industries as cosmetology, pharmaceuticals, and medicine.

The protein content in leaves was about 18%, in wood - about 3%; free amino acids in wood - about 0.5%, in leaves - about 2%. The high content of nitrogen-containing compounds and the good digestibility of woody greenery make it possible to recommend paulownia for use as a feed additive in animal husbandry.

The cellulose content in paulownia wood was about 47% of the absolutely dry weight of the sample, which corresponds to the average cellulose content in softwood and indicates the possibility of replacing traditional raw materials with alternative ones. The cellulose content in the leaves is about 36%. Such a high content of paulownia leaves makes it possible to consider biomass as a rapidly renewable source of industrial processing in order to obtain cellulosic materials.

Based on the results of the study of the chemical composition of wood and woody greenery, it can be concluded that this plant can be recommended for use as a raw material in medicine, perfumery, pharmaceutical industry, for the production of cellulose materials and products of its processing, as well as a feed additive for farm animals.

The high growth rate of paulownia, which makes it possible to obtain biomass suitable for industrial processing in one growing season, its ability to resume growth from the root at least 8-10 times after cutting, as well as its resistance to unfavorable factors, make it possible to consider paulownia as a promising raw material for obtaining cellulose materials based on it. In addition, despite the rather low winter temperatures (up to minus 40°C) and the lack of special care, the survival rate of plants a year after planting in open ground was more than 60%.

Thus, due to its high growth rate, resistance to unfavorable environ-

mental factors and its chemical composition, paulownia can be considered as one of the alternative woody plants that can significantly reduce the environmental load, replacing the use of traditional coniferous woody plants of Siberia in various sectors of the national economy.

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FATIGUE RESISTANCE OF WOOD-FIBERGLASS COMPOSITE MATERIALS

Bondarev Boris Alexandrovich
Doctor of Technical Sciences, Full Professor
Lipetsk State Technical University, Lipetsk, Russia
Bondarev Alexander Borisovich
Candidate of Technical Sciences, Deputy Head of Transport and Roads
Directorate
Lipetsk Oblast Administration, Lipetsk, Russia
Basinskikh Elizaveta Vasilievna
Undergraduate
Lipetsk State Technical University, Lipetsk, Russia

Abstract. This article presents the results of endurance tests of fiberglass composite material based on polyester resin. Low-cycle fatigue tests were carried out on machines GRM-2A and IP 5113-100 in accordance with the regulatory documentation. The equations of the empirical line of endurance are presented.

Keywords: polyester resin, composites, material fatigue, railway sleepers.

The process of gradual accumulation of localized damage when exposed to a time-varying load is called fatigue. The ability of a material or structure to resist fatigue is called endurance.

Distinguish between high-cycle and low-cycle, static and physical fatigue, depending on the power loading conditions [1].

Multicycle fatigue of DSVKM was investigated in the works of V. I. Kharchevnikov, O.P. Pluzhnikova and B. A. Bondarev [2, 3]. They proved that the material under study possesses sufficient endurance for its use in structural elements of railway sleepers [4].

With prolonged exposure to loads, the loading steps of the samples in terms of conditional stresses were taken to be 24.5; 33.0; 54.0; 63.0; 73.0; 83.0 and 93.0 MPa. Based on the test results, the creep curves of the specimens in bending were constructed and the boundaries of the possible value of the long-term strength (33 MPa $< R_{B,inf} <$ 54 MPa) were

determined. According to a well-known technique, the duration coefficients were calculated and the curves of the change in bending strength over time were constructed, and from them the duration coefficient was determined equal to 0.45.

Physical fatigue or the ability to resist various temperature and humidity influences was also reflected in the works of A.S. Prokofiev, V.A. Kabanov, A.A. Smorchkov [5].

Studies of long-term strength under the simultaneous action of liquid media and long-term bending load were carried out on samples - plates containing 3% longitudinal fiberglass reinforcement (by weight) and 2% - transverse (fiberglass mesh). Plate dimensions 320x180x10 mm. The initial strength at "pure bending" was 48 MPa, the instantaneous modulus of elasticity was $0.6*10^4$ MPa. Samples – plates were immersed in water and loaded using a special device that allows, by changing the levers and applying various combinations of weights, to create conditional stresses of 0.2 in the zone of "pure" bending of the samples; 0.3; 0.4 and 0.5 of the average ultimate strength in bending - 48 ... 50 MPa. The test results showed that the limits of the possible value of the long-term strength for accepting the percentage of reinforcement are 20 and 25 MPa. The coefficient of duration, taking into account the action of an aggressive environment, was determined using the structural diagram of A. M. Ivanov [6] and its value was 0.46. The studies carried out have established the presence of long-term strength not only in an ideal environment, but also under the action of an aggressive environment.

Low-cycle fatigue of fiberglass composite material has not been studied until now. Since the collapse of the USSR, the production of furfural acetone monomer (FAM) in the Russian Federation has not been restored. On the other hand, the industry for the production of polyester resins of various grades began to develop dynamically, in connection with this, the development of new compositions for polymer solutions, which are a matrix for the production of sleepers and their resistance to fatigue to variable loads, has become a topical trend.

For tests, prisms with dimensions of 100x100x400 mm and 40x40x160 mm were made from the composition shown in table 1.

Table 1 - Composition of polymer concrete mixture

№	Components	Content, kg per m^3
1	Polyester resin Holex HAS 2061	275
2	Hardener (to resin Holex HAS 2061)	5,5
3	Sand medium Mk=2…2.5 mm	610

| 4 | High quality microsilica MK-85 | 82.39 |
| 5 | Wood shavings (softwood) | 354 |

The characteristics of the above binder are shown in table 2.

Table 2 – Characteristics of Holex HAS-2061 polyester resin

Properties	Indicator	Units	Method
Appearance	Transparent yellow liquid with slight opalescence		Visual
Gelation time, at 20°C 2% (MEKP-50)	20-30	min	DUGALAK technique
Brookfield dynamic viscosity RV at 23°C, speed 12, spindle 3	700-800	mPas	GOST25271-93 ISO 2555-89
Flash point	31	°C	ISO 3679
Density	1.13	kg/m^3	ISO 2811-2001
Styrene content	31-35	%	GOST13549-78

Endurance tests of DSVKM in bending with a matrix based on Holex HAS-2061 polyester resin were carried out on an IP 5113-100 testing machine with a load frequency of 670 cycles/minute with a cycle asymmetry coefficient ρ = 0.1 A total of 6 elements were tested. The test results are shown in table 3.

Table 3 – High cycle fatigue test results ρ = 0.1

№ of beam	Breaking bending moment M_p(H*m)	Deviation from the mean, M_p	Squared deviation	Cycles to failure, N	lgN	Deviation from the mean	Squared deviation	Product of deviations
P1	1.55	0.402	0.162	72720	4.849	- 0.880	0.776	- 0.354
P2	1.35	0.202	0.0408	170700	5.234	- 0.496	0.246	- 0.0202
P3	1.14	- 0.008	0.000064	452620	5.653	- 0.246	0.0605	+ 0.00197
P4	1.00	- 0.148	0.0219	911860	5.959	+ 0.229	0.0524	- 0.0338
P5	0.95	- 0.198	0.0392	1851200	6.262	+ 0.532	0.283	- 0.1054
P6	0.90	- 0.248	0.0615	2660510	6.423	+ 0.693	0.480	- 0.1584
	M_p^{av} =1.148		Σ= -0.325		lg^{av}N		Σ = 1.898	Σ = - 0.669

At ρ = 0.1 the equation of the empirical line of endurance is written as follows:

$$M_{pul}^{p} = 3,333 - 0,381 lgN, \tag{1}$$

where M_{pul}^{p} - destructive bending moment (endurance limit of DSVKM), N - the number of load application cycles before failure.

Low-cycle fatigue tests were carried out with an asymmetry coefficient of the load application cycle at $\rho = 0.1$ on a GRM-2A testing machine in accordance with GOST 24545-81. Concrete. Endurance test methods. A total of 6 samples were tested. The results of their tests are shown in table 4.

Table 4 – Low cycle fatigue test results $\rho = 0.1$

№ of beam	Breaking loads, MPa	Deviation from the mean	Squared deviation	Cycles to failure, N	lgN	Deviation from the mean	Product of deviations
P1	34.06	- 5.56	30.914	5.290	0.814	0.663	- 4.526
P2	35.50	- 4.12	16.974	4.969	0.493	0.243	- 2.031
P3	39.06	- 0.56	0.314	4.225	- 0.251	0.063	+0.141
P4	41.61	2.99	8.940	4.105	- 0.371	0.138	- 1.109
P5	42.3	5.89	24.528	3.968	- 0.462	0.276	- 0.358
P6	45.86	7.24	52.418	3.793	- 0.683	0.466	- 4.945
	σ_x^{av} =39.73		$\Sigma\sigma_x^2$ =134.09	σ_y^{av} =4.39		$\Sigma\sigma_y^2$ =1.85	Σ = - 12.828

The equation of the empirical line of endurance for the DSVKM of the adopted composition under compression will be written as follows:

$$R_{v,pul}^{min} = 74.74 - 7.86 lgN . \tag{2}$$

Thus, the results of studies of DSVKM on Holex HAS-2061 polyester resin show that this material has sufficient cyclic durability under repeated and repeated loading. Studies on static and physical fatigue are nearing completion.

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FIELD RESEARCH OF THE LEVEL OF THE NOVOSIBIRSK RESERVOIR

Fomicheva Nyailya Nikolaevna
Candidate of Technical Sciences, Associate Professor
Siberian State University of Water Transport
Fomichev Makar Igorevich
Student
Gymnasium №11 "Harmony",
Novosibirsk, Russia

Abstract. The article discusses the study of the hydrological regime of the reservoir. The purpose of the study is to obtain data on the change in water level fluctuations. The tasks of studying the process of filling the reservoir due to the temporary hydropode device are solved and the results are presented on schedules. Conclusions are shown.

Keywords: Reservoir; hydropost; level fluctuations; Hydrological forecasts.

The Novosibirsk reservoir is the largest artificial reservoir in the south of Western Siberia, created in 1957 on Ob 20 km above Novosibirsk. The area of the water mirror of this reservoir is 1070 km^2, the total volume is 8.8 km^3, useful volume is 4.4 km^3. The largest width of the reservoir is 22 km, the length is 185 km, the maximum depth is 29 m, the average 9 m; The essential part (about half each) of the reservoir of shallow water (with depths of less than 5 m). The reservoir accumulates on average a small part of the volume of the annual flow of water Ob and carries out a shallow seasonal flow regulation.

In recent years, due to the decrease in water and essential reservoir, over a period of long-term use, the regulatory capacity of the hydraulio is reduced. This causes an increase in the accuracy of water balance calculations and short-term forecast forecasts for its operation. When calculating the water balance of the reservoir, many parameters must be taken into account, including the level mode. For scientifically based recommendations on the effects of fluctuations in water levels in the reservoir; Calculations and forecasts should address the tasks that include the creation of a

database for the Novosibirsk reservoir.

The purpose of this work is to obtain data on the level of the regime in the target of the village of Kirza of the Ordynsky district. In this regard, the tasks are set:

- Device of temporary hydropode;
- Observations and measurement levels;
- Observations of meteorological elements.

For more accurate tracking of the nature of the level mode, mathematical models are used. Mathematical models are able to reflect only a part of the existing causal relationships. The main task in constructing mathematical models of natural processes is the use of all available information [1]. Of particular value are the data of natural research. The use of the latter allows you to increase the reliability of hydrological models and on their basis - forecasts.

When planning a flood pass through the Novosibirsk reservoir and performing calculations by the equation of the water balance, data are used by the levels of the upper beef, obtained on hydrological posts (fig. 1).
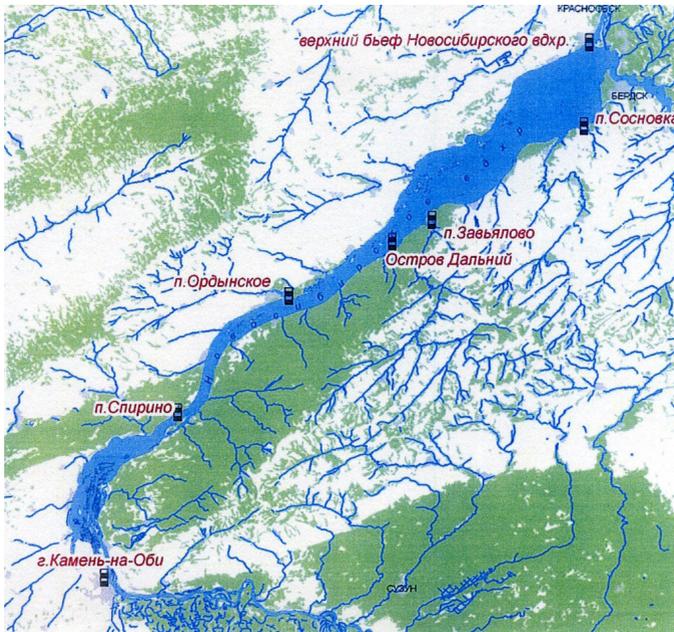

Figure 1. Scheme of the location of water-contained posts on the Novosibirsk reservoir

The calculation of the water balance can be performed according to the following formula [2]

$$N = (P_0 + P_s + O) - (C + A_b + E), \qquad (1)$$

where P_0 – the main tributary,

P_s – side tributary.,

O – the amount of precipitation on the reservoir water management,

C – discard through hydrousel,

A_b – accumulation in the bed of the reservoir,

E – evaporation from the surface of the reservoir,

N – insome balance.

According to the proposed method [2, 3], calculations of the components of the water balance were performed; For which the site of Ob Kamen-na-Obi - the upper beaten of the Novosibirsk reservoir was broken into three pitfalls with borders in Spirino and Ordynskoye. As a result, conclusions were made that it is possible to use the proposed model of the water balance of the reservoir under the condition of the operation of the input hydrograph [4].

The adequacy of the representation of the hydrological regime of reservoirs is determined by many factors: calculations of the water balance described above and the formation of flow; passing the wave of flood and its transformation; level ; temperature and ice regimes and so on [5]. Always important and relevant remains to study water level fluctuations. This is due to the provision of water users and drafting.

The technique presented in this article of inventory studies is based on the instructions of hydrometeorological posts and includes measurements of the following characteristics:

- Air temperature;
- Water temperature;
- Observations of the atmosphere;
- Water level.

The hydrological post for the planned personnel studies was arranged on the banks of the reservoir in the village of Kirza, Ordynsky district of the Novosibirsk Oblast. This post is temporary for the period of expeditionary studies (fig.2).
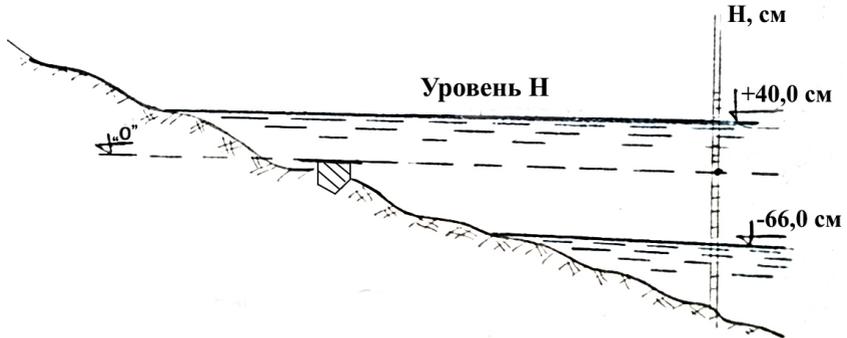
Figure 2. Water pole design

Fig.3. Using levels at low water levels

In the first days of research, the level "H" was below the selected "0", and the level of level was measured using levels and levels (fig. 3). In the future, the water level in the reservoir rose and the measurements were carried out using a water renik. All results were recorded in the table. Measurements of water and air temperature were measured using a mercury thermometer and watered weather and cloud observation [5].

The measurement results are placed in table 1.

Table 1– Investigative data in the summer of 2019 in Kirza

Date	t⁰ of water, C	t⁰ of air, C	Level, cm	Weather
06.06.2019	20.0	20.0	-66.0	windy
07.06.2019	19.8	18.0	-40.0	
13.06.2019	22.0	27.0	0.0	
14.06.2019	22.0	17.0	5.0	weak clouds
30.06.2019	19.2	19.4	28.5	weak clouds
01.07.2019	21.8	23.0	24.5	cloudy, Si
02.07.2019	20.4	21.8	24.0	cloudy, Sc
03.07.2019	21.0	19.9	23.0	weak clouds, Si
04.07.2019	22.0	25.0	23.0	clear
05.07.2019	21.6	23.0	17.0	weak clouds, Si
07.07.2019	24.4	20.0	15.5	weak clouds, Si
10.07.2019	21.4	23.3	19.0	partially cloudy, Si
11.07.2019	22.2	23.0	28.0	clear
12.07.2019	24.0	26.0	32.0	windy, Ci.
13.07.2019	24.0	27.0	40.0	clear, windy
14.07.2019	22.8	25.0	13.5	Ci
27.07.2019	24.0	25.0	17.0	weak clouds, Si
28.07.2019	25.0	27.0	2.0	clear
30.07.2019	24.6	30.0	0.0	haze
31.07.2019	26.2	30.0	-5.0	weak clouds
01.08.2019	25.8	30.0	-5.0	Ci
02.08.2019	26.8	30.0	0.0	clear

According to the results of studies, graphs of measurement of water levels in the Novosibirsk reservoir are built (post in Kirza) (fig. 4).

Figure 4. Water level fluctuations in Novosibirsk reservoir in the area of Kirza

In graphics drawings (fig. 5) shows the course of water temperature of the reservoir and air temperature in the area of research.
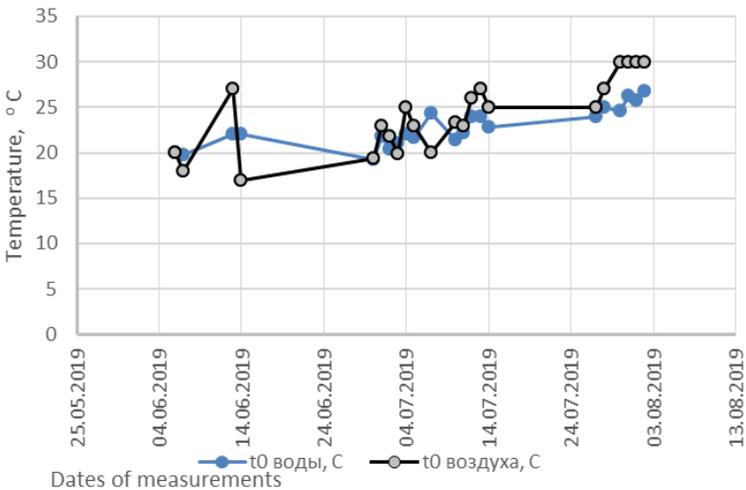

Figure 5. Graphs of changes in water and air temperature of Kirza

From the above graphs (fig. 5) it can be seen that with significant fluctuations in the air temperature, the amplitude of water temperature fluctuations are smaller, although it follows the trend of the air temperature. This can be explained by the difference in the thermophysical properties of water and air.

It is of interest to study the hydrological regime of the observation of water level changes. On the graph (fig. 4) it can be seen that not only the wave of flooding is affected by the nature of the reservoir, but also factors such as precipitation, evaporation of water and the mode of operation of the HPP itself, and the discharge of water from the reservoir. Although, in general, managed to trace the entire level of lifting level to design values.

Conclusions

1. Expeditionary field studies have been completed at the Novosibirsk reservoir, covering the period 2017-2019.

2. The tasks were solved: measurements of meteo elements and fluctuations in water levels by the Novosibirsk reservoir were carried out.

3. Analysis of research results showed:

- water levels in the reservoir for the observation period changed from -66cm to + 40 cm, i.e. the increase in the level was more than one meter;

- the temperature of the water changed from 19.2°C to 26.8°C;

- air temperature in the area of research oscillated from 17.0°C to 30.0°C;

- the intensity of the filling of the reservoir for the period from June 6, 2019 to July 13, 2019 was approximately 2 cm per day. This nature of filling does not exceed the regulatory requirements (5÷10 cm per day).

4. The data obtained as a result of expeditionary studies at the Novosibirsk reservoir can be used when calculating the water balance of the reservoir and also to compile hydrological forecasts.

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ENERGY AND RESOURCE SAVING "GREEN TECHNOLOGY" FOR PRODUCING A NEW TYPE OF PUZZOLAN CEMENT[1]

Buriev Akmal Ibragimovich
Chief Researcher
Begzhanova Gulrukh Bakhtiyarovna
Doctor of Technical Sciences, Chief Researcher
Iskandarova Mastura
Doctor of Technical Sciences, Chief Researcher
Institute of General and Inorganic Chemistry of the Academy of Sciences
of the Republic of Uzbekistan

Annotation. The article presents the results of research on the production of pozzolanic cements with the maximum use of ash and slag mixtures of dry removal of the Angren TPP as an additive.

Keywords: ash-and-slag mixture from TPP, dry disposal, disposal, addition to cement, Portland cement clinker, joint grinding, pozzolanic cement, strength, structure, environmental and economic efficiency.

In the Republic of Uzbekistan, the problem of ecology is being solved at the state level, in connection with which consistent work is being carried out in the field of ensuring environmental protection, rational use of natural resources, improving the sanitary and ecological situation. To achieve the National Sustainable Development Goals and Targets for the period up to 2030,The concept of environmental protection of the Republic of Uzbekistan establishes all aspects of maintaining the ecological balance in the republic, from "improving the environmentally safe waste management system" to "economic stimulation of the development and implementation of waste-free and low-waste technologies in production, as well as technologies for the processing of mining and processing waste. productions " [one].

In the sludge dumps of TPPs, a huge amount of ash waste from hydraulic removal is accumulated, which has a negative impact on the environmental situation, and low hydraulic activity inhibits their large-scale utilization in the production of construction products of a wide range [2].

Therefore, preference is given to the dry method of removing them from the furnaces of coal-fired boilers. This method increases the degree of their useful consumption by developing resource-saving and environmentally friendly technologies for the production of construction products, in particular, cement. In this regard, in 2016, the Chinese company Harbin Electric International Company Ltd on the basis of the Angren TPP modernized and put into operation one power unit for dry ash disposal.The power unit will annually generate 1,050 million kilowatt-hours of electricity and 642.2 thousand Gcal of thermal electricity. [3]. A new power unit with a capacity of 130-150 megawatts with a cogeneration extraction for burning high-ash coal was put into operation and put under load, in connection with which there was a problem of utilization of dry ash-and-slag mixture removal (hereinafter referred to as AZShS). Earlier, in the research and testing laboratory "Strom", comprehensive studies were carried out to determine the hydraulic activity and suitability for use as an additive in cement. Taking into account the rather high hydraulic activity of the dry ash-and-slag mixture (the value of Student's criterion t = 52.59), the organization standard TS 18388312-01: 2019 "Activated ash-and-slag mixture. Technical conditions", a technology for the production of Portland cement for general construction purposes has been developed, containing up to 20% of granulated dry ash and slag mixture, the ecological, technological and economic efficiency of using the active dry ash and slag mixture (hereinafter ASHS) of Angren TPP as an active mineral additive in cement[4-6]. At the same time, a significant margin of strength indicators of modified Portland cement predicts the possibility of introducing AZShS during grinding clinker, which prompted us to continue research in terms of direction. Portland cement clinker of Akhangarantsement JSC, gypsum from the Bukhara deposit and an averaged sample of dry removal AZShS at Angren TPP, the chemical compositions of which are presented in Table 1, were used as starting materials.

Table 1 - Chemical composition of clinker and gypsum stone

Component name	Mass content of oxides,%							
	p.p.	SiO2	Al2O3	Fe2O3	CaO	MgO	SO3	Other
Clinker JSC "Akhanga-rancement"	0.36	21.30	4.75	4.86	63.58	3.07	0.36	1.58
	Mineralogical composition and modular characteristics							
	C3S-59.09; C2S-16.49; C3A-4.34; C4AF-14.77; KH-0.91; n 2.22; p-0.98							
AZShS Angren TPP	0.61	64.79	20.64	3.99	3.36	0.80	1.64	4.12
Gypsum stone	At 4000C 19.57	8.76	1.82	-	28.58	-	42.77	2.41

For researchInfluence of AZShS on the physical and mechanical properties of Portland cements in terms of their hydraulic activity in laboratory conditions from cement paste with different content of AZShS small samples-cubes with a size of (2x2x2) cm with a composition of 1: 0 were made. As an object of comparison, no additive Portland cement was prepared, obtained by joint grinding of 95% clinker and 5% gypsum stone. The material compositions of the mixtures and the strength indicators of Portland cements modified with a high content of AZShS are shown in Table 2.

Table 2 - Influence of dry ash and slag mixture on the physical and mechanical properties of Portland cement

No.	Composition and designation of cements, wt%				Compressive strength, MPa, after (day) hardening				
	Designation	Clinker	Gypsum	AZShS	one	3	7	28	90
one	PC-D0	95	five	-	10.3	33.4	41.0	42.5	46.8
2	PC-D30	65	five	thirty	8.7	24.5	34.5	52.5	54.3
3	PC-D40	55	five	40	10.0	25.0	35.0	55.5	47.5
four	PC-D50	45	five	fifty	8.7	23.0	34.5	47.5	45.8
five	PC-D60	35	five	60	8.8	15.0	30.0	38.1	38,7

In accordance with the data in Table 2, the introduction of (30-40)% has a slowing down effect on the formation of the strength of the cement stone, as a result, its strength indicators are up to 7 days lower than that of PC-D0. However, in the future, the hardening process of these compo-

sitions of modified cements is accelerated and the strength indicators of stone based on them by 28 days are (10.0-13.0) MPa higher than that of PC-D0.

Specimens of highly filled cements containing (50-60)% of the addition of dry ash and slag mixture in the first (1-7) days are characterized by the same strength indicators as cements with (30-40) AZShS. In the future, their strength indicators have higher values, which for cement samples with 50% of concrete samples based on test cement PC400-ZD20 have maximum resistance to alternating wetting and drying in comparison with samples made of concrete based on PC 400-D0 cement. So, the coefficient of weather resistance of samples made of concrete O-No. 2, after 25 cycles of alternating moistening and drying was K_{atm}= 1.04, and the coefficient of weather resistance of concrete specimens O-No.1 - Catm = 0.91. The least resistance to natural influences is possessed by samples of concrete O-No.3, the strength loss of which amounted to 17.4%, and Catm = 0.83. Compared with the permissible value of indirect estimation losses (no more than 20 to 25%), all samples of concretes of optimal compositions withstood weather resistance tests: their strength indicators by 28 days are slightly higher than the strength of PC-D0, and for specimens made of highly filled cement with 60% AZShS - lower than that of it.

Based on the obtained research results, it was concluded that the higher the content of AZShS in the cement, the slower the strength of the stone based on it is gaining. At the same time, the degree of filling of the cement should not exceed 50%, otherwise the hydraulic activity of the cement stone will not provide its grade at the level of the base Portland cement.

Due to the fact that concrete during operation is exposed to various kinds of environmental influences (alternating drying and moistening, alternating freezing and thawing, etc.). The resistance of cement to various kinds of influences largely determines the durability of concrete made from it. One of the main methods for testing cement related to determining its resistance are weather resistance and frost resistance. The study of the resistance of cements with the addition of AZShS to various environmental influences was carried out on standard samples (70 × 70 × 70) mm, made of concrete of class B 15 (M200) in compressive strength. Experimental Portland cement containing 40% AZShS with the symbol PCZ-D40, characterized by a hydraulic activity of R28 = 465 kgf / cm2, was used as binders for the preparation of concrete. For comparative tests - Portland cement without PC-D0 additive (R28 = 418kgf / cm2). Crushed stone from gravel of a mixture of fractions from 5 to 20 mm was used as a coarse aggregate. The study of the resistance of cements with the addition of active

ash and slag mixtures to various environmental influences was carried out on standard specimens (70 × 70 × 70) mm made of concrete of class B 15 (M200) in compressive strength. For further tests, concrete compositions were taken based on cements of control cement PC 400-D0 and test cement PC 400-ZD40 of the following optimal compositions with a cement consumption: 298 kg per 1m3 - for the control composition of concrete from PC400-D0 (O-No.1) and The study of the resistance of cements with the addition of active ash and slag mixtures to various environmental influences was carried out on standard specimens (70 × 70 × 70) mm made of concrete of class B 15 (M200) in compressive strength. For further tests, concrete compositions were taken based on cements of control cement PC 400-D0 and test cement PC 400-ZD40 of the following optimal compositions with a cement consumption: 298 kg per 1m3 - for the control composition of concrete from PC400-D0 (O-No.1) and The study of the resistance of cements with the addition of active ash-and-slag mixtures to various environmental influences was carried out on standard specimens (70 × 70 × 70) mm made of concrete of class B 15 (M200) in compressive strength. For further tests, concrete compositions based on cements of control cement PC 400-D0 and experimental cement PC 400-ZD40 of the following optimal compositions with a cement consumption were taken: 298 kg per 1m3 - for the control composition of concrete from PC400-D0 (O-No.1) and 297 kg per 1m3. - for the optimal composition of concrete from cement with 40% AZShS (O-No.2).

When testing concrete samples, the following methods were used: determination of the ultimate compressive strength of concrete samples at the age of 28 days, 3, 6 months, 1 year, according to GOST 10180-2012 "Concrete. Method for determining strength by control samples "; frost resistance - according to GOST 10060-2012 "Concrete. Methods for determining frost resistance "; weather resistance - according to the accelerated method of the Central Scientific Research Laboratory of the Glavkievstroy.

The test results showed that concretes made from cements containing 40% AZShS as an additive have a sufficiently high frost resistance, they withstood 25 cycles of alternate freezing and thawing, which corresponds to their frost resistance brand F125. A decrease in the strength of the samples has not been established, moreover, after 25 cycles of thermal cycles, their strength even increased slightly and the values of the frost resistance coefficient (KCmrz) were: for concrete O-No.1 = 1.066, and for concrete O-No.2 = 1.089.

The study of the weather resistance of Portland cements with AZShS

was carried out on samples made of concrete O-No.2 and for comparative tests - from concrete O-No.1. Multiple alternating moistening and drying, causing a decrease in the strength (up to 20%) of concrete specimens, was used as an indirect method for assessing their resistance to fluctuations in atmospheric conditions. specimens made of concrete based on test cement have maximum resistance to alternating wetting and drying in comparison with specimens made of concrete based on PC 400-D0 cement. So, the coefficient of weather resistance of specimens from concrete O-No.2 after 25 cycles of alternating moistening and drying was Katm = 1.04, and for specimens from concrete O-No.1 - Katm = 0.91. Consequently, specimens of concretes based on Portland cement modified with 40% AZShS successfully passed the weather resistance tests.

The positive results of the research served as the basis for the industrial development of the technology of Portland cements with a high degree of filling with an activated ash-and-slag mixture of dry removal. At present, the technology of obtaining Portland cement grades "400" and "500", containing (40-45)% AZShS, has been implemented at LLC FE "BAZIS".

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COMPLEX DEFECTS DETECTION SOFTWARE FOR OIL REFINING INDUSTRY

Krasnova Marina Nikolaevna
Candidate of Technical Sciences, Associate Professor

Novopoltsev Sergey Dmitrievich
Undergraduate
Voronezh State Technical University

Abstract. The article discusses the principle of determining complex defects in cast body parts of main oil pumps made of 20GL steel by an ultrasonic non-destructive testing method using a flaw detector and a 16-element digital-focusing antenna array. The equipment used, the structure of the antenna array, the principle of operation and its adjustment according to the standard sample of the enterprise are presented. The maximum admissible frontal images of defects of the "looseness" type are found. Based on the equations for finding the maximum length of defects and its actual dimensions, software has been written that can be used to reject various parts, including the body of a main oil pump.

Keywords: software, non-destructive testing, ultrasonic testing, antenna array, cast parts.

Introduction

Inspection of cast body parts by ultrasonic testing (UST) is one of the most difficult due to several factors:

- complicated shape of the part, associated with different curvature of the surface and changing thickness in different areas of the part,

- the emergence of difficulties in the orientation of defects and their sizes in the product,

- after solidification, the casting has a coarse-grained structure, reducing the efficiency of UST due to significant attenuation of ultrasound [1].

Such objects of control include the cast body of the main oil pump (MOP), during the control of which one has to deal with many of the above factors.

Today, the use of ultrasonic flaw detectors using digital-focused antenna

arrays (DFAA) has already become the norm, because in comparison with traditional flaw detectors working with single-element piezoelectric transducers (PET), DFAA significantly expands the range of testing, allowing:

- visualize the internal structure of the product, presenting it as a cross-sectional image,

- monitor hard-to-reach places,

- change the operating frequency, solving the problem of attenuation of ultrasonic waves.

The aim of the work is to write software, a module for calculation based on research and equations for determining the permissible frontal and real dimensions of defects when inspecting a cast body part made of 20GL steel.

Equipment and control object

The object of control is the body of the oil pump (fig. 1). According to NTD, ultrasonic testing is mandatory and is carried out in 3 sections (fig. 2) for the entire thickness, which is 50mm, in some places reaching 100mm.

Figure 1. Casing of the main oil pump MOP
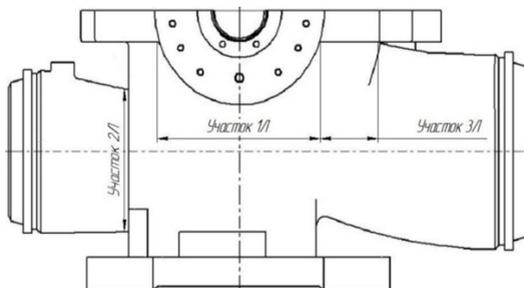
Figure 2. Control areas

The control is carried out for the presence of various defects in the casting of the body, the most common is a defect of the "looseness" type - a casting defect in the form of an accumulation of small shrinkage cavities [5]. A sign of this defect is that the image of the defect consists of a chain of small images.

Research and setting up equipment

An IntroVisor A1550 ultrasonic flaw detector (fig. 3) manufactured by "ASK" LLC in Moscow was chosen for the experiment. The technical characteristics of which allow you to perform this task [2].

Figure 3. IntroVisor A1550 flaw detector

The device also includes an antenna array sensor AA (fig. 4), which consists of a plurality of piezoelectric elements of the same type located along one line on the protector [3].
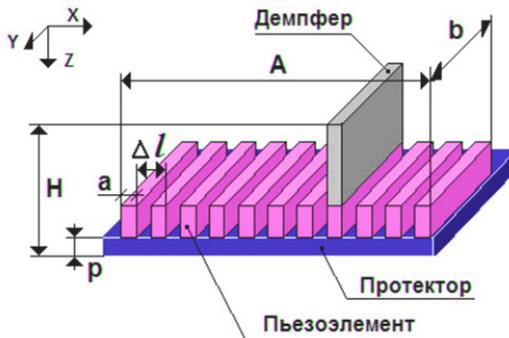
Figure 4. AA design

To calibrate and adjust the flaw detector, you need a standard enterprise sample (SES), which is a sample made of the same material as the test object, in the body of which there are holes - control reflectors (CR): 5 holes with a diameter of 6.2 mm, size which corresponds to the maximum size of the defect in accordance with the normative and technical documentation (NTD) for the controlled product.
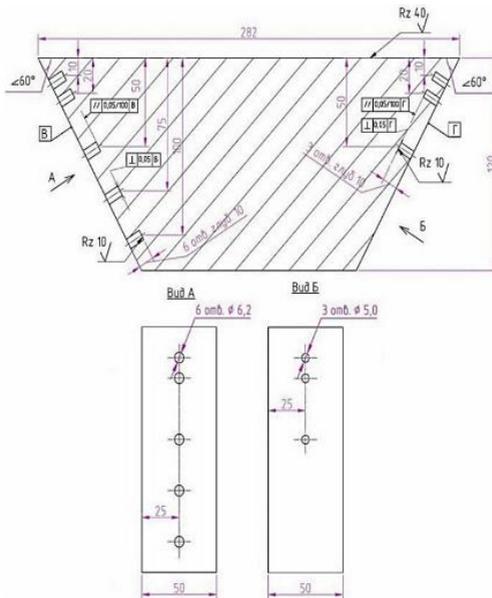

Figure 5. Standard Enterprise Sample (SES)

Using a flaw detector, it is necessary to obtain images of all control samples CR1, CR2, CR3, CR4, CR5. Depths Z of which are equal: 10, 25, 50, 75 and 100mm. Moving AA linearly, we find the maxima of CR (fig. 6), and using the flaw detector functions, we determine their frontal size, the dimensions of which are: D_1=5,8mm, D_2=6,4mm, D_3=11,0mm, D_4=18,9mm, D_5=22,2mm.
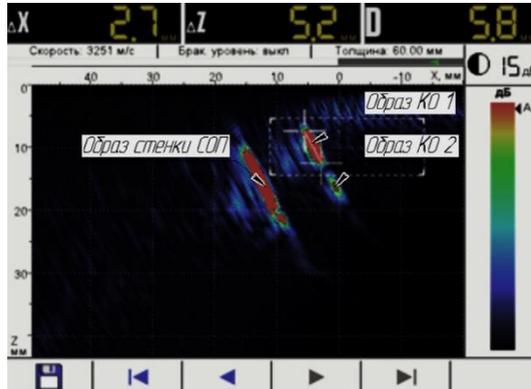
Figure 6. Results on the flaw detector screen

This implies the dependence of the frontal size of the CR image on the depth of occurrence, i.e. if an indication of a defect is found at a depth of 50mm, and the frontal size on the flaw detector screen is D = 11.0mm, then the actual size of the defect is 6.2mm.

Knowing this, it is possible to find the values of the maximum frontal dimensions of intermediate depths Z, it is necessary to approximate the size D [4].

The equation looks like this:

$$D_{permissible} = D_{min} + \frac{(D_{max} - D_{min}) * (Z_x - Z_{min})}{(Z_{max} - Z_{min})} \qquad (1)$$

where, Z_x – defect depth, mm;

Z_{min}, Z_{max} – values assigned from the SES setting, the range where Z_x falls;

D_{min}, D_{max} – are selected from the depth values Z_{min}, Z_{max}.

For example, having found a discontinuity with a frontal length D_x=7.8mm at a depth of Z_x=44mm, the frontal dimension falls into the interval between a depth of 25 and 50 mm, we calculate $D_{permissible}$ for a depth of Z = 44mm:

$$D_{permissible} = 6.4 + \frac{(11.0 - 6.4) * (44 - 25)}{(50 - 25)} = 10{,}08mm$$

The maximum allowable length of a defect at a depth of Z = 44mm is equal to 10.08mm, therefore, the defect found is acceptable.

To find the real size of the defect, the formula (2) is derived:

$$D_{actual} = \frac{D_{CR}}{D_{permissible}} * D_x \qquad (2)$$

where, D_{CR} – maximum permissible defect size, mm;

D_x – flaw detector screen data.

Using these data, we will write a program (fig. 7) that will help the NDT inspector determine the suitability of the product, without additional calculations.

The program interface consists of a tabular formula editor.

The program works as follows:

1. The found maximum lengths of the frontal images of defects are entered into the corresponding cell.

2. The depth of the defect at which it was detected is entered into the corresponding cell.

3. Using the functions, the calculation of the maximum permissible size of the frontal length and the actual size of the defect in the metal thickness are carried out.

4. The final stage is rejection, if the maximum length of the defect on the flaw detector screen does not exceed the calculated one, and the actual size of the defect is less than the specified NTD, then the defect is acceptable, if the resulting values exceed the permissible values, the detected defect is invalid.

Figure 23. The program for determining real defects in the metal thickness during the UST non-destructive testing method

Conclusions

In the course of the work done, software was written for determining complex defects in cast body parts of mainline pumps. With the help of which, it simplifies and accelerates the search for the value of the permissible size for intermediate depths and real sizes of defects according to the formulas.

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MASS TRANSFER CONTACT DEVICES

Nurtashova Madina Zhaskairatovna
master student
Massakbayeva Sofya Ruslanovna
Candidate of Chemical Sciences, Professor
NJSC «Toraigyrov University»

Abstract. Mass transfer processes play a significant role in petrochemical production. In this regard, the issue of increasing the efficiency of mass transfer processes becomes urgent due to the use of highly efficient contact devices with low hydraulic resistance. This article discusses poppet contact devices that are highly efficient, have relatively low metal consumption and cost.
Keywords: mass transfer processes, efficiency, mass transfer devices

It is now known a large variety of mass transfer devices, and the continuing development of new progressive. This is due to the fact that a mass transfer devices presented a large number of requirements, many of which contradict each other. Therefore, it is impossible to develop a universal design of mass transfer devices.

Applications of contact devices determined by the properties shared mixtures working pressure in the apparatus by a pair of loads (gas) and liquids and the like

It designs mass-transfer devices must meet the following basic requirements: low cost, ease of maintenance, high protectivity, the most developed area of contact between the phases and the transmission efficiency of mass of substance from one phase to another, the stability of the regime in a wide range of loads, the maximum capacity for steam (gas) and liquid phase, the minimum flow resistance, structural strength and durability, etc.

Depending on the way the organization contact mass transfer device phases are usually divided into Belleville, packed, and the rotor (Figure 1) [1].
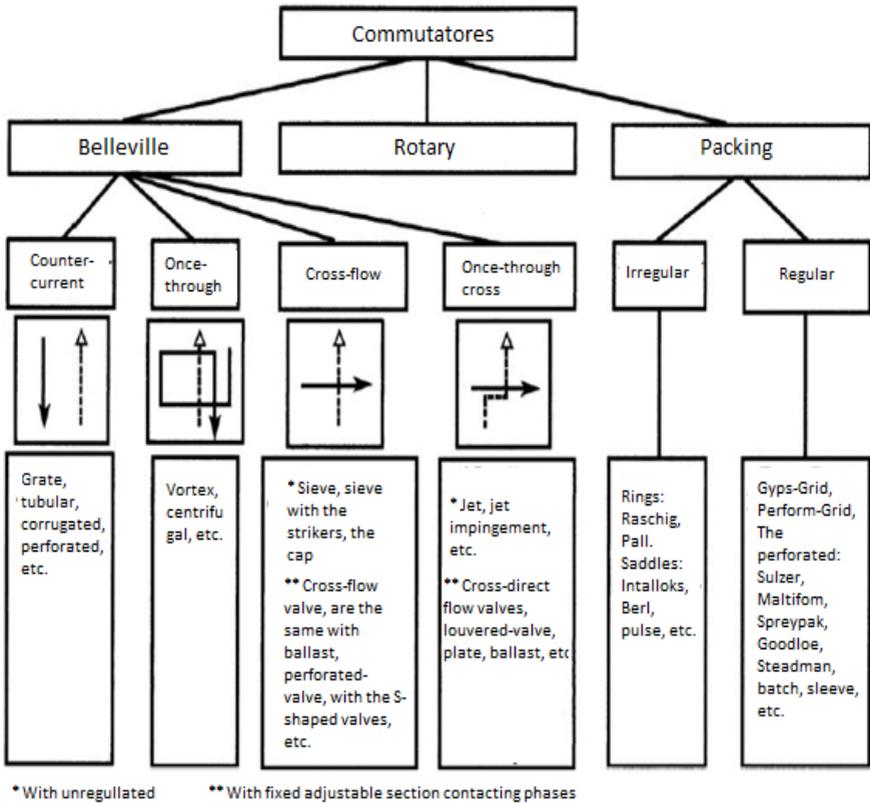
Figure 1 Classification of contact devices

About 60% of manufactured column apparatus for distillation and absorption are tray columns, packed the rest. Recently with the proper organization of the process fluid dynamics, often more economical than Belleville.

In [8], tower units are divided into Belleville, packed, and film.

Rotary film and due to the complexity and high manufacturing cost little used in the industry, so is not described here.

In the oil refining industry the most widely used devices are plate columns. In the plate column the mass transfer is performed by repeated contact of two phases. For this purpose it is equipped with special devices - plates, where mass transfer mainly occurs, except for a small mass transfer in the void volume of the column. Plates are mounted horizontally inside the column.

The distillation columns utilize plates of various designs, that differ greatly in performance and technical - economic data.

The assessment of plates usually takes into account the following indicators:

a) performance;

b) hydraulic resistance;

c) efficiency under different workloads;

d) the range of workloads in condition of high efficiency;

e) resistance of the theoretical plate to different workloads;

f) the ability to work in environments that are prone to the formation of encrustations, polymerization, etc.;

g) simplicity of construction, which is manifested in the complexity of manufacturing, installation and repair;

h) metal utilization.

Universal design Plates (as well as other universal mass transfer devices) does not exist. In most cases for the sufficient performance it is enough to have two or three above mentioned data (a, c and d). If they relatively different, the analyzed parameters f, g and h are taken. Indicators b, and e are of great importance for vacuum and multi-plate columns where the decisive role is played by the device resistance. Therefore, in many cases for the vacuum tower's bottom may be advantageous to use plates that have relatively low efficiency and low resistance. Crucial indicators when reconstructing columns are: a, b, c, d [2, 3].

However, at the moment, along with the most modern designs of plates there are plates (grooved, etc.) used. They provide obtainment of essential products, but can not be recommended for modern productions.

Construction and operation of the most common types of plates: bubble cap, and valve trays will be overviewed below.

Babble cap trays include trays with round caps, grooved and with S - shaped elements, etc. Plates with capsular caps have a relatively high efficiency (0.75-0.80) and operate over a wide range of capacities for gas. They can be used at unstable loads of liquid and vapor. The disadvantages of these plates are: significant metal content and complexity of manufacturing.

Thanks to ease of use and versatility the plates with capsular caps were recently considered as the best contact devices for distillation and absorption columns.

The disadvantages of bubble cap trays include: low thermal performance, relatively high flow resistance, large metal consumption, complexity and high cost of production.

The distillation apparatus of oil refineries utilize grooved plates (tunnel) caps (Figure 2).[1,3]

The main operational drawback of grooved plates is a small area of bubbling and incomplete use of cross-sectional area of the column to create a bubbling mirror.

Currently, in the refining columns plates with S-shaped elements 4 are used. Plates can be set up perpendicular to the direction of movement of the liquid on the plate. The S-shaped plates are the variety of bubble cap trays and consist of separate elements, each of which forms a cavity for both vapor and liquid.
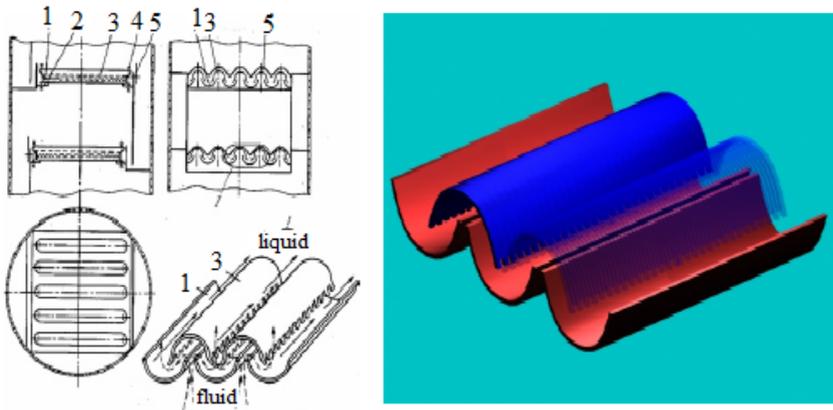
1 – gutter; 2 – supporting rails; 3 – caps; 4 – pins; 5 – drainage
Figure 2 Plate with grooved (tunnel) caps

In separation processes under moderate pressure or vacuum the ballast plates with rectangular valve are very promising. The presence of the movable ballast ensures uniform opening of all valves with minimum load by steam and adjustable cross-motion transition from phase to parallel flow at high loads. As a result, the ballast plate has 15-20% higher separation efficiency in comparison with ballastless plate over the entire load range.

The use of rectangular valves instead of round valves allows approximately 30% reduction of metal use during their manufacture, and due to the large size of the valves (one rectangular valve equivalent to eight round valves).

In recent years the ballast plates become widespread, especially those that work in varying gas velocities, and are gradually replacing older designs of contact devices.

Valve Trays mass transfer column devices have a wide range of load by the gas (vapor), while maintaining a stable mass transfer efficiency. [3,4]

In these constructions, the gas substantially coming out from the valve in the form of a continuous thickened jet, which leads to restriction of surface area of contacting phases due to the leakage of part of gas without interacting with the fluid. This also increases the liquid entrainment from the plate due to high speed exiting gas-liquid jet from the surface layer. Additionally, the flow of gas is formed directly below the upper plane of the valve, whereby the lower adjacent plates to the layer of liquid is virtually eliminated from the interaction with the gas. In this case it is possible for the fluid from the inlet to the plate to overflow threshold without the explicit participation in the mass transfer.

Thus, the formation of gas flow in a continuous jet emerging from the valve disc, limits the surface contact area of the phase and reduces the efficiency of mass transfer.

Besides, a common disadvantage is characteristic for all valves, revealed in valve fouling or coking, which cause them to "stick" and not function in a dynamic mode. [3-5]

Disastrous plates type usually include perforated plates and lattice.

The advantage of the perforated plate - great free (i.e, engaged holes) cross-section of the plates, and, consequently, high steam output, ease of fabrication, low metal content. As steam production (gas), these plates 30-40% exceed the cap. Disadvantage - the high sensitivity to the installation accuracy. Devices with sieve trays is not recommended for use in polluted environments; this may cause clogging of the holes.

Sieve-valve disk provides a large range of stable operation at low flow resistance, making it suitable for the processes taking place in a vacuum.

The perforated plates with cut-drawn holes (Figure 3) are used in column apparatuses diameter 1200-4000 mm. These plates consist of separate sections that are made of a sheet of 2-3 mm thick expanded metal openings. Plate acts as a co-current jet. To reduce entrainment angle of 60 ° over the plate elements 2 mounted chisel.
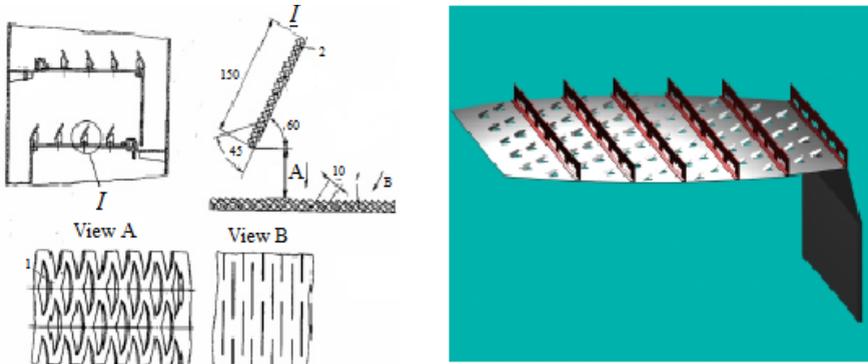
a) sieve tray with prosechno- exhaust openings and baffle elements

b) sieve tray with perforated elements (punched perforation) with perforated vertical partitions

Figure 3 Various types of perforated plates with baffle elements

The free cross-section of dishes, selected from the conditions of the lack of "failure" of the fluid, must be large enough (at least 30% of the cross-section of the column) to plate possessed, low hydraulic resistance. Allowing such plates are used in vacuum towers. The minimum distance between the plates in a column of 450 mm.

One of the technological progress in the refining industry - the creation of contact devices with high capacity for liquid and vapor, in particular the longitudinal and transverse partitioning.

It is known that increased performance plates phase when contacted in cocurrent. However, the continuous-flow motion and high speed steam (gas), the liquid is displaced toward the drain pocket, which complicates the work of dispensing devices. [1,3]

To compensate for the movement phase ramjet and exclusion of its spread to the entire plate can be mounted on a plate longitudinal and transverse partitions, providing a zigzag movement of the liquid on the plate from the overflow to the drain, as well as creating conditions for traffic flow vapor-liquid mixture on a plate or in opposite directions intersecting.

An example is longitudinally partitioned dish with perforated elements (Figure 3, b). On the canvas stamped plate punching, bent at an angle. Plate partitioned along the liquid flow by vertical partitions, and for creating a constant flow resistance across the perforated baffle plate.

The perforated plates are the most common as contact devices distillation columns of air separation units operating at low temperature.

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In the apparatus a small diameter is used S-shaped perforated plates (Figure 4). [1,3]

Figure 4 Perforated plate with an S-shaped baffle
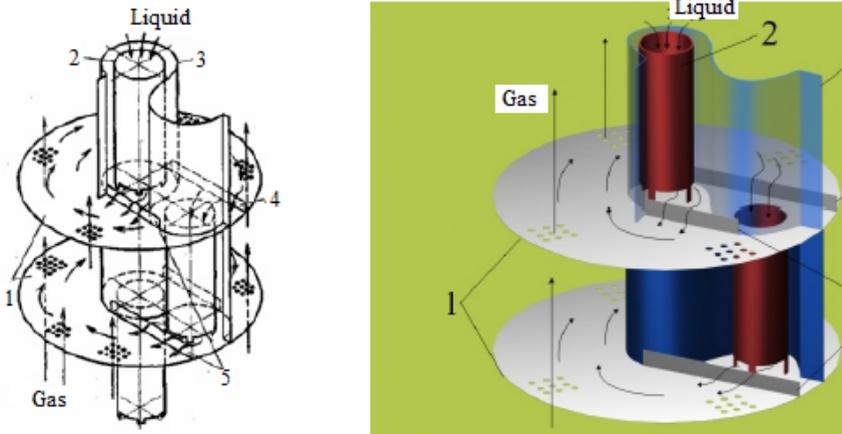
The advantages of these dishes should be, above all, the simplicity of design and a low metal content. Further, trays have a greater liquid throughput and of sufficient width at the gap, can be used for the treatment of contaminated fluids which leave the sediment at the plate. On the effectiveness of failing grid plates are usually not inferior plates with overflow.

The disadvantages include a narrow range of stable operation and complexity of providing a uniform distribution of irrigation plates on the surface at the beginning of the process. Plates of this type are much more sensitive to a change on the liquid and vapor loadings and have a more narrow range of operating loads than the overflow dish with special devices. With a little steam load pressure of the vapor is not sufficient to form a liquid layer on a plate. At higher loads steam resistance to flow of liquid through the hole plates becomes so great that the foam fills almost all inter-poppet space and the normal flow of liquid from tray to tray is broken. This sharply increases the hydraulic resistance to flow of vapor. This mode of operation is called flooding and determines the limit steam and liquid load of the column. [1,3]

Thus, the large variety of poppet contact devices makes it difficult to choose the optimal design. Since, along with general requirements (high intensity per unit volume of the apparatus, its cost, etc.), a number of additional requirements can be set, which are determined by the specifics of production. For example, a large interval of stable operation with changing loads in phases, the efficiency of the tray to work in an environment of contaminated liquids, the ability to protect against corrosion, etc. Quite often, it is these characteristics that become prevalent when determining the suitability of a particular design for use in a particular process. [6]

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EFFICIENCY FACTORS IN THE DESIGN AND CONSTRUCTION OF RESIDENTIAL AND CIVIL BUILDINGS

Kamzina Nadezhda Enovna
Candidate of Art Criticism, Associate Professor

Mazina Yuliya Ilyinichna
Candidate of Art Criticism, Associate Professor

Kisamedinov Ildar Nurtayevich
Undergraduate

Gazizov Zhandos Muratuly
Undergraduate

Innovative University of Eurasia

Abstract. The article discusses the principles of design and construction of residential multi-storey buildings. The development of the construction industry based on the typification and unification of construction products, the reasons and methods leading to the improvement of various indicators of the construction process are considered: from accelerating the construction process, to a variety of variations that allow you to make standard elements of buildings. The article presents the classification of systems and production of building products, the evolution and reasons for their changes, the application and development of innovative technologies and materials that provide a new approach to the construction of buildings based on high economic indicators of reducing the cost of building residential buildings, and at the same time, improving its quality and comfort.

Keywords: Housing construction, typification and unification, efficiency of construction processes.

The development of construction and design of residential buildings looks very simple - a cave, a hut, a house: wooden, stone, low-rise, high-rise, skyscraper, etc. Understanding the evolution of this development, one can note the unprecedented growth of new technologies, materials, constructive, space-planning and functional solutions in housing construction. Kazakhstan is rapidly developing housing construction, already in 2021 it is planned to build 17 million m2 of housing. [1]

One of the objectives of this article was to analyze the formation of the housing industry in the Republic of Kazakhstan. The table systematizes the stages of the formation of the volume of housing construction and the factors affecting the effectiveness of this process. For the convenience of visual analysis, consider it in table 1.

Table 1 - Efficiency factors of construction production in various countries from 60 to 2000

Period	Factors contributing to increased growth in housing construction	Innovation and materials	Characteristic signs of changes
60s	Construction industry, a developed network of design and sci-entific organizations Full prefabricated and large-panel housing construction	Typical projects. Reduc-ing the weight of building structures	Reducing con-struction time by 30-40%, reducing the cost of 1 m2 of living space by 10-15%.
1961-1965	Technologies of facto-ry production of parts and structures	Use of cassette and vibro-rolling technology	Typical projects of large-panel residen-tial buildings of the second generation. Overcoming monot-ony and monotony.
1966-1970	Transfer of mass housing construction to the construction of multi-storey residential buildings from unified products of the unified Catalog	Modernization of rein-forced concrete struc-tures; transition from large-block to panel con-struction.	Convenience is in-creasing, engineer-ing equipment is being improved
1970-1975	The design methodol-ogy was improved, its variant capabilities were checked	Standard designs of multi-storey large-panel houses of the third gen-eration have been cre-ated from the products of the unified Catalog, pro-duced by house-building factories.	

1975-1990	Complex ensemble urban development, increasing comfort and operational parameters of apartments and buildings	High manufacturing accuracy and excellent quality of products manufactured on vibro-rolling mills, more advanced assembly equipment and construction assembly technology	Use of loggias

The created production base and the extensive experience accumulated by the end of the sixties in the mass construction of large-panel residential buildings made it possible to conduct a comprehensive assessment of the achievements and shortcomings of modern housing construction.

On the basis of this analysis, a methodology for standardization and typification of industrial housing construction was developed, which allows to ensure a significant improvement in the quality of building in city blocks; effectively organize factory and construction production, as well as improve the operational and technical and economic indicators of facilities under construction. [4]

Scientific and methodological conferences of the 60s provided a large amount of material, which became the basis for the design and construction of residential and civil buildings on the basis of a single Catalog. A system of unified industrial buildings was formed.

The catalog is a systematized list (nomenclature) of building parts and equipment items, architectural and planning, technical and design parameters and solutions, on the basis of which designers have the opportunity to create projects of buildings of various storeys and architectural design from standardized elements with an optimal number of standard sizes and brands of products. spatial composition, taking into account the dynamics of the development of requirements for mass housing.

Enterprises adapted production to the range of products envisaged by the project, as a result of which they produced sets of parts and structures that did not differ much from each other, the nomenclature of products increased significantly, and the buildings themselves, in essence, did not differ from each other.

In these conditions, the creation of a unified range of building elements and parts made it possible to determine the following industry prospects:

- provide a clear order in the design,
- organize a planning process in industrial production and construction
- to determine the technical orientation of mass housing construction for the coming years and the future.

- to determine the choice of economically sound architectural and technical solutions, structural, units and schemes of residential buildings, which determine the reliability, efficiency and labor intensity of buildings.

- the minimum possible labor intensity at the plant and construction site.

The experience in the construction of large-panel buildings of increased number of storeys has shown the effectiveness of the constructive system of residential buildings with a narrow pitch of transverse load-bearing internal walls. [6] This system provides:

- general rigidity and stability of buildings,

- lower consumption of steel, concrete, cement per 1 m2 of total area compared to other structural systems.

That is why for the mass construction of residential buildings from unified products of the unified Catalog, a pitch of internal transverse load-bearing walls of 3.6 m was adopted, which, in combination with a three-meter pitch and room-sized ceilings, makes it possible to erect buildings of various architectural and layout solutions with expressive facades, with different layouts and a set of apartments and to achieve low total (factory and construction) labor costs, as well as to use technological equipment proven by long-term practice.

In all projects of residential buildings with a height of 9, 12, 16 and 22 floors, created on the basis of a single Catalog, an improved layout of apartments is provided:

- increased areas of residential and utility rooms,

- the dimensions of the sanitary facilities were increased.

- the arrangement of living quarters and ancillary premises is made taking into account the requirements of the household regime of families.

- reserved places for the installation of sectional kitchen equipment and cabinets at the request of the new settlers.

- apartment types are duplicated, i.e. an apartment with the same number of rooms can have different living and usable area.

- well thought out conditions for study, rest, more amenities that facilitate housekeeping

The residential buildings designed and built according to the unified Catalog were distinguished by significantly higher urban planning, architectural planning and technical and economic properties in comparison with the previously used series of houses. [4]

The unified products of the unified Catalog ensured: while maintaining the necessary stability of the construction industry enterprises and with the effective use of technological equipment and tooling, a variety of residen-

tial buildings, the replacement of some types of buildings with others. Nowadays, the technological process of factory production of parts and structures should be such that it would be possible to produce not a narrow, constant range of products for a long time, but rather quickly and efficiently be reorganized for the production of new products. This restructuring was carried out on the basis of a wide standardization of products. This made it possible to build up residential quarters with a variety of beautiful and comfortable buildings and ensure the manufacturability of constructions.

The object of typing was not the house, but the industrial products themselves. The previous design-to-product principle is being replaced by a new product-to-design principle, resulting in increased cost-effectiveness.

The second important step in increasing the efficiency of construction was the tendency of successive enlargement of the used prefabricated parts and structures, external wall panels - by two spans, floors - per room, floors of loggias and staircases - by two constructive steps. The volumetric-monolithic structures of balconies, articulated in the conditions of the plant with external wall panels, were also tested. An analysis of the development of the construction industry in European countries showed that it had a number of specific features that were fundamentally different both from the socialist system and from each other. [5]

The competitive struggle of numerous construction and machine-building firms, financing of construction by private customers, a large proportion of individual construction - these and other factors contributed to the fact that many of the methods used in construction practice are characteristic only for the territorial conditions of these countries. At the same time, foreign experience makes it possible to note a number of technical solutions that were of certain interest for domestic construction.

We have proposed our own classification of these innovations:
- monolithic reinforced concrete structures,
- erection of buildings and structures using prefabricated elements,
- widespread use of metal.
- the use of mixed designs.
- erection of pure metal frames with prefabricated or monolithic floors.
- fabrication of prefabricated structures directly at the construction site.
- use of lightweight concrete with pumice aggregate, shale rocks with a bulk density of 1700-1800 kgf/m2. This has significantly reduced not only the weight, but the cost of the products.
- the use of panels with a wooden and combined frame

Both in Europe and in the USA they are also striving for maximum unification and, in accordance with production requirements, they use grids of

columns 6x6 m and 9x9 m, and the height of the floors - in accordance with production requirements. Experts from foreign countries attached great importance to typification and unification for the development of industrialization of construction and for reducing its cost.

For the construction of buildings in monolithic reinforced concrete in foreign construction, modern and advanced instrumental methods of work are used. The manufacture of inventory formwork, reinforcing cages and nets is carried out at specialized highly mechanized enterprises. Parts in wooden formwork systems are not connected with nails, but with high-strength adhesives or dowels, pressed in with automatic machines.

The development of building materials is also interesting in the development of the construction industry in the 60-90s. Innovation and research in the field of economically sound solutions lead Western countries to discoveries in this area. The example of formwork processing in various European countries gives a clear idea of the breadth of the approach to this problem. (table 2)

Table 2 International experience

№	Country	Product	Processing methods
	Scandinavian countries, England and the USA		Waterproof plywood or wood board based on epoxy resin
	England and FRG		Wooden formwork covered with synthetic varnishes and films to protect against moisture
	USA	Formwork	To protect the formwork, a nylon and Relin coating is used.
	Germany		Steel and aluminum from stamped and bent profiles, metal sectional formwork
	Russia		Trough-shaped shields with one or more stiffeners for welding
	2000's USA		Formwork made of plastic, and in some cases - "dead" or "permanent" formwork in the form of cladding panels made of water-proof cardboard

Conclusion: *The use of the presented formwork technologies allows* work at different external temperatures, the labor productivity of the formworkers increases by 3-5 times, the prevailing wear resistance. The level of organization and technology for performing concrete, reinforcement and formwork works in foreign countries provides structures made of monolithic reinforced concrete with good technical and economic indicators.

The development of the construction industry involves the development not only in the field of unification and typification of construction industries to increase the efficiency and speed of construction of various objects, but also in the field of innovative technologies and materials, the development of construction machinery and equipment, all together this should ensure the safety and reliability of not only individual structures, but the entire building as a whole.

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MAINLAND GLACIATION AND CONDITIONS FOR FORMATION OF EXARATION RELIEF IN THE TERRITORY OF THE BALTIC SHIELD

Skuf'in Pyotr Konstantinovich
Doctor of Geological and Mineralogical Sciences, Leading Researcher

Chuvardinsky Vasiliy Grigor'yevich
Candidate of Geological and Mineralogical Sciences

Geological Institute of the Kola Scientific Center
of the Russian Academy of Sciences
Apatity, Кгыышф

Annotation. The hypothesis about the absence of a powerful multi-kilometer ice sheet on the territory of the Baltic Shield is discussed. It is believed that in the Quaternary period, the glacier plowed up powerful strata of crystalline rocks on the shield and spread their boulders thousands of kilometers. The article analyzes the arguments of supporters of the concept of continental glaciations. Modern studies have shown that the bottom layers of glaciers do not participate in the general movement of ice masses, and there are no moraine layers at their base. As for the exaration relief, "curly rocks", "sheep's foreheads", fiords, lake basins, finite moraine ridges, etc., their origin is associated with neotectonic processes, large vertical and horizontal movements of blocks of crystalline rocks, shallow and large scale scaly thrust faults.

Keywords. Baltic shield, glaciation, exaration relief, scaly thrust faults.

Introduction. In the middle of the XIX century, a group of naturalist scientists (J. Charpentier, L. Agassitz and others), in an attempt to substantiate the reasons for the accumulation of boulders of crystalline rocks on the plains of Europe, put forward a hypothesis about powerful continental glaciation in the Quaternary period in northern Europe, Asia and America. The works of the German geologists A. Penck and E. Brueckner on the Alpine cover glaciers and "moraine formations" of the r. Danube - formed the basis for the periodization of the Ice Ages: Günz, Almond, Riss, Würm.

Subsequently, the supporters of this hypothesis (O. Torrell, A. Geiki, and others) argued that the glaciers of Scandinavia actively formed the

so-called exaration relief, plowing lake basins, deep fjords, furrowed and polished "sheep's foreheads", "curly rocks" and other "glacial" forms of relief. Since then, the number of publications based on the glacial hypothesis has amounted to many thousands.

However, in parallel, the greatest naturalists Ch. Darwin, Ch. Lyayel, R. Murchison, A. Keyserling put forward a drift theory of the formation of boulder accumulations in the Northern Hemisphere due to the spread of boulders by floating ice during transgressions of sea basins. During the war, Professor I.G. Pidoplichko, as part of the active army, examined all the known "glacial" deposits in the Alps.

In his works, he argued that all these "glacial" constructions of German scientists and their followers are deeply mistaken and based on self-hypnosis and a kind of mass hypnosis. In the 50-60s of the XX century, many domestic geologists (A.I. Popov, I.D.Danilov, R.B. Krapivner, P.P. Generalov, etc.) came to the conclusion that the northern territories of Europe and Siberia were not subjected to continental glaciations, and thick strata of boulder loams accumulated as a result of transportation of boulder material by icebergs and fast ice floes. As a result, two points of view coexist in the scientific world on the issues of continental glaciation in Z. Siberia and the European North - "glacial" and "marine". However, the "exaration relief" of Scandinavia and Canada until recently was considered indisputable proof of the inviolability of the main prostates of the glacial theory.

Postulates of the "glacial" theory and the results of drilling out modern ice sheets. University and academic scientists, united in scientific and "glacial" schools, constantly refer to the cover glaciers of Antarctica and Greenland, which, in their opinion, did a great job of transforming the ancient surface of platforms and crystalline shields. It is believed that the very existence of these mighty glaciers testifies to the inviolability and fidelity of the "glacial" doctrine, and that in the Quaternary period, such glaciers plowed up and carried away from the Baltic shield strata of crystalline rocks up to 200 m thick and smashed rocks and boulders of bedrock for thousands of kilometers, dragged hundreds of kilometers huge rejects.

However, to date, the dynamics and patterns of movement of cover glaciers throughout their section have been studied by the works of glaciologists, geologists, drillers and geophysicists. Of unique importance are the results of the through - to the basement, drilling out of the continental glaciers of Antarctica and Greenland, obtained under International projects. It turned out that instead of strata of moraine-containing ice, completely filled with huge blocks and boulders (which is usually depicted in diagrams and

figures in textbooks on General and Quaternary geology), only inclusions of sandy-loamy are recorded in the continental ice. Even in the bottom parts of glaciers, where it is customary to place a powerful bottom moraine filled with huge blocks and boulders (for example, in the schemes of V.M.Kotlyakov and N.V. Koronovsky), only small lenses and clots of clay and sandy loam matter are recorded, yes rare sandy grains. These mineral inclusions are mainly represented by volcanic ash, aeolian dust of distant deserts, rare inclusions of fine terrigenous matter, as well as spores and plant pollen. Glaciologists have also established that the bottom layers of the cover glaciers (according to the canons of glacial theory and must perform all geological work) do not participate in the general movement of ice masses, they lie in place as a dead weight for hundreds of thousands of years, protecting the underlying rocks from denudation. Moreover, the cover ice preserves large paleotectonic lakes, with their relict, very ancient water, and protects them from the notorious glacial plowing out.

Origin and mechanism of formation of textbook-exaration relief. Based on almost fifty years of geological work in the Kola-Karelian region, V.G. Chuvardinsky resolutely opposes the generally accepted doctrine of enormous Ice Ages, the cover glaciers of which, plowing the bedrock of the glacier bed, moved huge boulders and kilometer-long rock outcrops and moved southward, covering Europe and North America with the cover glaciers up to 3 km thick. In his works [3,4,5], he analyzes the arguments of supporters of the concept of continental glaciations, which ascribes the role of an active relief-forming factor to the powerful glaciers rapidly advancing on Europe.

Glaciological studies on the continental glaciers of Antarctica and Greenland have shown that the bottom layers of ice are practically motionless, and they do not produce any "plowing out" of the glacier bed - all movements in the glaciers occur higher as a result of viscous-fluid sliding of packets of ice plates along intraglacial cleavages. The bed of mountain-valley glaciers keeps the primary rock surface, soil layers and even the grass cover completely intact under the moving ice masses.

And the bed of the Greenland and Antarctic huge glaciers is generally mothballed for hundreds of thousands of years, and ice-kilometer thick ice calmly glides over this bed without affecting it. The modern researcher of the glaciers of Antarctica D.Yu. Bolshiyanov concludes: "... The glaciers of the cover type are not able to actively transform the continental bed" [1].

**Fig. 1. Tectonic formation of "sheep's foreheads"
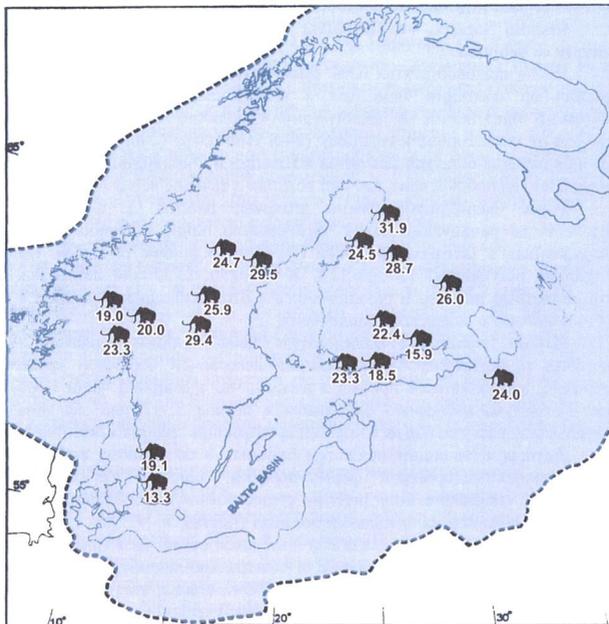in the Precambrian granodiorites, in the process of neotectonic
growth of granite domes**

**Fig. 2. Locations of fossil remains of mammoths in Fennoscandia
during the last (Würm) ice sheet (age 26000-10000 years)**

As for the exaration relief, "curly rocks", "sheep's foreheads", fiords, lake basins, finite moraine ridges, etc., V.G. Chuvardinsky connects all these formations with neotectonic processes, vertical and horizontal movements of rocks, small- and large-scale scaly thrust faults (Fig. 1).

The materials of the 2014 Geological Meeting in Lund (Sweden) devoted to the problem of glaciation in Scandinavia are presented in the last article by D.Yu. Bolshiyanov [2]. The final communiqué says: "... The latest geographic, geological and botanical studies indicate the absence of a continuous cover glacier on the Scandinavian Peninsula during the last glacial maximum. Instead of the cover glaciers, small ice domes developed in these territories, which could not actively mechanically influence the ice bed."

New literary data on paleontology, paleobotany and Quaternary climatology cast doubt on the presence of powerful continental glaciation even in the citadel of the adherents of the "glacial" theory - in Scandinavia. Numerous publications point to permanent finds of mammoth remains where, according to the "glacial" theory, the thickness of the ice in the Würm reached 4 km (Fig. 2).

Numerous radiocarbon dates in the Würm of mammoth remains (26-11 thousand years old) indicate the comfortable living conditions of these voracious animals in the lush river valleys of Finland and Norway overgrown with lush vegetation. Modern researches shows that the climate of Scandinavia in the Würm was colder and more continental than the modern one, but on the whole is close to the modern climate of Siberia, and forest-tundra steppes with permafrost in the basement and lush vegetation in river valleys occupied vast territories in Europe, including in Scandinavia.

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THE ROLE OF YOUTH IN DEMOGRAPHIC POTENTIAL IN THE FAR EAST[1]

Sidorkina Zinaida Ivanovna
Candidate of Geographical Sciences, Leading researcher,
Pacific Institute of Geography, Far Eastern Branch of the Russian Academy of Sciences

Abstract. The state of demographic potential in the Primorsky Territory, the most numerous in the Far East by the number of inhabitants, is considered. Stimulating the birth rate ensures an increase in the share of young people in the region. The problem of migration of young people associated with obtaining education in the central universities of the country and abroad with the intention to find application of their knowledge in other regions and foreign companies is identified. Geographical distance from the leading scientific and educational centers of Russia – indicate the need for changes in the availability of higher and secondary special education for young people in the Far East.

Keywords: Far East, demographic potential, factors of youth migration

The state of the state's human capital depends on two interrelated factors: demographic potential and its quality. In recent years, decisions aimed at regulating demographic and migration processes in the Far Eastern Federal District have been repeatedly taken at the state level. In this regard, the appeal of the authorities to this problem, the development and implementation of state programs of the corresponding orientation is quite natural. But despite this, the population in the region continues to decline. The steady trends of demographic degradation and the low level of socio-economic attractiveness of the region indicate that the efforts made so far do not change the current situation [1, 5, 6].

The lack of state interest in high-quality labor potential may worsen, and the creation of long-term prerequisites for improving the competitiveness of household members in the labor market is possible through investments in youth education and health [2]. Analyzing the dynamics of the age

composition of young people, the current levels of fertility and mortality of the population that form its composition, the task was to assess the quantitative potential of future settlements in the Far Eastern territory.

What is the demographic situation, we will show on the example of the Primorsky Territory, the most numerous among the Far Eastern subjects of the federation. Primorsky Krai ranks first in terms of population in the Far Eastern Federal District-23.2% of the total population. According to estimates, as of January 1, 2021, 1902.7 thousand people permanently lived in the Primorsky Territory, with a predominance of the urban population. If we estimate the change in the number of inhabitants over the past decade, the decrease by 51.7% was due to migration outflow and by 48.3% to natural decline [3].

In the Primorsky Territory, the significant excess of the number of women over the number of men, which is typical for the population of the whole of Russia, continues, now from the age of 49 (at the beginning of 2009-from 41). A noticeable drop in the number in the age structure is observed in the group of 15-19 years (less than 1.5 times, compared to 2009, in boys and 1.6 times in girls) and 20-24 years (1.5 times in boys and 1.8 times in girls) [4].. As a result of the catastrophic decline in the birth rate in the 1990s. Due to the increase in the birth rate in recent years, there has been a tendency to increase the number of children in the age group of 0-4 years. Population under working age was in 2009 – 306202 pers, 2019 – 340576 people. If we consider the changes in the main age groups over the past 9 years, the number of working-age people decreased by 12.7 %, and the number of those younger than the working-age group increased by 11.1 %. The proportion of children born to women aged 25 to 35 years increased from 52.3 % in 2009 to 60.4 % in 2018, and in women over 35 years from 9.5 % to 18.3 %, respectively [4]. In recent years, the proportion of repeated births has increased, the main part of which falls on women over 25 years old. Such an economic factor as the maternity capital received at the birth of the second and subsequent child had a serious impact on the increase in repeated births. In 2007, it amounted to 250,000 rubles. The size of the maternity capital was reviewed annually. Since 2012, the Primorsky Territory has introduced the payment of regional capital – 30,000 rubles. From January 1, 2021, the payment of the maternity capital amounted to 639,431 rubles (an increase of 2.5 p). Payments of regional capital increased to 139,985 rubles. for the second child and 177,841 rubles. for 3 children, an increase, respectively (in 1.3 p. and 5.9 p.). And the size of the maternity capital, in contrast to the regional, is the same for the whole country. The increase in demographic potential is

noticeable, but its growth rate is not sufficient for the implementation of the adopted roadmaps of economic growth [3, 4]..

According to the state of the demographic situation, the region, as well as the Far East as a whole, did not go far from the post-war situation. There are some opportunities to increase the labor potential within the region. In such demographic conditions, there is a need to review the terms of training of young people in school and in professional institutions, including universities. In particular, it suggests reducing the duration of education in general education schools to 10 years [3]. To reduce the duration of training, it is possible to use more effective forms of "family education", external studies, and distance learning for schoolchildren. Distance learning is especially important for the former Baltic republics, Ukraine, and Moldova, which declared war on the Russian language.

Currently, there are contradictory trends in the field of domestic higher education [6]. On the one hand, the emphasis is placed on academic mobility, the openness of universities, and the attraction of foreign students. On the other hand, the outflow of talented young people to foreign universities in various fields and levels of training is increasing. There is also a third trend – internal educational migration, which is associated with the admission of graduates from the subjects of the Russian Federation to central universities. In this regard, regional universities are experiencing great difficulties, which face difficulties in recruiting students in their areas of training. The demographic base has decreased, and school leavers have become fewer due to the low birth rate. All this affects the personnel policy in general, since graduates who studied at central universities practically do not return to their "small homeland", which ultimately affects the quality of regional intellectual capital. A special role is played by how strong regional universities are to attract applicants from their own and other regions, foreign students with a high quality of education. It makes sense for graduates of the Far East to provide training of specialists required in the Far Eastern labor market for quotas in the leading universities of the country, as it has already been done for some autonomous entities.

Considering the age profile of child migration, it is impossible not to notice the highest level of migration at the age of 14-15 years [2]. The "difficulties" created with the admission of Far Easterners to central universities, in the form of inflated tasks on the Unified State Exam, the approximately equal cost of education in the Far Eastern and metropolitan universities, encourages parents to send children as early as 14-15 years old to the European part of the country in order to ensure their further admission to the selected "top" university. There is only one conclusion:

in far-eastern universities, education should be fully budget-funded, if the country needs specialists in the region who will work in familiar natural and social conditions.

However, it is much cheaper to get a higher education under a contract in the Russian leading universities, in the capital universities the price is about 400 thousand rubles a year (about 7 thousand dollars). In Russia, you can also give your child a paid school education. Most schools operate in large cities. The price for a year of training is from 60 to 150 thousand rubles [7].

The citizens of the CIS countries who speak Russian, are familiar with the Russian culture, and are ready for integration and socialization are more interested in Russian educational institutions. This makes it expedient to expand the legal regulation of the status of educational migrants, guarantees of their education, and other issues, including within the framework of bilateral agreements between Russia and these countries [8].

Of particular interest to Russia in recent years is the educational sphere. Young people are focused on studying abroad. Eastern wisdom says: "If you want to defeat the enemy, bring up his children." The dynamics of the international market of educational services, the capacity of which, according to experts, is 50-60 billion dollars. It is characteristic of such leading recipient countries, which accept more than 70 % of migrants for training, as the United States, Great Britain, France, Germany, Australia, China, Canada and Japan [6]. The last four of these countries enjoy priority among the Far East.

Russians are ready to invest a lot of money in their children with an eye to the fact that they will remain abroad. According to the Gallup Research Center, about 20% of citizens would like to emigrate [7]. In this regard, the appeal of the authorities to this problem, the development and implementation of state programs of the corresponding orientation is quite natural. But despite this, the population in the region continues to decline. The steady trends of demographic degradation and the low level of socio-economic attractiveness of the region indicate that the efforts made so far do not change the current situation [6].

According to the Gallup Research Center, about 20% of citizens would like to emigrate [7]. More than 40% of respondents aged 15 to 29 expressed a desire to leave their homeland forever. Parents feel political and economic instability, so they want to ensure that their children can choose a country for a longer life. In adolescence, it is easier to adapt to a different cultural environment. As a result, the demand for foreign boarding schools is growing even more than for higher education [7].

With regard to the migration of children, important issues of international regulation are the protection of children's rights, based on international legal norms. Moreover, not only those who leave separately from their parents, but also those who live there with their parents who have Russian citizenship [8]. The issues of adoption of Russian children by foreign citizens are relevant. Despite the fact that the demographic potential is being degraded in the country, children were taken out of the country for a long time. Moreover, with the consent of the Russian state, without the necessary legal protection and further control over the adopted children. Until they reach the age of majority, they are essentially considered Russian citizens. In general, adoption was allowed with a certain diagnosis, but getting a conclusion with a "necessary" diagnosis was not a problem for adoptive parents. The provisions on possible adoption are not universally the same for foreign and Russian adoptive families. In the context of globalization, not only the general characteristics of international migration processes are changing, but also the conditions that determine them.

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MARKET OF PLASTIC WASTE IN KAZAKHSTAN[1]

Zhaparova S.B.
Candidate of Technical Sciences, Dean of Faculty
Shokan Ualikhanov Kokshetau State University
Bayazitova Z.E.
Candidate of Biological Sciences, Associate Professor
Shokan Ualikhanov Kokshetau State University
Bekpergenova Zh.B.
Senior Lecturer
S. Seifullin Kazakh AgroTechnical University

Abstract. This article examines the problems of the plastic waste market and the main factors affecting the recycled plastic waste markets.
Keywords: plastic waste, disposal and recycling of plastic waste, secondary raw materials from plastic waste.

Every year around the world, billions of tons of plastic are burned or dumped into landfills, which in turn is a waste of valuable resources. In Kazakhstan, millions of tons of plastic waste are generated annually, only a small part of about 10% is recycled. According to article 351 of the Environmental Code of the Republic of Kazakhstan [1], plastic waste is classified as waste prohibited for burial at landfills, but is classified as secondary raw materials. Separate collection and recycling of this plastic waste will bring significant economic and environmental benefits to Kazakhstan.

The above figures, in comparison with world experience, allow us to conclude that Kazakhstan is critically lagging behind developed countries in terms of sampling and recycling of waste (10% versus more than 60% in Western Europe, USA, Japan). However, positive trends have been observed in the past few years. First, the collection rate is increasing. Secondly, the waste collection and sorting system is changing. Separate collection, which is the main source of raw materials in developed countries

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and can significantly improve the business economy, in Kazakhstan has practically no effect on the market.

Currently, there are about 130 enterprises in the Republic that sort and process waste, producing more than 20 types of products: plastic, metal, wood, glass, paper, rubber crumb and rubber products [2]. A significant amount of separately collected plastic is not actually recycled: almost half of the plastic waste collected in Kazakhstan is exported and the final processing of this plastic waste is largely unknown. Finding and promoting examples of European manufacturers using recycled plastics to make new products can stimulate greater use of recycled plastics as raw materials in local markets and reduce the need to export material for recycling.

There are certain barriers that limit the use of plastic waste in the manufacture of new plastic products.

Technological barriers related to the quality of the raw material were identified, including the presence of mixed types of plastics and other contaminants in the collected waste. Indirect technological barriers include a lack of design for the recycling of plastic products and a lack of diversification of existing recycling technologies, which are currently mainly focused on packaging waste.

Legal barriers stem from the fact that plastic waste is traded internationally. Inharmonized systems across geographic regions and the existence of an illegal waste market are major obstacles that need to be addressed in legislation.

Barriers were also identified in relation to the market / value chain / logistics aspects. Another problem that can hold back investment is the volatility of the price of plastic waste versus virgin plastics.

Knowledge gaps identified are addressed through interviews with relevant stakeholders, where possible and relevant.

Kazakhstan's waste management policy is aimed at developing the waste processing sector with the production of products from secondary raw materials. This policy is reflected in the Concept for the transition of the Republic of Kazakhstan to a "green economy", approved by the Decree of the President of the Republic of Kazakhstan dated May 30, 2013.

There are dozens of enterprises in the country for the disposal and processing of various types of raw materials: paper, plastic, glass, waste tires, electronic, medical, mercury-containing and other types of waste. Table 1 shows complete information on technologies for processing plastic waste in the context of areas used in the Republic of Kazakhstan.

Table 1– List of technologies for waste processing in the Republic of Kazakhstan

№	Waste type	Regions	Product name
1	Plastic (PET containers, PET packaging, plastic)	Akmola	Recyclable materials
		Aktobe	Manholes, rings for engineering networks
		Almaty	Production of recycled PET granules
		Atyrau	Recyclable materials
		East Kazakhstan	Production of sanitary ware - polyethylene polypropylene pipes and fittings for them
		West Kazakhstan	Production of hatches, tiles and tiles made of polymers, sewer hatches, paving and facing tiles.
		Karaganda	Sewer hatches, Recyclables, PET flakes
		Kostanay	Geotextile production, Sorting and recycling
		Kyzylordinskaya	Paving slabs, roof tiles
		North Kazakhstan	Recyclable materials
		South Kazakhstan	Recyclable materials
		Turkestan	Staple fiber
		Nur-Sultan	Ecowool
		Almaty	Plastic crumbs, non-woven materials, furniture, products, paving slabs
2	Polyethyl-ene	Akmola	Recyclable materials
		Atyrau	Recyclable materials
		East Kazakhstan	Production of polyethylene products
		Zhambyl	Release of siding and sewer pipes
		West Kazakhstan	Recyclable materials
		Karaganda	Recyclable materials
		Kostanay	Geogrid, manholes, insulating materials
		North Kazakhstan	Polyethylene products
		South Kazakhstan	Recyclable materials
		Nur-Sultan	Recyclable materials
		Almaty	Plastic products

As can be seen from table 1, almost all organizations from the listed regions of the Republic of Kazakhstan are engaged in the processing of PET waste into recyclable materials (granulate), which can be used in the manufacture of products with reduced consumer properties (fibers, including non-woven and geosynthetic, tapes, sheets, etc. products for technical use), including in the Akmola region, where only one enterprise "LS Kokshetau" in Kokshetau is engaged in this activity. But it can also be noted that organizations located in West Kazakhstan LLP "Antey" and Kyzylorda LLP "Ibraikhan and K-LTD" regions and the city of Almaty Rocket Plastic use recycled PET in their own technological cycle for the production of final products based on it, such as production of building materials. In Kostanay, it is also planned to launch the production of building materials from plastic waste. Despite the quality and environmental friendliness of polymer sandy building materials in Kazakhstan, the demand for these materials is very low and are individual requests. Large construction companies prefer traditional building materials made from cement, sand, etc.

The main factors affecting the markets for recycled plastic waste:

✓ volatile dynamics of prices for primary materials;

✓ stagnation of demand for final products (processed products);

✓ changes and improvements made to environmental legislation;

✓ lack of raw materials for processing.

The latter factor is a key obstacle to the development of the plastic waste disposal market. The inability to ensure stable supply volumes, without which it is impossible to establish an effective business, is a consequence of the lack of an effective plastic collection system and a lack of sorting capacity. In addition, until recently, there were no economic and legislative incentives to increase the volume of recycling waste. At the same time, the beneficial use of waste is, in fact, the only solution to the "waste problem", since the flat placement of waste as a way of their circulation is in a critical state. Waste incineration (even with the production of energy) also cannot be considered as an alternative to the return of useful fractions into circulation.

At present, the situation in the field of waste management in the Republic of Kazakhstan is fundamentally changing, the last few years have become the main ones for this area: the priority of waste recycling has been designated, a development strategy has been developed, the legislation has been radically revised. In fact, the formation of a new industry has begun. The reform includes:

1) preparation and approval of territorial waste management schemes in each region of the country;

2) selection of regional operators who will be responsible for the entire waste management cycle, including the creation of the necessary infrastructure;

3) setting the tariff for the region for the waste management service;

4) creation of modern high-tech complexes for waste disposal.

In parallel with these measures, it is planned to gradually introduce separate waste collection in the regions.

The plastic waste market is very complex: it includes many different types of participants with very different and often opposing goals and often with direct relationships only with participants at the same step in the value chain. From a technical point of view, it includes many sometimes interchangeable but often mutually exclusive polymers, and market conditions are largely dependent on a completely external factor: the price of oil.

To facilitate analysis, the market has been broken down into submarkets: markets between two interrelated types of participants in the value chain. The purpose of the market analysis is to identify factors hindering the development of the plastic waste disposal market in Kazakhstan. Where these barriers affect multiple participants and types of participants, they can be characterized as hot spots. Identifying hot spots allows for the formulation and analysis of policies that can be used to address these hot spots in order to free up the market and the flow of recycled plastic through it.

The recycled plastics market is facing a number of technical and socio-economic challenges that hinder an increase in recycling volumes.

One of the key problems is market fragmentation and lack of communication between the parties. The plastic market is very complex and cannot be described as a "single market". Plastic waste comes from several very different waste generators (eg municipal, industrial, agricultural, etc.), and "plastic" is a generic term for many chemical polymers (eg PP, PE, PET, etc.). The use of composites composed of several types of polymers and additives further complicates the recycling process.

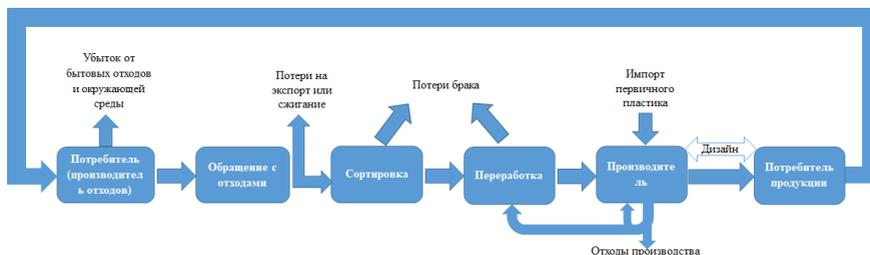The value chain for recycled plastic is shown in figure 1.

Figure 1. Value chain for plastic waste recycling

Each arrow in the value chain represents a relationship between two parties and thus represents a submarket. The supply and demand issues of these submarkets depend on the number of players, substitution opportunities and legal requirements.

The recycled plastic market includes several sub-markets in the value chain. Plastic products and raw material requirements are also very diverse. There are a number of different polymers with different properties, which are sometimes mixed and added with additives to achieve specific properties. This means that quality requirements are not only a matter of high or low quality, but also a matter of using the right type of plastic for the right type of product.

There are many challenges associated with recycling mixed plastic waste from households and recycling centers, but this fraction can also have great potential for increasing recycling volumes. However, this may be associated with higher costs than incineration, since the separate transportation of light and bulky waste is expensive and the automatic sorting technology requires significant investment.

The lack of supply and demand for recycled plastic was highlighted throughout the value chain. This is likely due to the very fragmented nature of the market.

Many stakeholders point out that increased collaboration in the value chain is key to increasing plastic recycling.

Developing the correct recycled plastic specifications for a specific product can be costly. To make this investment, the manufacturer must be confident in the supply of the specified plastic. This is an ongoing problem.

Many stakeholders point to the development of plastic products for recycling as an important opportunity to increase plastic recycling. Particularly problematic are articles composed of several plastic polymers.

The diverse nature of the market means that measures to increase plastic recycling must also be varied.

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MIGRATION PROCESSES IN THE COASTAL ARCTIC REGIONS OF THE FAR EAST[1]

Ushakova Valentina Leonidovna
Research Officer
Pacific Geographical Institute of the Far Eastern Branch
of the Russian Academy of Sciences

Abstract. The structural and territorial trends of the migration dynamics of the coastal Arctic regions of the Republic of Sakha (Yakutia) are considered. Based on the statistical analysis of migration processes for 2010-2018, the features of their ongoing changes are revealed: the main reason for the reduction in the resident population is the migration outflow; in the structure of migration flows, the share of intraregional migration is increasing, while the outflow of the rural population to the urban area remains; the share of interregional migration is decreasing; in the age structure of migrants, the flow of the working-age population is predominant; young people are actively leaving coastal territories, which in the future may have serious consequences, as this age group is of great importance in the demographic and economic development of the Arctic regions of the Far East.

Keywords: migration processes, age structure of migrants, coastal Arctic regions, the Far East.

Further development and increase in the level of socio-economic development of land areas belonging to the Arctic zone of the Russian Federation is one of the priority directions of state policy from the point of view of ensuring national security. However, it is impossible in the conditions of an insufficiently favorable demographic situation, which has developed due to the migration outflow, which significantly exceeds the rate of natural population growth.

On March 5, 2020, the President of the Russian Federation approved a new edition of the Fundamentals of State Policy in the Arctic for the period up to 2035, which defines the goals and objectives of the development of

the Arctic territories for the next 15 years [8]. The main instrument for the implementation of state policy should be a new development strategy for the Arctic zone of Russia [2]. Among the main threats to the national security of the Arctic territories, there is a decrease in the resident population. In the context of the growing geopolitical and economic significance of the Arctic zone for Russia, it is especially important to strengthen its demographic potential. And for the Far Eastern Arctic regions, this is important, also from the standpoint of ensuring the country's national security in its strategically important northeastern borders, and the development of the economy of the region with a huge natural resource potential. Other decisions were made to improve the demographic situation - in the country as a whole, in the Far East, in its Arctic territories - but they turned out to be insufficiently effective. It can be assumed that the measures taken do not fully solve the problems that have accumulated in this area. And they are based not only on the lack of financial resources in the country to solve them, but also on the lack of understanding of the depth of these problems.

The coastal Arctic regions of the Republic of Sakha (Yakutia) include 5 municipal districts of the Republic of Sakha (Yakutia), directly adjacent to the Arctic Ocean - Allaikhovsky, Anabar national (Dolgan-Evenki), Bulunsky, Nizhnekolymsky, Ust-Yansky [7]. The demographic features of the regions under consideration are determined by the small population (26 thousand people, or 38.4% of the total population of the Arctic regions of the Republic of Sakha (Yakutia), uneven distribution over the territory (36.9% of the area of the Arctic regions of the republic).

The population of the coastal Arctic regions of the Far East, like all regions of the Russian Arctic, was formed to a large extent "according to the needs" of the region being developed. According to Rosstat estimates, the resident population as of January 1, 2019 was 25963 people (of which the urban population was 13,061 people, the rural population was 12902 people). Over the period from 2010 to 2018, it decreased by 2362 people, or 8.3% (tab. 1). The greatest losses of the entire population were noted in Ust-Yansky (12.8%), Allaikhovsky (11.2%). A slight increase in the population is noted in the Anabar national (Dolgan-Evenk) region. This is the only coastal region that has a positive dynamics of socio-economic development [10]. The population in the Anabar region is growing steadily (the only one of the Arctic regions where population growth is observed), the indicators of its economic development are improving, which is associated with the work of three diamond mining enterprises:Anabarsky MPP OJSC AK "ALROSA", OJSC "Nizhnelenskoe", LLC "Almazy Anabara". The age and sex structure of the district's population is distinguished by a high pro-

portion of children and adolescents (32%, with an average republican level - 24.9%) and a low proportion of persons of retirement age (6.9%, with an average republican level - 17%) [2]. In this regard, it can be assumed that positive demographic processes will be observed in this area in the near future, despite the small population (3597 people, 2018).

Table 1
Population dynamics in Arctic coastal regions
Of the Far East in 2010-2018, people [5]

	Year		Population change for 2010-2018	
	2010	**2018**	**people**	**%**
Coastal arctic regions including	28325	25963	-2362	-8.3
Allaikhovsky	3050	2708	-342	-11.2
Anabar	3501	3597	+96	+2.7
Bulunsky	9054	8340	-714	-7.9
Nizhnekolymsky	4664	4290	-374	-8.0
Ust-Yansky	8056	7028	-1028	-12.8

The decline in the population continues, it is taking place against the background of positive natural population growth, which to varying degrees compensates for the migration outflow in individual Arctic regions.

In the coastal Arctic regions, a number of problems have developed that negatively affect their socio-economic development. One of them is the migration loss of the population, which amounted to 3467 people in 2010-2018, which is 2.8 times higher than the natural increase. The greatest migration losses are noted in the Ust-Yansky region (1356 people, or 39.1%), Bulunsky region (795 people, or 22.9%).

Negative migration adversely affects the demographic situation, which manifests itself in a decrease in the birth rate, an aging population, and a decrease in the population in the settlements of the territories under consideration. As a consequence, according to A.I. Pilyasov, the outflow of the population "means a decrease in cultural and intellectual diversity in villages and towns", "a decrease in the total population means a decrease in the number of talented, creative people" [4, p. 294]. Moreover, the negative balance of migration, notes V.N. Lazhentsev, "reduces the hope that these territories will be support bases for the development of the North" [1, p. 44].

In the Arctic territories, the following types of migration are distinguished: intraregional migration (rural population to cities, population movement to more favorable territories of the Russian Federation, nomadic migration of indigenous peoples, etc.), outflow of young people to promising regions, departure of persons of retirement age to favorable climatic zones, rotational method of labor activity.

The coastal Arctic territories are characterized by high migration activity, which increased by 1.5 times over the period under consideration. Among those who left in 2018, 64% of migrants move within the republic (2010 - 51.8%), 33.3% leave for other Russian regions (2010 - 47.0%) (tab. 2), more favorable in natural and climatic terms.

Table 2

Distribution of migrants in the coastal Arctic regions by direction of movement (%) [2]

| | Arrived | | | | | |
| | Intra-regional migration | | Interregional migration | | International migration | |
	2010	2018	2010	2018	2010	2018
The Republic of Sakha (Yakutia)	64.5	63.0	29.8	29.6	5.7	7.4
Coastal areas	40.7	61.5	56.8	37.8	2.5	0.7
	Left					
	ntra-regional migration		Interregional migration		International migration	
	2010	2018	2010	2018	2010	2018
The Republic of Sakha (Yakutia)	43.3	59.0	55.1	39.1	1.6	1.9
Coastal areas	51.8	64.0	47.0	33.3	1.2	2.7

The dynamics of migration processes largely depends on economic factors. The growth or decline of the population, the formation of the demographic potential depend on the scale of economic activity, the specifics of production and the prospects for economic development. The determining process in the dynamics of population changes is employment, which includes the need for labor resources and the nature of their use. In the northern regions, including the coastal Arctic regions, an unfavorable

combination of natural and climatic conditions with low inhabitedness is one of the obstacles to creating a permanent population. Throughout the entire period of the development of the northern and arctic territories, economic interests were the basis for the policy of forming the population and labor resources. Despite the permanent population in the north, its own demographic base is not enough to provide the branches of the economy with labor resources. The existence of settlements is associated with the development of deposits, the use and depletion of the raw material base of economic activity. This contributed not only to the high mobility of the population forming on this territory, but also to the mobility of the settlement structure being created, which presupposes the creation and subsequent disappearance of both small and larger settlements. The long-term intensive influx of the population significantly influenced the demographic situation.

The age structure of migrants in the Arctic coastal regions has a number of features. The share of children and adolescents is higher here. In Allaikhovsky (22.0%), Bulunsky (20.5%), Anabar (20.0%), this age group exceeds the level in general for the Arctic regions (14.5%) and the average republican level (13.7%) (tab. 3).

Table 3

Age composition of migrants in the Arctic regions in 2017, % [3]

	Age of migrants					
	younger than able-bodied	able-bodied	older than able-bodied	younger than able-bodied	able-bodied	older than able-bodied
	Arrived			Left		
The Republic of Sakha (Yakutia)	13.7	79.4	6.9	13.5	77.0	9.5
Coastal districts	17.5	73.4	9.1	16.5	72.2	11.3
Allaikhovsky	22.0	73.0	5.0	10.7	81.8	7.5
Anabar	20.0	76.5	3.5	17.4	76.1	6.5
Bulunsky	20.5	74.9	4.6	17.3	72.5	10.2
Nizhnekolymsky	19.3	69.1	11.6	16.0	68.1	15.9
Ust-Yansky	13.0	70.6	16.4	15.3	66.8	17.9
Arctic regions	14.5	77.9	7.6	16.0	73.8	10.2

In the structure of the retired persons of working age occupy over 70%, and in some regions and higher: Allaikhovsky - 81.8%, and taking into account persons under the working age - over 90%. There is a destruction of the labor potential of the territory accumulated over many years, which meets the needs of the country's economy in raw materials and foreign exchange resources. In the coastal areas, more people over the working age drop out - Ust-Yansky District (17.9%), Nizhnekolymsky (15.9%).

For the Arctic territories, the problem of not only the outflow of the able-bodied population, but also of young people who are actively leaving these territories, is very relevant, which in the future may have serious consequences, since it is this age group that is important in the demographic and economic development of the Arctic territories of the Far East. There are three main factors in motivating youth migration: personal and family reasons, migration for education in a large city, and labor migration. The main part of the migration flows is made up of young people aged 16-29, heading to cities for education, profession, employment, and family creation [6].

The high potential of youth migration mobility is associated, on the one hand, with the specifics of the Arctic regions themselves - harsh natural and climatic conditions, remoteness from the center, single-industry development of the economy, and on the other hand, with the peculiarity of youth as the most mobile social group ready to implement ambitious life tasks. An analysis of the migration flows of the Arctic regions showed that in most of them there is a negative migration increase in young people, with the exception of the Allaikhovsky and Anabar districts. The development of the Arctic regions largely depends on the perception of the young generation of their own prospects, on the choice to continue living in this territory. This factor for the Arctic territories remains insufficiently studied.

According to Rosstat data on the distribution of migrants according to the circumstances that caused the need to change their residence, the following four main reasons for the migration of the population from the Arctic regions of the Republic of Sakha (Yakutia) in 2018 are noted: personal and family nature - 26.1%; in connection with studies - 23.9%; in connection with work - 12.7%; return to the previous place of residence - 4.5% [3].

Thus, the identified migration trends in the coastal Arctic territories necessitate the study of factors affecting the migration activity of the population. The prospects for the socio-economic development of this strategically important territory of the Far East depend on the success of measures aimed at reducing the migration outflow of the Arctic population.

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NOTES

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