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MEDICAL SCIENCES

INNOVATIVE LEARNING TECHNOLOGIES IN THE MATHEMATICAL PREPARATION OF BACHELORS IN TECHNICAL AREAS AND IMPROVING THE QUALITY OF EDUCATION

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Abstract. In the work, groups of goals for teaching mathematics are formulated as the planned result of its study at a university. In accordance with the objectives, the needs to improve the quality of mathematical and professional training of bachelors in technical areas are identified. The potential of the application of innovative teaching technologies in solving problems of a professional orientation in the conditions of prolonged teaching of mathematics is described. An example of the use of additive technologies in the implementation of projects in the youth educational forum is considered.

Keywords: research, project, prolonged training in mathematics, content of instruction, interdisciplinary integration, learning technologies, learning objectives, quality

Currently, engineering is one of the leading factors in socio-economic development. Mathematization and informatization of production, the need to increase the efficiency of the use of scientific knowledge, the rapid obsolescence of information and the need to update it in the conditions of scientific and technological progress require changes in the preparation of bachelors in technical areas.

Modern methods of solving engineering problems are based on the use of high-tech mathematical and informational methods and lie in the plane of professional research. The acquisition by students of the experience of such a study must be ensured at the university.

The question arises: how, in the conditions of the main educational program for training students of a technical university that corresponds to the federal state educational standard of higher education, can we implement conditions aimed at involving students in research using mathematical tools?

The purpose of this work is to describe innovative teaching technologies aimed at improving the quality of mathematical training in a technical university in accordance with the goals.

The ratio of the goal and the result of educational activity achieved by a certain time determines the quality of education [7, p. 19]. The leading goal of engineering education is to prepare graduates who are ready in their activity to conduct independent or collective research, go beyond the known, able to apply knowledge from different fields in an unusual situation, create and implement innovative ideas aimed at achieving the optimal result in modern conditions [2]. Achieving this goal improves the quality of mathematical training and engineering education in general.

Based on the experience in formulating goals set forth in the scientific and pedagogical literature [1], taking into account the requirements of regulatory documents, the specifics of engineering, the content and structure of the mathematics course, we distinguish several groups as the leading goals: 1) goals aimed at creating motivational and value components of mathematical knowledge ; 2) goals focused on the assimilation of fundamental knowledge, abilities, skills and methods of mathematical activity; 3) goals aimed at the formation of ways to use mathematical knowledge and methods in solving problems outside the subject area; 4) goals for the formation of readiness for self-education, for conducting independent research in solving problems of various contexts using mathematical tools; 5) goals aimed at creating readiness for reflection, to analyze the results of activities; 6) goals aimed at personal and professional development.

In accordance with the listed groups of goals, it is relevant to enrich the content of a mathematics course and improve the organization of the learning process. E.F. Zeer and E. E. Symanyuk substantiate the need for innovative education. To engage students in innovative education, the following conditions must be fulfilled: enriching the content of educational programs with practice-oriented tasks, using modern innovative technologies in the educational process, organizing independent work based on a competency-based approach, tracking learning outcomes [3, p. 8-9]. Based on the above conditions, taking into account the specifics of engineering activity, we formulate key provisions, the integration of which is aimed at achieving the goal of teaching mathematics at a technical university.

Firstly, in the preparation of modern bachelors in engineering areas of study, mathematics is studied mainly during the first three semesters. During this time, it is not possible to fully demonstrate the applied nature of the discipline under study, due to a lack of professional and interdisciplinary knowledge. In senior courses, due to the natural forgetting of the material and the lack of experience in transferring mathematical knowledge to a new situation, students have difficulties in solving interdisciplinary tasks and tasks of a professional orientation. To solve this problem, we proposed prolonged training in mathematics [8]. The essence of prolonged teaching of mathematics is that it continues after the completion of traditional teaching of mathematics, is aimed at involving students in the study and is implemented in a variable format.

Secondly, professionally-oriented content of training establishes a correspondence between content and future professional activities, increases interest and motivation for the material being studied. Solving problems with a professional context in the conditions of prolonged teaching of mathematics involves students in research and project activities. In the process of research, a need arises for the independent acquisition of new knowledge, the application of mathematical knowledge and methods of activity in new conditions, and the analysis of the results. The research experience necessary in future professional activities is acquired. In research and project activities, similar methods are used to achieve the desired result, but there is also a significant difference. A. V. Leontovich notes that in the project activity the ideas about the final product are worked out in advance. To achieve this goal, research tasks that perform a serving function are used. In research, the achievement of truth as the main product that is intellectual is valuable [6, p. 3-4].

Thirdly, the use of modern innovative technologies allows involving students in self-educational activities, partially automating the process of accounting for learning outcomes and their assessment. It is a necessary tool in solving problems of a professional orientation in the conditions of prolonged teaching of mathematics and helps to achieve the stated goals.

Consider the use of innovative technology in conducting research in the context of prolonged teaching of mathematics.

The development of distance technologies allows introducing distance learning courses into the educational process. For future technical bachelors, various types of distance learning courses in mathematics are relevant. For example, an alignment course is addressed to students to repeat basic school material and fill knowledge gaps. Students enroll in this course on their own or on the recommendation of the teacher in the

first semester. A distance course in mathematics supplements the main course and is implemented in parallel with it. A prolonged course is designed to help students solve special and professional problems through mathematical tools and is recommended after studying the main course of mathematics.

Information and communication technologies contribute to the organization of interaction between participants in the educational process. Applied computer programs are indispensable in building models of tasks of a professional orientation, when performing laborious calculations.

The use of interactive technology is changing the roles of teacher and student. The student becomes a full-fledged participant in the educational process, the source of knowledge is the personal experience acquired in an independent search, and the teacher takes the role of a mentor and organizer of the educational process.

Additive technologies for the creation and prototyping of three-dimensional objects are actively being introduced into educational activities [5]. They act as a means of increasing the level of motivation of students, as a factor in the emergence of new forms of training and the involvement of students in research activities [4], they allow solving educational, research and design problems.

When using additive technologies for students, new opportunities open up: involvement in educational research not only in the design of any parts or devices, but also in the manufacture of their layout. After that, it becomes possible to evaluate the characteristics of the device empirically. As a result, students are involved in project activities.

The student receives invaluable experience by participating in various conferences and forums. Such formats allow organizing interdisciplinary integration during the implementation of a research or project task and are based on innovative teaching technologies.

Consider the possibility of organizing project activities in an educational forum.

Organizing time. The forum is attended by several teams. Each team consists of 5-10 students of different courses with different levels of training. Participants independently distribute responsibilities among team members.

Formulation of the problem. Design and print a vehicle on a 3D printer. Conduct his test.

Design phase. Vehicle design is carried out in three stages: collecting ideas and sketching the details of the future product, creating a sketch of the vehicle, calculating the mechanical characteristics of the mathematical

model of the product. When designing a vehicle, knowledge from physics, mechanics, mathematics, engineering graphics, 3D modeling and their integration are necessary. Mathematical modeling is used to build a future vehicle model. Also, mathematical tools are used when calculating product details for stiffness and stress.

Presentation of the results. A vehicle is printed on a 3D printer and presented to the jury and tested.

Formulation of conclusions. During the design of the vehicle, experience is gained in applying integrated knowledge in the fields of physics, mechanics, mathematics, engineering graphics and 3D modeling. The student represents himself in the place of the designer.

Experience of participation in the ongoing is Reshetnev Siberian State University of Science and Technology forum on additive technologies allowed students to carry out a team project, to be in the place of a design engineer, constructor, and showed the importance of readiness to transfer fundamental knowledge to a new situation in the process of independent work.

So, summarizing the above. To prepare creative, controllable graduates of engineering areas of training, it is necessary to involve them in research and design activities to solve professional problems. Solving problems of a professional orientation in the conditions of prolonged teaching of mathematics allows you to get an educational result, in accordance with the stated goals. Remote, information and communication, interactive and additive technologies play an important role in the mathematical preparation of students in technical areas of training. They activate the cognitive activity of students and help to improve the methodology of teaching mathematics.

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USE OF SPEECH PATTERNS IN DIFFERENT FORMS OF COMMUNICATION IN THE ENGLISH CLASSROOM

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Annotation. In this study we introduce and analyse main forms of communication in the classroom associated with appropriate language and functions. Based on the goals and expected outputs of the lesson, discourse genres in the classroom quickly change from one format to another giving birth to diversity in the language instruction. Our observations and analysis outline two basic formats: teacher-learner interaction and learner-learner interaction, which will be successfully implemented through the use of appropriate language patterns in classroom discourse.

Keywords: discourse genre, teacher-led/learner-led interaction, communication discourse, monologic/dialogic instruction.

Classes are the communities employing different forms and genres of communication. There are many different genres of classroom discourse: teachers' and learners' presentations, teacher-led or learner-led discussions and debates. Discussion may focus on problem exploring or problem solving, presentation may focus on information or persuasion. Such forms of classroom communication can be carefully planned, carried out by the teacher and learners, and unplanned: they may "break out" spontaneously as well. In educational discourse the interaction evolves between teacher and learners, or learner to learner. Generally, this process is meaning-based, through which the students' language knowledge is constructing or transmitting.

Based on the goals and objectives of the lesson discourse genres in the classroom are often fairly hybrid. They quickly change from one format to another. According to their organisational efficiency and expected output we identify two basic formats: teacher-learner interaction and learner-learner interaction.

Nowadays, in the era of communicative language teaching, interaction lies, in fact, in the heart of communication. A communicative approach is essentially learner-centered. It aims to motivate the learners to learn the target language by building on and extending their knowledge and experience. [Sheils J., Communication in the Modern Language Classroom, p.1]. Through interaction - discussions, joint problem-solving tasks or dialogues, students can enlarge their language store as they produce or exchange authentic ideas, linguistic material within authentic situations. Students use all they possess of the language-all they have learned or casually absorbed in real-life context [Thornbury S., How to Teach Speaking, p.63]. Even at an elementary stage, they learn in this way to exploit the elasticity of the language.

Teacher-learner interaction: There are two formats of teacher-learner interaction:

• **Monologic instruction** - only one speaker – the teacher is involved
• **Dialogic instruction** - teacher-led discourse, jointly constructed with the class through interaction:

Monologic instruction

Monologue is the speech of one person who expresses his thoughts and feelings in a particular situation and shows his definite conclusion. Monologue is generally prepared speech. The speaker even may have the plan of his speech. Sometimes it can be unprepared as well. Of great importance are the speaker's

- logical pauses
- the speed of speech
- the gestures.

Monologic instruction in the language classroom is carried out in two slightly different formats [Ur P., A Course in English Language Teaching, p. 127]. In the first, the teacher talks during the whole lesson: *frontal education*. There is hardly any learner's contribution to the discourse. The teacher serves as a model how to think, or how to solve a problem. The learners' task is only to listen to their teacher and understand his/her information. Learners' experiences and knowledge are not important. The teacher talk is designed by subject-specific topics and argumentation. Classroom discussion can be seen as a waste of time. In the second, the teacher is mixing his/her talk with questions to the learners. She/He does not accept possible learners' initiatives to change the topic. The most important point is to transmit information to the learners. Although this format of interaction could be perceived as a dialogue, it is in fact a monologue. The questioning mainly aims at continuing the line of observation and reasoning by the

teacher. The questions demand small, reproductive answers, in one or two words by the learners. The learners' answers are only elliptical sentence fragments. The teacher avoids controversial topics. He uses the "dialogue" to control the classroom situation. Often teachers choose the frontal situation because it is a way to control the classroom and prepare the learners for upcoming tests. [Harmer J., The Practice of English Language Teaching, Pearson, Longman, 2011, p.277]

An effective oral discourse is built on language and skills and requires confidence. The thorough observation and elaboration of subject-specific materials made it possible to spot, single out classify and introduce the list of language patterns, which might be uniquely helpful for both the EFL teachers and the learners in their oral production:

Starting conversation	Putting forward arguments
• I'll start by saying that… • In the first place I would like to say… • To begin with, I would like to say…	• The main point is… • A critical aspect of….
Defining key terms	**Discussing main ideas**
• Such a process is known as a… • ….is usually defined as…	• I think it would be best to… • There are many advantages and disadvantages here. • Major considerations should be given to… • What really matters is…
Introducing points	**Generalizing**
• First… • Second… • In the first/second place… • To begin with… • Finally…	• It's generally known that… • It's a well-known fact that… • It's a common knowledge that… • Admittedly… • We tend to… • It is common/popular/ widespread belief/ assumption that… • Generally speaking, … • It is widely accepted that….

Connecting ideas • At the same time… • While on the subject of… • Besides that, … • More than that… • On top of that… • In addition, … • Furthermore… • By the way… • Moreover…	**Expressing contrast** • On the other hand, … • Although… • Though… • But… • However, … • Despite… • In spite of the fact that… • Nevertheless… • While … • Whereas… • Yet… • Not only, but also… • By contrast, … • Conversely, … • ….in relation to… • In contrast, ….
Expressing certainty • It is obvious (that)… • I'm sure (that)… • I'm certain (that)…	**Expressing doubt** • I doubt that… • It's most doubtful that… • It's hardly likely that… • It's questionable that…
Developing the idea • There is one more thing to be noted… • More than that… • Another reason why… • What is more… • In this connection I'd like to add… • I might as well add that… • What is more controversial… • In addition…	**Giving examples** • A (clear, good) example can be found/ seen in…. • To give/provide an example, we can look at…
Categorizing and listing • The model/example presents /introduces four approaches to … • The first category is called/ is known as….	**Describing a process** • First of all, we notice… • Secondly, we shall observe the…
Describing trends • Something can rise/develop slightly, gradually, steadily, slowly, suddenly, sharply, dramatically… • There can be a slow drop, fall, decrease, rise, increase, climb in ... (to be continued…)	**Giving reasons for something** • Since... • As long as...

What was said earlier: • As I said/discussed/ argued/stated a few minutes ago/before/ previously... • So far/ Thus far I have talked about… • Having talked about some of the….	
What will be said next: • What I want/would like to talk about now is the… • What I would like to focus/concentrate on here, is the… • I'll now move on to… • I want to outline / summarize / sketch out some general principles that are followed in…	
What will be said later: • I'll say more about that in a while, both the positive and negative effects… • I'll come back to that in a moment/soon/presently… • Before going on to give some examples….	
Describing simultaneous actions • While… • During the time that we are…	**Showing a result** • As a result, … • Consequently,…
Citing other works • Numerous studies have shown /indicated/suggested / show /indicate/suggest… • (Authors Titles) have found/ suggested/argued, that…	**Paraphrasing information from another source** • (Authors Titles) describe/, illustrate/, outline how e.g. something is used…
Summarizing the main points • So, let me now summarize the key points… • … by going over the main points again. • … highlight the most important points in what I've said. • … by repeating what the major points are.	**Drawing conclusions** • That brings me to the finish/ finale /conclusion /last point of my presentation… • I'd like to summarize /redo/ reiterate/repeat… • I would like to finish off by review/reviewing the key points. • In conclusion, I'd like to reiterate the advantages of…. • So, to complete/conclude/ finish/sum up… • Finally, I just want to… • Let me end by… • Okay, I'd like to finish by… • We are coming to the end of the talk… • In view of all this… • Summing it up / To sum up… • In short / In a word…

Expressing gratitude	Invite comments and questions
• So, that's it. Thank you. • Thanks for coming. • Thank you for listening. • Many thanks for your attention.	• If anyone has any questions or comments, we've got a few minutes left. • We've got a few minutes more, and I'll do my best to answer questions if you've got any. • There is some time left and I am happy to take any questions or comments you may have. • We have got a bit of time for questions if there are any.

Dialogic instruction

Dialogue is a **conversational** exchange between two people. **Dialogue** is for purpose. Most part of the **dialogue** includes questions and answers, requests and information. Conversation is talking between two or more persons. It is always situational and emotionally coloured. Dialogue is generally unprepared. Sometimes it can be both prepared and planned as well. Dialogues make teaching process more interesting and enjoyable. While talking we can say everything, even we can joke, tell a story, laugh. Conversation is informal interchange of thoughts, information, etc. Conversation is interactive, more-or-less spontaneous, communication between two or more interlocutors. Spontaneity occurs because a conversation must proceed, to some extent, and in some way, unpredictably.

In dialogic instruction the objective of the lesson is not to transmit knowledge, but to transform understandings, to negotiate on the meaning of the topics of conversation. So we differentiate between

- **Transactional dialogue**
- **Interpersonal dialogue.**

Transactional language is carried out for the purpose of conveying or exchanging specific information. It is an extended form of responsive language.

Interpersonal dialogue is carried out more for the purpose of maintaining social relationships than for the transmission of facts and information. These conversations are a little trickier for learners because they can involve some or all of the following factors:

- casual register
- colloquial language
- emotionally charged language
- slang
- ellipsis
- sarcasm, etc.

Dialogues are one of the main formats of classroom instructions. They are characterised by some definite conversational rules: turn taking, mutual comprehension, social relationship, and etc. Dialogues stimulate teachers and learners to contribute their ideas to a discussion in which their understandings evolve and the format of the communication becomes wider: they explain, question, judge, hypothesise, express their intentions, agreement, disagreement, etc.

Questioning is another skill and art needed for effective spoken interaction and. It goes beyond just the words and is a powerful means of controlling communication. The questions tend to diagnose learning problems, or to stimulate the learners' thinking process. They try to provoke learner ideas, activating their critical and creative thinking. There is a substantive engagement by teacher and learners. Questions can be asked for a range of purposes, using a variety of language forms. Questions may be about information - for detail, for reasons, for feelings; they may be about clarification - checking understanding, confirming; they can also be tactical - to stall for time, to disturb, to show the strengths or weaknesses of arguments. To ask questions, learners need to know several language structures:

- use of the auxiliary with subject/verb inversion
- 'Wh' words + auxiliary + inversion
- statements and (rising) intonation
- statements + tags. These are frequently not genuine questions: they can be used to confirm information but are often used merely to express a view or desire [Dudley-Evans T. and Jo St John M., Developments in English for Specific Purposes, p107].

The teacher evaluates the learner's participation, their understanding and discourse in class, and stimulates an open learning climate in the classroom. The evolving discourse in the classroom requires the use of co-coordinating conjunctions like "but", "because", "so", and subordinating conjunctions like "when", "although", "if"… Teachers' and learners' feedbacks are transparent and visible.

Learner-learner interaction

Learner-learner interaction varies along two factors:
- the number of learners (small or larger groups)
- the assignments set for the learners' work.

Learners' activities can be tightly or weakly guided by the assignment, and tightly or weakly controlled by the teacher. But in any case learner-learner interaction develops different kinds of talk. Understanding is achieved through the use of paraphrasing, summarizing and questioning,

all of which require the learners to take part, to be an insider. [Harmer J., The Practice of English Language Teaching, Pearson, Longman, 2011, p.276].

The language patterns introduced below are situational academic phrases, which can be widely used in different situations of oral interaction by both: teacher and the learners themselves:

Ask for further information:	Add information of their own:
• You mentioned that…. Could you say a bit more about … please? • You mentioned… Can you explain this in a little more detail, please?	• You have shown us that… I think this is particularly the case…
Challenge what the presenter said:	**Support what the presenter said:**
• You said quite rightly that…. • But I am not sure I agree that… • Isn't it actually the case that… • I think you are right to say…. • But don't you think that…	• I just wanted to say that I think you are quite right. • I just wanted to agree with you about that.
Showing Agreement	**Showing Disagreement**
• I tend to agree with this. • I think you make a good point here. • That's a fair point. • That is right, I think. • This seems to me to be entirely valid. • I totally agree. • I think so too.	• It's certainly the case that… but actually… • I have my doubts about this. • Rather it seems to me that… • It might be true that… but in fact… • I'd like to question this… • They don't appear to take into account… • I'm not sure about this at all. • I'm afraid I disagree. • I can't agree with that point of view. • Quite the opposite.
Giving opinions	**Giving advice**
• My point is that… • It is my belief that… • I believe that… • I really think that… • In my opinion…	• I'd advise you to… • I think you should… • You'd better… • Why don't you …
Making things clear	**Expressing surprise**
• I mean… • Actually… • In other words… • That is to say…	• It is rather surprising that… • How strange (odd) that… • I'm very surprised that… • Incredibly… • Wasn't it strange that…

Expressing purpose	Expressing reason
• In order to… • So that … could	• As/because… • Since…
Expressing comparison	Expressing similarity
• As…as • More…than.. • Less…than…	• In the same way as… • In a similar way… • As in the case of… • The same as… • Just the same as… • …like… • …as though…
Expressing condition	Expressing preference
• In case of… • If… • As long as… in case • So long as… • Supposing… • On condition that…	• Would prefer…. rather than… • Would rather…than… • Prefer…rather than… • Prefer …to….
Expressing result	Expressing time
• Consequently… • So… • As a result… • Therefore…	• …by the mid…. • …at that time… • …the next year… • …meanwhile…

In a nutshell, different forms of communication in the classroom generate a scenario where students realize the urgent need to master language patterns for successful oral discourse. We suppose that the permanent and purposeful use of these units may provide a firm basis for meaningful interaction in the classroom, promoting learners' motivation and their communicative language competence as well.

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NAMES OF TREES IN EVEN AND EVENK LANGUAGES: COMPARATIVE-COMPARATIVE ANALYSIS

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Resume. This article is devoted to the phytonymic space of Even and Evenki languages and their classification based on lexical and semantic features: trees, shrubs.

Key words: Even language, phytonyms, vocabulary, Evenki language.

A study of the cultural characteristics of Even and Evenki ethnic groups in the linguistic picture of the world allows us to see how each national language reflects a particular way of perceiving the world. "Nature, climate, the topography of the area where the ethnos takes shape - all this contributes to the emergence of a" stereotype of behavior "called the national character." A special place among the lexical-semantic groups is occupied by phytonymic units, the use of which in various areas of life of any ethnic group is very significant. The analysis of vocabulary material and the study of the semantic features of phytonyms functioning in the phytonymic space of Even and Evenki languages allows us to classify them according to lexical and semantic groups and subgroups and identify equivalent phytonyms.

The selection of the corresponding vocabulary was carried out according to the dictionaries: V.I. Tsintsius "Comparative Dictionary of Tungus-Manchu Languages", V.A. Robbeck, M.E. Robbek "Even-Russian Dictionary", L.D. Riches "Russian-Even (Russian-Lamut) dictionary", G.M. Vasilevich "Evenki-Russian Dictionary", A.N. Myreeva Evenki. Evenki-Russian Dictionary ", B. V. Boldyrev" Evenki-Russian Dictionary ".

The largest and most diverse group in these two languages studied are the names of trees and shrubs. Trees and shrubs can grow in and outside the forest. The names of the tree mo can be found in all Tungus-Manchu languages with the meaning "wood, firewood for kindling, log, stick The largest and most diverse group in these two languages studied are the names of trees and shrubs. Trees and shrubs can grow in and outside the forest. The names of

the tree mo can be found in all Tungus-Manchu languages with the meaning "wood, firewood for kindling, log, stick". Name of the forest: Even.Higi "forest", Evenk. whitefish "forest"; Evenk. dilkeke "taiga", Even. dөmңe "taiga", "forest", Even burgag "Deciduous forest", Evenk. ai "taiga", "forest on the plain".

Consider conifers: Even. iretBer "young tree", "young larch, pole", Even. irekeg "larch thickets", Evenk. irekTk, Tmt, Uchr, Chm, Chmk, Cx, Urm "larch forest"; Even. IrekBer, T 1) "young larch"; 2) "young shrub, talnik", Evenk. Irevellen E "thin young larch", etc.

In Even and Evenki, pine is called the same Even. DyagdaBer "pine", Evenk. dyagda "pine";

Even.astaBer, T "spruce", Evenk. AsiktaChmk, Uchr, PT, N "spruce".

Even. ңаңтаБер, Ол, Б, П, СК, Т "fir", Evenk. ңаңтеУчр, ПТ, Н, Е, И, С "fir". Even. BolgerBer, Ol, M, Oh, P "stlanik", Evenk. BolgiktaTk, Tmt, Uchr, Ie, Z, A, Chmk, Cx, Tng "cedar elfin", etc.

Deciduous trees: Even. hulB "poplar", "aspen", Evenk. hulUchr, Chlm, Urm "poplar"; Even. AnguBer "poplar-dead wood", Evenk. Buldan Urm. "Young poplar"; Even. Urga T, SK "poplar", Evenk. sirikteurm. "Big old willow"; Even. HulakagB "poplar thickets", Evenk. hulikagUchr "poplar thickets";

Even. chalBer, Ol, B, M, Oh, P, T "birch", Evenk. the birch chalan; Even. chalbukagBer, Ol, Oh, "thickets of birch", Evenk. chalbukTMt, Uchr, Chlm, M, Evenk. chalbukig PT, N, E, AND "birch";

even. DyvudBer, Ol "dwarf birch", Even. dyvedBer, Ol, B, M, Oh "stone black birch", Evenk. divegSkh birch forest (forest, black birch grove), Even. nivetBer "creeping dwarf birch", Evenk. nivektUchr "high marnik birch";

even. keKerBer, Ol, P "rowan rod", EvenkkarTk, Z "thin rod";

Even. nognemkarBer, Ol, Oh, P "willow", Evenk. kachikamuraAld, Uchr, Z, N "willow";

Even.otlatBer, Ol, All "dwarf alder", Evenk. dugdenUdr, "black alder";

Even.NektevkiOl, Oh "mountain ash", Evenk. achaktaUchr, Chlm, Urm "mountain ash maple".

Names of shrubs: Even.KecuentavteңenBerbukv. "(Cuckoo berry) juniper", Evenk. hэңкире "juniper";

Even. Berdoslach "(Biting) dogrose", Evenk. suptyle, huptyleTTMT, E, AND "dog rose";

Even. hekkesBer, Oh, M "rosemary creeping", Evenk. sekkiretmt, Uchr, Chlm, Urm, Z "Ledum";

Even.NektevkiBer, Oh, Ol "mountain ash", Evenk. NukteTkm, PT, E, S, S-B "mountain ash".

Even. imuketBer, Ol, B, P "talnik, willow, young shoots", Evenk. hektaTmt, Vl, E, And "talnik, willow, willow";

Even.garBer, Oh, Ol "bitches"; Evenk.gara PT, S "bitches"; Even. hevte-Ber, Oh, M "coniferous branch", "litter", Evenk.sektehektekshektteTMt, Uchr "coniferous branch".

Name of herbs and herbaceous plants:

Even. nirgatBer, Ol, All, Oh, P "black-headed (grass that grows on bumps)", Evenk. nirgakteUchr, Ald, M, TT, Cx, Urm, Z "black-headed (grass growing on bumps)";

Even.Evenk. chukag "meadow, lawn";

Evencoat "reed", Evenk. hanchara "reed", "seaweed";

Even.orat "dry grass, hay", Evenk. orocto "dry grass";

Even. hightBer, Ol, All, Oh, "dry grass", Evenk. икаiktaTk, Tmt, Uchr, Ie, Z, Urm, A, Cx, Brg "marsh soft grass dried on the vine", etc.

The lexical-semantic groups of phytonyms are distinguished by extra-linguistic characteristics, but at the same time they differ in the constituent units of these groups.

Phytonyms, as one of the fragments of the linguistic picture of the world, can transmit ethnocultural information, reflecting the popular perception of plant realities.

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BORROWINGS IN SPANISH SCIENTIFIC TEXTS

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Abstract. The article deals with borrowings in Spanish scientific texts from other languages as result of intercultural dialogue accelerating the process of modern society globalization, which led to the introduction into the Spanish scientific information space of foreign units reflecting a system of respective scientific concepts. The findings can be used in development of linguistics and in the practice of language teaching.

Keywords: borrowings, scientific text, terminology, intercultural dialogue.

The modern world is characterized by broad political interaction, close economic and scientific ties, active intercultural cooperation and increasing globalization. In the context of globalization, English has become the language of international communication and has increasingly influenced other languages of the world.

Nowadays the world is in the process of constant development: new discoveries are made in all the fields of science. We recognize that effective cooperation is carried out through active language contacts. The need to designate in a speech certain events or phenomena arises from these processes and can be clearly traced in linguistic borrowings, translation loan-words, mostly from English. In the formation of scientific lexical fund there is a tendency to replenish it with international vocabulary.

Terminological vocabulary enables to present the subject content in the most accurate and economical way and ensures the correct understanding of the issue essence being treated. The main requirement for the scientific texts is the extreme accuracy of the expression of thought, not allowing the possibility of various interpretations.

The presence of borrowings from other languages in Spanish scientific texts is the result of intercultural dialogue accelerating the process of modern society globalization, which led to the introduction into the Spanish scientific information space of foreign units reflecting a system of respective scientific concepts (Krasnykh, 2018).

The research material includes natural science articles and theses of Spanish scientists for the period of 2012-2018.

Specialized communication is defined as a set of contextual and extralinguistic conditions, in which texts with certain characteristics are produced (Cabré. 2013).

The methodological base of research is leading to modern linguistics, discursive and communicative approaches. "A text is the meeting point of linguistic personalities, meetings of linguistic abilities" (Karasik et al., 2014). In intercultural communication there is a clash of language pictures of the world, ideas and values, characteristic of those linguocultural communities to which communicants belong.

Foreign language text links are the relations between this particular text and a text corpus in other natural language, between different semiotic systems. The presence of borrowings in Spanish scientific texts is the result of intercultural dialogue.

There are also changes in almost every language of the world. In the context of globalization. The appearance of English terms in Spanish scientific texts shows the dominant influence of the English language in the international scientific community.

They are introduced into Spanish scientific discourse in:

1. Translation into Spanish:

"La espectroscopía de fotoemisión (PES, del inglés "Photoemission Spectroscopy").

2. Descriptive construction:

"Esta fragmentación de la molécula principal se conoce como "craking pattern", o fragmentación, que será el término utilizado en este trabajo".

3. Parallel explication:

"Se ha estudiado la desorción inducida en las muestras en condiciones 'as

received' es decir, cuando no se realiza ningún tratamiento especial en los materiales".

4. Without any translation or explication:

"Otros métodos también utilizados en la solidificación de óxidos, como Edge Defined Film Fed Growth (EFG) o Micro pulling down, utilizan crisol y extraen el fundido".

In most cases, English language terms are introduced into Spanish scientific discourse in parallel explication and translation into Spanish since the representatives of the Spanish scientific community do not yet have nationally determined connotations and associations shaping the perception of these English precedent phenomena.

Foreign language terms include precedent statements performing a general scientific function –Latin names and expressions that, being generally known to representatives of the scientific community, are not explained and form part of the universal cognitive space.

In scientific works on biology, the Latin language is regarded as an independent scientific language, derived from the Latin language of the Renaissance, but enriched by a multitude of words borrowed from Greek and other languages. Besides that, a lot of Latin words are used in biological texts in a new, special sense.

International Codes of Biological Nomenclature require that the names of taxonomic groups should be in Latin form, that is, be written in Latin letters and obey the rules of Latin grammar, regardless of the language they are borrowed from: "La nomenclatura zoológica requiere que a los nombres científicos, independientemente de su origen lingüístico, se les asigne un nombre en latín, para lo cual se usan las 26 letras del alfabeto latino (incluyendo j, k, w, y) y las normas gramaticales de esa lengua" (CINZ, 2019).

Let's give some examples:

"El langostino Melicertus kerathurus es un crustáceo decápodo ampliamente distribuido por todo el Mediterráneo";

"El grupo de bacterias facultativas más comunes que realizan la desnitrificación son Bacillus, Enterobacter, Micrococcus, Pseudomonas, y Spirillum".

Latin expressions are often used in the process of citation; they help the addressee to navigate in the scientific text. For example:

Et Al. (and others): when the cited text belongs to more than one author; Supra: reference to the mentioned document "see above", "as stated above"; Infra: "see below, as indicated below"; Op. cit: expression used in notes and footnotes to refer the reader to an earlier citation. The expression refers to the quoted source immediately before the last source cited; Idem, Ibídem: "the same", "the above work", "see the last quoted source; "Ibíd: "in the same place".

In accordance with the established system of norms governing the process of knowledge reproduction in Spain, a thesis should be preceded by a short abstract in English and a scientific article - depending on the editorial requirements.

In this case, the authors of the scientific work create their own, author's text using other language. It is interesting to note that at present an abstract in English is an obligatory component of Spanish dissertations' structure.

Marking of foreign language inclusions is of particular interest, there are:

- italics and quote marks like traditional ways of marking borrowing;

- indention on the text surface in a separate text, in case of author's text creation;

- markers of a higher level, i.e. belonging to another verbal system of natural language.

Thus, scientific texts act in the text space and are in constant interaction. All the researched foreign language terms are included in the basic scientific fund, which comprises the values and knowledge of the world scientific heritage.

The presence of foreign inclusions in academic Spanish texts is the result of intercultural dialogue accelerating the process of modern society globalization, which led to the introduction into the Spanish scientific information space of foreign units reflecting a system of respective scientific concepts.

Foreign language precedent phenomena form a universal precedent space, they are universal because belong to the universal cognitive space.

At a certain stage of their existence, some texts acquire universal significance and become relevant to the scientific community.

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CULTURAL RESOURCES MANAGEMENT OF ALTAI

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Summary. The aspects of the research funds of G.D. Grebenshchikov of the State Museum of the history of literature, art and culture of Altai are developed in the article from the standpoint of cultural resources management. The model of the Russian version of this direction, taking into account scientific results obtained by Russian researchers in the study of Museum object and its semiotic discourse is generated. Museum objects - publications transferred from the American collection of documents relating to the biography of G.D. Grebenshchikov are regarded as a cultural resource that contains information of linguistic, globally axiological and political nature.

Keywords: the cultural resource management, museum objects, cultural text, the semiotic discourse, the cultural resource value of the text, the significance of cultural resource.

Cultural resource management includes several procedures: a) the study of the cultural artifact (resource) in order to identify, assess, register and determine the amount of additional information needed to identify the resource; b) planning connected with the need to confirm that the information about the cultural artifact (resource) is well integrated into management processes for decision-making and identifying priorities; C) management, according to which decisions are implemented and resources are saved, protected and presented to the public [NPS-28: Cultural Resource Management Guideline].

Cultural resources include: a) archaeological resources; b) cultural landscapes; C) buildings; d) structures, which include material ensembles that expand the limits of human capabilities; e) museum objects. The greatest interest for us, in connection with the study of the cultural heritage of G.D.

Grebenshchikov, are museum objects, the essence of which is defined as follows: "Museum objects are manifestations and records of behavior and ideas that span the breadth of human experience and depth of natural history. They are evidence of technical development and scientific observation, of personal expression and curiosity about the past, of common enterprise and daily habits. Museum objects range from a butterfly collection to the woven fragments of a prehistoric sandal. They include the walking cane of an American president, a blacksmith's tools, and the field notes of a marine biologist is. They encompass fossilized dinosaur bones and business journals, household furnishings and love letters bound with a faded ribbon. They are invalid-samples and fragments of the world through time and the multitude of life there" [NPS-28: Cultural Resource Management Guideline p. 14].

Museum objects from G.D. Grebenshchikov's Fund of the State Museum of history of literature, art and culture of Altai founded by Tamara Ivanovna Varaksina are in the center of our attention. In its significance, the term museum object in museum discourse is comparable to the term museum item.

Among the basic concepts of museology, a museum object is defined as an object of museum value extracted from real reality, included in the Museum collection and capable of long-term preservation and endowed with the following properties: informative, expressive, attractive, representative, associative, museological [Basic concepts of museology].

E.V. Starinkova [E.V. Starinkova, 2014] considers a museum object as a text of culture, presented as an integral system of codes through which the accumulation and transfer of cultural experience is carried out. The researcher proposes a number of value criteria related to a) the main branches of philosophical knowledge, b) the possibility of using the information inherent in the museum object, C) the actual properties of the museum object. The first group includes axiological, epistemological, ethical, aesthetic criteria; the second group includes communicative, discursive, informational, semantic criteria; the third group includes representative, attractive, expressive criteria. N.A. Nikishin defines museum objects as the basis of the Museum language, signs, with the help of which the base of any exposition "statement" is created [N.A. Nikishin, 1997].

Museum object, according to E.V. Starinkova, performs a functional and meaning-forming function in culture and the code information contained in the Museum object is decoded in the process of its study and displays the Museum object at the level of a document that allows you to trace the stages of development of culture and contributes to the level of cultural literacy [E.V. Starinkova, 2014].

The concept of "cultural literacy" is introduced into scientific and social usage by E.D. Hirsch in his work "Cultural literacy: What Every American Needs to Know" in 1987 [E.D Hirsch, 1987]. In this work E.D. Hirsch brought to the discussion a fairly simple truth: to communicate, people must accommodate or operate with the same amount of knowledge.

"Deciphering" words is a necessary part of reading, but, unlike speech communication, this process is less "natural" because it requires deep cultural knowledge, which also becomes the key to the" success " of the reader. Cultural literacy is the basis of general literacy which is guided by the authors of both fiction and other texts created in accordance with the requirements of discursive practices that model social relations and relationships. If the readers do not have the appropriate skills, they will not be able to assimilate the relevant material offered them for review. Available "skills" for detecting words, dates, ideas (the main meaning) of the facts almost do not help, because it is quite time-consuming process. The problem is that the reader in the absence of general cultural knowledge does not understand when the situation (material) requires switching to a language that he does not know. In this case, reading, for those who do not "speak" the language, becomes an unpleasant task, to the resolution of which later no effort will be made.

"Reading" of museum objects assumes, on the one hand, replenishment of the general cultural knowledge getting acquainted with a Museum subject, on the other hand, existence of a certain stock of cultural knowledge without which "reading" of a museum subject as the text of culture and understanding of its value is impossible. E.V. Starinkova suggests that the museum object studied as a text of culture has a meaning that should be considered from the point of view of cultural-historical, exposition, educational, communicative, sign and legal discourses.

What unites all cultural resources is the concept of meaning, or more precisely, significance. To be meaningful, a cultural resource must be woven into a network of important historical, cultural, scientific or technological associations and this must be manifested in its physical substance. Otherwise, the importance of cultural resources is based on two interrelated qualities. A cultural resource consists of a certain number of physical, chemical or biological traits, at the same time, it consists of ideas, events and relationships. This duality is evident in cultural resources, whether they are small, like a penny, or huge, like the statue of Liberty. Cast from copper, both cultural resources are united by the properties of the material from which they are made. Decorated in symbols, one of them has economic significance, the other cultural resource means a fundamental human right. At the same time, both cultural resources represent the expression of ideas, or, otherwise, "cultural expressions" [NPS-28: Cultural Resource Management Guideline].

In our opinion, it is rightful to study the value of a museum object in the aspect of validity and purposes of interpretation by E.D. Hirsch [E.D. Hirsch, 1967, 1976] and the distinction between the concepts of "meaning" and "significance". According to E.D. Hirsch, meaning is what is represented by the text, what the author meant through the use of a sequence of signs. It is what the signs represent. Significance, on the other hand, names the relationship between meaning and a person, or concept, or situation, or anything imagined." But to understand the meaning of the text, and therefore to interpret it, is possible only on the basis of certain and required for the text and its interpretation the quality and nature of which is determined by the context.

The semiotic discourse of a Museum object can be used as a context for a museum object. The study of the semiotic discourse, as emphasized By E.A. Okladnikova and S.T. Makhlina [E.A. Okladnikova S.T. Makhlina, 2006], involves the synthesis of descriptive and analytical procedures carried out in the study of these objects with the involvement of broad historical and cultural parallels to verify their historical, cultural, artistic and emotional value. The study of the museum subject, according to the evidence of E.A. Okladnikova and S.T. Makhlina, should take into account three successive stages: 1) attribution; 2) systematization; 3) interpretation. Attribution involves identifying, fixing the functional purpose, history of origin, existence of the object. Systematization is based on establishing the relationship between museum objects as units of the museum collection. The tasks of interpretation of museum objects include the synthesis of the results of attribution and systematization, as well as the identification of the semiotic status of the Museum object and the parameters of its discourse, which affects the formation of the idea of the Museum object as a Museum value [E.A. Okladnikova S.T. Makhlina, 2006].

Each cultural resource has its place in the history of the country and significance for a particular ethnic group. The relationship between a resource and its cultural context is established through associations that belong to four areas [NPS-28: Cultural Resource Management Guideline]: 1) historical events or prominent people; 2) technical solutions, design; 3) sources of information important in historical or archaeological research; 4) axiological dominants in the cultural system of an ethnic group. The scale of the associative context can be defined as national or regional.

Associations are an integral part of the meaning of cultural resources. They determine the reason why a resource should be preserved and which of its features are most important. The evaluation of associations generated by a cultural resource depends on the temporal parameters that in-

fluence the systems of views and the specifics of axiological criteria in the context of the history. Therefore, according to foreign researchers, a cultural resource has more than one period of determining its value and significance, since at different periods of its "life" it generates different associative fields, and therefore "provokes" the creation of various semiotic discourses of a cultural resource in its typological variety (which is especially important for our study) of a museum object.

We turn to the consideration of the Museum objects of the State Museum of the history of literature, art and culture of Altai-cultural resources received from the American heritage of G.D. Grebenshchikov. Publications from Russian newspapers "Rossiya" and "Novoye Russkoye Slovo", published in New York, were selected by us. The newspapers were published in Russian language. The unifying semiotic component of these museum objects is the description of events significant for the American Russian community – events, the venue of which was the estate of G.D. Grebenshchicov. In 1935 it was the Russian holiday on Independence Day on July 4, in 1951 it was a celebration dedicated to the friendship between the Russian and American peoples, in 1960 it was the divine Liturgy and a memorial service for Nicholas II and members of his family.

«Rossiya 1935»

Русскій праздникъ въ ЧураевкѢ

Въ День Независимости 4 Іюля 1935 г. въ ЧураевкѢ, СаутБюри, Кони, устраивается большой Русскій Праздникъ. Будетъ совершена Божественная Литургія сонмомъ окрестного духовенства, возможно, что Богослужение возглавит Преосвященный Леонтій Епископъ Чикагский. Въ Богослуженіи будетъ участвовать Церковный Хоръ изъ Ансоніи под управленіемъ Е.А. Серебренникова, при чемъ тотъ же хоръ и оркестръ изъ Ансоніи и Бриджпорта будуть участвовать въ концертной программѢ, которая будет дана с участіемъ ряда ораторовъ на русскомъ и английскомъ языкахъ въ продолженіе всего дня. Праздникъ не отмѢняется ни при какиъ обстоятельствахъ. Въѣздъ и входъ для всѢхъ свободен.

«Novoye Russkoye Slovo». 243 West 56th Street, New York 19, NY. Vol. XLL № 14 373 Satuday, September 1951

Русско-американское торжество в Чураевке

[The material is preceded by a photo, under which is placed the signature: "Metropolitan Leontius making a solemn prayer in Churayevka during the meeting, arranged by G.D. Grebenshchikov and his wife for the manifestation of friendship between the American and Russian peoples].

В субботу 18 августа в Чураевке в имении Г.Д. Гребенщикова состоялось торжество, посвященное дружбе между русским и американским народами.

В торжестве приняли участие несколько сот человек, в том числе, многие видные члены русской общественности и представители американского литературно-артистического мира. Некоторые прибыли издалека. Поводом к торжеству послужило недавнее письмо президента Трумена – Швернику и соответственная резолюции Конгресса С. Штатов. Торжество открылось благодарственным молебном в небольшой часовне Св. Сергия, расположенной в центре Чураевки. Часовня собственноручно сложена из камня Г.Д. Гребенщиковым на холме и окружена купой деревьев.

Небольшой храм не мог вместить молящихся и многим пришлось во время службы стоять под открытым небом. Большое впечатление на присутствующих американцев произвел Крестный Ход, возглавляемый митрополитом Леонтием и пышные облачения духовенства.

Владыка Леонтий произнес краткое слово, выразив благодарение на пребывание в Америке и похвалу устроителям торжества.

После молебства в доме Гребенщикова у подножья холма, на котором стоит часовня, состоялся концерт, программа которого передавалась по радио. Часть программы зарекордирована для радиопередач «Голоса Америки» на русском языке.

В концерте приняли участие американские и русские артисты. Их числа последних следует отметить Ксению Прохорову, исполняющую фортепианные произведения Чайковского и Рахманинова, Маргариту Агреневу-Славинскую с хором в национальных русских костюмах, певицу Мару Славинскую и мн. др. Был исполнен также яд американских гимнов. К сожалению, композитор А.Т. Гречанинов не мог присутствовать на концерте по болезни.

Были оглашены приветственные телеграммы от генерала Клэй, сенаторов Мак Мэхона и В. Бентона (Коннектикут), Холлэнда (Флорида), Тэфта (Охайо), секретаря президента Трумена по делам печати Шоррта, писательницы Перл Бок, Игоря Сикорского и других.

В своей речи Г.Д. Гребенщиков поделился с участниками торжества воспоминаниями о своем детстве в России и о пережитых им в первые годы лишениях, и выразил надежду, что устроенное им торжество послужит делу укрепления русско-американской дружбы и прочного всеобщего мира.

По окончании концерта присутствующим была предложена обильная трапеза. Гости с большим интересом осмотрели коллекцию картин, собранных Г.Д. Гребенщиковым. В устройстве торжества большое участие приняли руководители общества Художников и Писателей Коннектикута, во главе с президентом, г-жою Аделин Кент. Церемонемейстером во время исполнения программы был член общества Альберт Бенедикт из Вотербери.

«Rossiya, June, 1960»

В воскресение, 17 июля, в Чураевке, в Часовне препод. Сергея Радонежского прибывшим из Махопаки игуменом, о. Викторианом была отслужена Божественная Литургия, а после нее – панихида по Царе-Мученике Николаю Втором и Членам Его Семьи, с Ним умученным. Отлично пел хор любителей под управлением регента Д.Б. Александрова.

The publication of 1935 attracts attention with its graphic design containing the letters i and ѣ, which symbolize the cultural literacy of pre-revolutionary Russia. The letters i and ѣ, are a kind of indicators of general knowledge that unites representatives of the Russian world.

The publication of 1951 is full names of the representatives of the Russian public, preserving Russian culture and Russian traditions honoring and names of American politicians welcoming the Russian settlers and their host customs and traditions.

The publication of 1960 is the shortest in volume and the saddest in the content. This is information about the memorial service on the day of the execution of the Russian Tsar and his family. Attention is drawn to the sequence of lexical units marked with an initial capital letter (except for proper names) - the Chapel, the Divine Liturgy, the Tsar-Martyr, the Second, Members of His Family, with Him martyred. These units form a special discourse and an image of the lost-time, Fatherland and prudence.

All three publications are also of scientific value in terms of research of the state of the Russian language in the process of existence of the language system and the native speaker in a foreign cultural environment. The system of the Russian language acts as a connective structure, reconciling and uniting the «past» (past perfect tense) and «present» (present continues tense) of Russian culture. Publication dates mark significant historical "run up to" in the history of Russia (USSR), Europe and the United States of America: 1) the run up to intensification of Soviet mass repression and European fascist stagnation; 2) the run up to the completion of the "industrialization" of the Russian Patriarchal consciousness, the destruction (deconstruction) of the internal form of German philosophy and the stabilization of the structures of the semiotic discourse "cold war"; 3) the run up to cosmological Russian supremacy, American cybernetic superiority and the political decline of Europe.

In the future it is supposed to pay attention to the study of Churayevka as an independent cultural resource, as well as an expositional statement and a kind of artistic image in the context of American culture. At the same time, we are going to rely on the concept of N.L. Malinina [N.L. Malinina, 2017] which is connected with the philosophical aspects of the museum development and the actual aesthetic design of the Museum. It assumes the presence of elements of the artistic image, the possibilities of which allow to communicate with the visitor as a cognizing subject and through emotional impact to build a holistic view of the concept of the museum. The image, according to the researcher, awakens a mystical sense of existence, acting as a support, which is used by the consciousness of the visitor in the process of virtual movement and the formation of a new temporality – non-being existence, based on being valence and occasionality.

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TOXIC MANAGEMENT: SPEECH BEHAVIOR OF A LEADER IN THE ENVIRONMENTAL ASPECT

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Annotation. Toxicity is considered as a characteristic of anti-environmental communicative behavior of a person in a business environment. This concept becomes most relevant when identifying the style of professional activity of managers at various levels. The widespread occurrence of toxic communication phenomena in the business environment determines the linguo-environmental significance of this problem for solving the task of increasing the communicative and business level of the current elite. The object of the study is the linguistic characteristics of verbal communication of the so-called toxic leader. The material used was the self-reporting data of company employees presented on Internet sites. By the method of discursive analysis, the types of anti-environmental speech behavior of toxic managers were established: a) violation of business communication standards; b) the psychological dependence of subordinates. The communicative behavior of employees is an environment for maintaining the specified communication style in the team.

Keywords: anti-environmental communication, business communication, leader as a communicative type, toxicity, communicative style, emotional communication, rationalization of emotions.

Toxicity as a concept indicating anti-environmental human behavior has recently become popular and widely used in socio-political, media, professional and interpersonal discourses: *toxic person (s), toxic parent, toxic mother, toxic employee, toxic advertising, toxic policy, toxic policies, toxic charity, toxic muscularity, toxic communication, toxic behavior, toxic reaction, toxic feeling, toxic thoughts, toxic consciousness, toxic (poisonous) reason, etc.* This concept today has gone beyond the scope of special use into general communicative practice. In modern contexts, the word "toxicity" is increasingly used not in a direct but in a figurative sense.

In this sense, this concept is supported at the level of official discourse of the authorities, including in international dialogues:
"Toxic" Trump (https://news.ru/v-mire/toksichnyj-tramp-tolkaet-evropu-k-putinu - 11 May 2018);
Toxic policy (https://realcorwin.livejournal.com/587993.html 16.04.2018).
Toxic image ... (http://maxpark.com/community/politic/content - 16.03.2017);
Toxic America. (https://harmfulgrumpy.livejournal.com.html - 22.06.2016) and etc.

This concept becomes most relevant when identifying the style of professional activity of managers at various levels. In social psychology, when determining the leadership qualities of an individual and analyzing them from the point of view of the management style of managers of different levels deviating from generally accepted communicative norms, it has already received the following notation: *toxic leader, toxic manager* [Stogdill 1974]. It is these qualities that determine the forms of destructive communication, as a result of which ethical-linguistic assessments are shifted, violates the norms of public morality, the ideas of decency / indecency in social and interpersonal interaction, accepted in this society, professional ethics, i.e. non-environmentally friendly situations are formed. The object of our study is the linguistic mechanisms and methods of verbal communication, the organizing force of which is the personality of a so-called toxic leader.

In modern linguistics, the concepts of linguotoxicology, linguotoxins, language toxins, which correlate with the phenomena we are considering, have a linguo-environmental explanation and are associated with elements that "clog up speech, and in the extreme case, language" [Ecology of the Russian language 2017: 221, 350]. However, these concepts can also be used to characterize communicative strategies and tactics, communication conditions, and even characteristics of linguistic personalities - participants in communicative situations.

Management activity is a special type of business activity that ensures, on the basis of receiving and processing information, the systematic and purposeful joint activity of the management object and the adoption of appropriate decisions aimed at further improving the management object. Leadership is understood as the process of carrying out speech actions, on the success of which the result of the practical activity of the team depends. To coordinate the "horizontal" relations in the structure of the organization, professional ethical standards are developed, while the "vertical" relations in the service hierarchy are most often regulated by the duties of

employees, corporate ethics, etiquette standards. But, as practice shows, the norms of communication in the system "leader - subordinate" to a large extent develops spontaneously and are largely determined by the personal qualities of managers.

The powers vested in leaders acting as leaders form certain styles of "imperious" communication. Recognizable are the types of "despot" and "democrat", "specialist" and "amateur", "player" and "fighter", etc. [Personnel Management 2010]. In the speech of a certain modern managers, examples of a negative leadership style that allow harsh expressions are not uncommon (*"How many timesdo I have to explain!", "Are you deaf?" "I owe you nothing!", "I don't have to spoon-feed the task to you, if you don't understand - your problems", "I don't care about your opinion. Do what I say!", "These are not my problems"*), negative markings. Such verbal behavior by the leaders themselves is justified and designated as methods of "tightening the screws", "wigging", "disciplining". Scientists propose to designate this style as a deviative discourse [Tolochek 2000: 96], which includes "obscene speech, criminalized units (*racket, infighting, soaking in the toilet*), jargon and argotisms, word-making and verbiage, tongue-tied, semantic "confusion", clogging of the Russian language in foreign words having "native" analogues [Majaeva 2010]. On the part of subordinates, such communicative behavior is most often perceived as unreasonable, inappropriate, violating the rules of business interaction, and causes negative emotions.

Such images are steadily associated with bad leaders in our country, and their speech behavior - with destructive actions that harm the business, destroy the normal interaction in the company, and psychologically traumatize its employees.

The speech behavior of toxic leaders has repeating linguistic features, among which a significant place is occupied by emotional means and ways of expressing or restraining emotions. They are directly related to the negative quality of the fulfillment of the basic duties of a leader: *planning, organization, coordination, control*. As a material in this study, we used the data of self-reports of company employees in different countries, presented on websites *"Black list of directors, managers, superiors" https://work-info.org/chernyj-spisok-rukovoditelej?start=280; Gartner CIO Leadership Forum 2019 in London, UK; leadership@cio.com*. Among the linguistic mechanisms of anti-environmental speech behavior of toxic managers by the method of discursive analysis, the most frequent are identified: a) violation of the rules of business communication; b) psychological dependence of subordinates.

Violation of business communication standards. Etiquette situations are associated with observance of communicative taboos and imperatives, which can be hard ("not allowed") and soft ("not accepted") [Sternin 1996: 4]. Violation of business ethics by the manager is most often associated with impolite and rude as a style of communicative behavior: familiar behavior, talking in high tones, cursing, belittling the dignity of subordinates - due to their inability or unwillingness to fulfill the requirements of speech cooperation. Evidence of such examples of communication in the "supervisor - subordinate" system is contained in large numbers on company websites. See for example:

Every morning we start with screaming. The door swings open, and the chief from his office begins to take turns "wigging" everyone. We used to worry, but now we're used to it. This does not affect the work. He would let off steam, and we continue to work.

Our boss's favorite greetings and messages have long been "well, dumbasses," "get to work, brainless herd," "in position, army of idiots."

The head of the department - is a disgusting person. Treats employees as expendables. Often from her lips you hear "you are from a sharashkin office, no one will take you, no one needs you."

He is characterized as a tyrannical sociopath with a mass of external complexes, megalomania and a level of intelligence not higher than average. All this is expressed in the direct humiliation of subordinate, unpaid overtime <…>.

The deputy director is a rare hypocrite, flattering everyone and joking with everyone, but in reality he sets everyone against me.

May offend you in presence of your subordinates and other people (leadership@cio.com).

The cause of rude and even offensive speech behavior of a toxic leader may be his incompetence, internal failure, the desire to assert himself or excessive self-confidence. In these cases, they deliberately choose a lower style register of communication. The factors reinforcing such a speech style of leadership are the tolerant attitude towards it on the part of subordinates (asymmetric communication in the team is perceived as the norm), as well as the loyalty to the toxic leader on the part of higher authorities (to representatives of which his style does not apply).

The other side of violation of the rules of verbal interaction is the absence of a reverse reaction on his part, which creates the impression of ignoring the activities of the team [Ionova 2015]:

She is not at all interested in how my work is going.
Gives assignments, mainly by email. I execute.

It feels like I'm working in another city, although her office is ten meters away from my desk (https://work-info.org/chernyj-spisok-rukovoditelej?start=280).

The ability to communicate correctly, providing a backlash, is traditionally attributed to the basic skills of a professional manager. The lack of appropriate emotional emphasis [Ionova 2015], the formed system of speech filters [Osgood 1957] and the assessment of the positive actions of employees does not allow the manager to properly implement the managerial functions of organizing joint, coordinated actions of his employees.

Psychological dependence. Using psychological methods to motivate employees is the most obvious way to manage. Along with material stimulation, this is a powerful lever of influence on the motivational sphere of the personality. At the same time, the emotional component plays an important role in the organization of the team, its association and increased efficiency. In business communication, rationalized methods of verbalization are actively used: nomination of emotions (*lexemes* such as *joy, happiness, grief, sadness, surprise,* etc.); forms of expressing the emotional state and designating the attitude to the subject of speech (*I'm glad to report, regrettably stating, I hope for understanding, sincerely surprised by misunderstanding, sincerely disappointed, surprised to find out, I regret what happened, I hope for a long cooperation, I thank you for the work,* etc.

The open expression of emotions is a technique of the most sincere communication of feelings, but at the same time a powerful manipulative tool. It is known that a leader who does not restrain negative emotions in relation to subordinates and uses speech forms that allow rude expressions causes fear and hatred on the part of subordinates. Often this is precisely what managers achieve, having no other leverage over employees, fixing the norms of deviative communication in the team. They enjoy humiliation of people, constant pressure and even violence, forming a toxic corporate culture in the team, changing the communicative and moral standards of business interaction between people.

The emotional dependence on the communicative style of the leader becomes his tool for the implementation of psychological control over subordinates. Speech acts of humiliation, intimidation, threats exclude the manifestation of empathy, which means that the communicative interaction between the leader and subordinates becomes unidirectional, allowing the manager to abuse his power [Kelley 1975]. The threats of blackmail are often used by him to motivate employees to work beyond their specified working time. The exultant speech actions of the prosecution, humiliation,

sarcasm are used to affirm the significance and competence of the leader. The positive result from the actions of the team is completely attributed by the leader to himself, in connection with which his communicative tactics acquire the appearance of necessary, positive, productive actions, and the leadership style - effective management.

A consequence of the spread of this leadership style is the use by subordinates of various psychological defense techniques ("Self-Relief"; "Response - Disease"; "Hiddenness" [Majaeva 2010], under conditions of long-term emotional pressure in employees 'speech, the elements of medical discourse are actualized, and the state of physical malaise and psychological dissatisfaction: *melancholy and sadness, severe fatigue and drowsiness, poor sleep, lethargy, weakness, fragility, mood swings, pain in the area heart, blood pressure, appetite disorders, headaches of uncertain etymology* [Ibid]. The results of a survey of 1,200 workers from various industries from several countries at a business school at the University of Manchester showed that employees working under the leadership of such leaders constantly talked about their dissatisfaction with their work, lack of motivation, physical and intellectual strength [Morin URL]. In such conditions, a need is developed for the development of protective measures to counter the aggressive communicative behavior of a leader.

Most often, the result of working in a deviative communicative environment for employees is the development of appropriate types of reactions [Ionova 2018] to the speech actions of the leader and their own anti-environmental style of communicative behavior: confrontation, rudeness, unpleasant criticism of each other, aggression, lies. The degree of destructiveness of business interaction in the team increases sharply.

Unwillingness or inability to conflict among some employees determines the development by them of tolerant tactics of conduct in the team, verbal actions of consent, tolerance, and ostentatious respect (*the boss is always right!*), Which in their extreme terms determine an uninterested, superficial attitude to the case, moral losses, decrease in professional and social status of employees.

Thus, the result of the communicative activity of the toxic leadership, on the one hand, is a violation of verbal tolerance in the team, conflict in the communicative environment, aggressive behavior, and on the other hand, the emotional burnout of employees and professional indifference to the results of work. Highlighted here are some aspects of the problem of "vertical", hierarchical communication show that this area of communication is specific in comparison with interpersonal and business "horizontal" communication.

The widespread occurrence of toxic communication phenomena in the business environment, the social significance and the interdisciplinary nature of this problem require a comprehensive linguistic approach to its study and description, indicate its great linguistic and environmental significance for solving the problem of increasing the communicative and business level of the current elite.

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STATE POLICY ON CULTURAL HERITAGE IN THE 1920s IN SOVIET HISTORIOGRAPHY

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Abstract. The article discusses the historiography of the cultural policy of the USSR in the 1920s. The main problems of state management of archival, library, museum construction are presented. The author analyzes the works that examined the main aspects of the state's activity in the field of the protection of historical and cultural monuments. The emphasis is placed on methodological approaches to the coverage of state policy regarding the cultural heritage of the USSR after the October Revolution. The advantages and disadvantages of research papers on the study of Soviet culture are shown.

Keywords: cultural heritage, protection of monuments, state policy, USSR, museums, libraries, archives, cultural construction, historiography.

The new model of social development, affirmed in modern Russia, is accompanied by significant and not always unambiguous changes in the sociocultural sphere. Significant changes in the sociocultural situation in Russia brought to the fore the problem of studying the mechanism and results of cultural traditions and borrowing simplified forms of Western mass culture, a need arose to assess cultural changes in their complexity and diversity.

The activities of state and public bodies in the field of cultural heritage in historical literature have not yet received sufficiently complete and comprehensive coverage. Some problems were considered in generalizing works on the history of culture, the history of state institutions.

There are few historiographical works on this topic. Only in the 1980s did the first works on the historiography of culture and cultural construction appear (1). These works marked the search for new theoretical and concrete historical approaches to a comprehensive study of the history of culture and cultural policy, their place and significance in the general complex of building a new society.

In the first years of Soviet power, a number of works came out, from which we can gather information about the formation of public education bodies, about some structural units of the People's Commissariat for Education, and about certain shortcomings in the work of the educational apparatus (2). Questions of state leadership of the cultural revolution occupy a prominent place in the book of V.N. Durdenevsky (3), who considered the demolition of bourgeois-landlord statehood and the construction of the Soviet state apparatus from the standpoint of the Leninist plan for building socialism. Issues of the formation, organization and development of archival affairs, party leadership in archival construction are reflected in the works of M.N. Pokrovsky (4), who headed the country's archival service for 10 years.

By the mid-1930s, under the influence of political processes in society, the objective study of cultural transformations had significantly slowed down. In an atmosphere of harsh ideological dictatorship, the possibility of expressing views and opinions that did not coincide with the general direction of the Short Course of the History of the CPSU (B.), Was nullified. For almost a quarter century, the organization of state leadership in the cultural revolution has not been the subject of special research. Put forward by I.V. Stalin's position that the cultural and educational function in our state did not receive serious development until the liquidation of the exploiting classes was an excuse for the curtailment of research in the field of cultural construction and state leadership (5).

During this period, a number of works were published on individual problems of building a socialist culture, in which new materials were introduced into the scientific circulation, the successes of the Communist Party in the field of cultural policy were highlighted (6). The monographic work of L.S. Fried "Essays on the history of the development of political education in the RSFSR (1917-1929)" (7), dedicated to the cultural transformations of the 1920s. The main emphasis in the published works was on the elevation of the role of the party leadership in cultural processes.

The research approach to the problem of interest is present in the book of I.S. Smirnov "From the History of the Construction of Socialist Culture in the First Period of Soviet Power (October 1917-Summer 1918)" (8). The author in general terms was able to show how in the field of public education the ideas of breaking the old state machine and creating the Soviet administrative apparatus were put into practice. Particular attention was paid to the role of V.I. Lenin in the formation of the People's Commissariat of Education. During this period, works were published covering the issues of the participation of party bodies in archival work, including the creation of a network of historical parties and local party archives (9).

The state policy in the 1930s regarding antiquities, church life led to the fact that research in this area has practically stopped. We single out only a small article by Yu. Osnos, who, based on an analysis of legislative material and archival documents of the People's Commissariat of the RSFSR (10), analyzed a number of aspects of the history of the protection of monuments in Moscow and Petrograd, the first measures of the Soviet state to save artistic values.

Thus, the real activity and practice of the party and Soviet bodies for the development of culture did not receive adequate coverage in publications of that time. Their advantage can be considered the introduction into the scientific circulation of a relatively new extensive factual material and the emergence of studies analyzing specific problems of culture.

The next stage (the second half of the 1950s - the end of the 1980s) was characterized by a build-up of knowledge on the problem being studied, but all the studies were based on the Marxist-Leninist methodology. In the mid-1950s, a wide publication of Lenin's legacy on cultural issues began; The state activity of V.I. Lenin in this area was shared (11). In a monograph published in 1960 by I.S. Smirnova "Lenin and Soviet Culture: State Activities of V.I. Lenin in the field of cultural construction (October 1917 - summer 1918) ", valuable factual material was summarized, a review of the activities of state bodies for the protection of cultural property was made, the contribution of V.I. Lenin in the protection of monuments was shown.

The main directions of the work of historians in that period were the study of the forms and methods of political education. New sources and documents were introduced into scientific circulation. Works appeared that elucidated the leading role of the Communist Party in the implementation of the cultural revolution (12). The most significant contribution to the study of the history of cultural transformations at this stage was made by the works of Academician M.P. Kim (13). The merits of the work of M.P. Kim is: the methodological integrity of research, a wide source and historiographic base, the detailed development of a whole range of problems of Soviet culture. At the same time, these works are characterized by idealization of achievements, exaggeration of the role of party leadership in cultural processes.

A significant contribution to the development of this problem was made by the works of V.V. Gorbunov (14), where for the first time the scientific material was introduced the material of a number of meetings of the Politburo of the Central Committee, documents revealing the struggle of V.I. Lenin and the party against the views of the leaders of proletcult organizations.

Special mention should be made of industry literature, which examined certain areas of the cultural revolution. There have been attempts not only to generalize information about the organizational side of the state leadership in cultural construction, but also to advance further the development of this problem (15).

Interest in the problem of safeguarding cultural heritage is growing again (16). Among the works of the 1950s, the article by I.A. Bulygin and S.M. Troitsky, in which the example of the protection of the largest museum collections in the country shows the government's activities to save art in the first months of the existence of the Soviet state (in October-November 1917).

A major role in the study of the history of the protection of cultural heritage was played by the works of the employees of the Research Institute of Museum Studies, which became the basis of the multi-volume publication Essays on the History of Museum Work in the USSR. These works, based on a wide range of first published historical sources, explored the problems of creating a system of state museum bodies in Soviet times, identifying and accounting for cultural values (17).

Thus, the development of the historiography of the problem under study in the second half of the 1950s and the beginning of the 1960s was determined by the positive trends that clearly appeared on the historical background after the 20th Congress of the CPSU. The research arsenal became richer, the source base expanded, shedding light on some pages of history relating to the activities of the apparatus of the People's Commissariat of Education and the formation of its local authorities.

However, in these years, as before, the scope of research tasks was limited to the reconstruction of individual events, mainly the original history of cultural construction. M.P. Kim noted that the "sectoral" approach to reporting on the history of Soviet culture cannot satisfy either researchers or readers, because it allows historians to "give only a summary of what has already been covered fundamentally in special works" (18).

In the 1960-1980s, a significant rise was observed in Russian historiography. Scientific life has intensified: the history of the cultural revolution and cultural construction have become the subject of scientific discussions. In these years, the historiography of Soviet culture was replenished with many interesting works that differed in the breadth of subjects, the penetration into such deep layers of the theory and practice of cultural construction, which previously remained outside the scope of researchers. The implementation of a new problem-integrated approach to the study and coverage of the history of Soviet culture began (19).

In the vast literature of these years, the works of V.T. Ermakov, V.V. Gorbunov, G.G. Karpov, S.A. Galina and others devoted to the general problems of the theory of culture and the history of cultural construction stand out (20). In a number of monographs, these authors revealed the main directions of the cultural revolution and cultural construction in the USSR, identified the most important events and phenomena in the domestic culture of the Soviet period, thereby identifying the prospects for studying Soviet culture in domestic science.

Note that in the period under review, the situation and fate of cultural monuments after the revolution becomes the object of special scientific research (21). Of particular note is the work of D.A. Ravikovich on the history of the protection of monuments in Soviet times (22). The problem of the protection of cultural heritage is considered in it in a wide chronological range, in particular, in the late 1920s - early 1930s - the most difficult and controversial period in the protection of monuments. The reasons for the loss of many valuable historical and cultural objects at that time, according to the author, were a violation of the centralized system of state security bodies, as well as because of vulgar-sociological trends that had become established in society and science.

The attitude of the Soviet government towards cultural heritage was reflected in the works of V.A. Razumov, Yu. Bychkov, M.B. Keyrim-Marcus, E. Konchin, G.I. Ilyin, V.P. Lapshin (23) and others. They described the essence of the cultural policy of the Soviet state, presented an analysis of the government's efforts to preserve cultural property and organize the management of museums.

The problems of library construction in the USSR are considered in detail in the generalizing works of K.I. Abramov (24). The author described the main stages in the formation of Soviet library science. The main attention was paid to the implementation of the Leninist program of organizing library services for the population; the leading role of the Communist Party was emphasized; the problems of creating a training system, as well as the formation of Soviet library science as a social science, were considered.

Given the biased nature of the literature, the desire of researchers to circumvent the "sharp corners" led to a distortion of the history of state policy in the field of cultural heritage. Again strengthened in the 1970s, party control in the center and locally over scientific developments began to hold down the possibilities of historians. Therefore, many important issues in the field of cultural construction began to be carefully addressed. Virtually no mention was made of the shortcomings that took place in

the development of culture in general, the protection of monuments and museum work in the mid and second half of the 1920s. They were generated by a sharp restriction on financing of culture, a new economic policy that reduced government spending on culture, forced industrialization, the beginning of forced collectivization of agriculture and the policy of dispossession. Very little data was provided on difficulties in providing educational institutions and cultural enlightenment institutions, archives with premises, and on the difficult financial situation of cultural enlightenment workers.

An attempt to a new approach to the study of the cultural-historical process, reflecting positive changes in the spiritual life of Soviet society in the second half of the 1980s, were two large collective works of the Institute of History of the Academy of Sciences of the USSR (25). Along with historical research, the authors of these works had to simultaneously solve theoretical and methodological issues. They largely departed from the narrow industry approach, considering culture as a systemic unity of the three main structural elements of human consciousness - science, art and morality, functioning under the influence of certain socio-political conditions, which helped the authors interpret the historical and cultural material in a new way. In historical literature, a discussion began about the essence of the concept of "cultural revolution", and the Leninist concept of cultural transformations was revised.

Depending on the theoretical ideas of the authors, the question of the results of cultural transformations was decided differently: from recognition of the achievements of the goals to the complete denial of any successes of the cultural revolution.

A number of works on the problem of adopting legislation in the field of the protection of cultural monuments have been published. Among them, the works of M.A. Polyakov, Yu.N. Zhukov, A.A. Kozlov, A.P. Sergeev, V.F. Kozlov (26). Edited by S.A. Kasparinskaya published the two-volume "Museum and Power" (27), dedicated to the history of the relationship of the state to the preservation of artistic values and museum construction during the XVIII-XX centuries stand out.

Issues of state management of museum business after 1917 are reflected in the article by G.A. Kuzina (28). The author, using a wide range of published and archival sources, analyzed state policy in matters of financial, material, technical support of museums, as well as the relationship between the state and the intelligentsia in the field of museum business. This work was one of the first to reveal the real policy of the state in relation to cultural heritage.

Thus, Soviet researchers paid much attention to the study of the activities of party organizations in the implementation of cultural transformations. Historians have analyzed the forms and methods of party leadership of culture, showed their continuous improvement. The issues of state administration of cultural construction, the interaction of party, state and public organizations in this process are much less studied.

Most of these works have a pronounced ideological orientation, which, however, is characteristic of studies of those years. Anyway, due to the wealth of factual material, a wide range of problems studied, and a solid documentary basis, these works made a significant contribution to the development of this topic.

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STRUCTURAL-PSYCHOLOGICAL MODELS OF THE METACOGNITIVE REGULATION OF MOTIVATION OF SCIENTIFIC ACTIVITY OF RESEARCHERS IN A SITUATION OF STRESS

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Abstract. In the work, the motivational prerequisites for effective coping with the stress caused by a dissertation by researchers are studied. It is shown that neither the strength of motives nor stress resistance in this situation is associated with the destructive effects of stress. It has been established that the depth and strength of stress experience among dissertants primarily depends on metacognitive regulation mechanisms. Three models of metacognitive regulation of motivation were found, the most effective of which is the secretive restructuring of the MND system, with preservation of its integrity.
Keywords: motivation of scientific activity, stress caused by dissertation, metacognitive regulation, functional reliability

During scientific-research careers, employees often encounter situations of stress, and one of the strongest, destructively affecting functional reliability, is the dissertation. The recovery period after a dissertation can take up to several years. Nevertheless, a number of thesis do not experience severe stress and are capable of continuing creative work almost immediately after the presentation. The aim of the work was to establish due to what psychological mechanisms and conditions dissertants are able to not experience stress during the presentation and quickly restore their functionality.

The study was conducted in the period 2018-2019. The sample consisted of 42 candidates who presented doctoral and candidate dissertations in dissertation councils of the city of Yaroslavl and the city of Moscow in scientific specialties: psychology, pedagogy, economics, and mathematical sciences. The average age of the dissenters was 37.5 years, of them 31 are women, 9 are men.

The methods of data collection were the author's methodology for diagnosing the motivation of scientific activity [4], questionnaires, the questionnaire "Fatigue - monotony - satiety - stress" (adaptation by A.B. Leonova), the Methodology for determining stress tolerance and social adaptation (adaptation by L.D. Stolyarenko), resource loss-acquisition questionnaire (N. A. Vodopyanova), individual conversation. Data processing methods - descriptive statistics, student t-test, correlation analysis, methods of structural psychological analysis, including structural organization system indices (SCI - system coherence index; SDI- system divergence index; SOI- system organization index) and express χ2 method for comparing matrices and structuregrams for their homogeneity-heterogeneity.

Data collection was carried out according to the principle of longitudinality. All indicators were measured 1 month before the dissertation, on the day of presentation, one month after presentation, 6 months after presentation, 1 year after presentation.

In the course of research, three groups of dissertants were discovered, depending on the strength of the stress caused by the situation of the presentation of the dissertation. In the event that stress was of insignificant strength, destructive manifestations were not observed, and in case of severe stress there was a violation of functional reliability, a sharp decrease in the motivation of scientific activity (hereinafter - MSA), its deep destabilization, a sharp decrease in resource life.

At the same time, significant correlations with the strength of individual MSA motifs were not found, paradoxically, but no clear correlations with stress resistance were also established.

In the studies of a number of authors, direct and inverse relationships with the power of motivation were found, and these relationships are ambiguous and depend on the stage of the stressful situation, its duration. When a stressful situation only develops high motivation, as a rule, prevents its negative impact [1, 3]. If the stressful situation is prolonged and is not resolved, then high motivation can enhance its destructive effect on functional reliability and on the quality of professional activity [7, 8]. At the same time, severe stress can also reduce motivation in the process of its

impact on the employee [5, 6]. Even when the stressful situation is over, employees often experience conditions that are close to mental burnout. All of the above patterns are also characteristic of stress caused by the presentation of a dissertation. Therefore, it is obvious that not absolute strength, but other characteristics affect stress. It has been suggested that the depth and strength of stress experience among dissertants will primarily depend on metacognitive regulatory mechanisms, which are manifested primarily in the structural-level organization of MSA.

Moreover, for a reliable study of metacognitive organization, it is important to take into account the nature of metacognitive processes, which: "... in reality, perform their functions as a whole and exert their determinative effect on activity manifestations only in a complex with each other - holistically" [2, p. 154]. This necessitates studying the features of the structural organization of the system, since "... the effects of structural organization and integrity phenomena are fundamentally unavoidable from this influence, and its study should also be carried out, first of all, not at the analytical level of study, but at the structural level" [2, p. 154].

The subjects were divided into three groups. The first included those who experienced severe stress, the second - those who experienced moderate stress, the third - those who did not experience any signs of stress.

The structural-level characteristics of MSA and their dynamics were analyzed before the presentation, during the presentation and after the presentation (table 1).

Table 1

The value of the structural organization indices of the MSA system

	High stress n = 18			Medium stress n = 14			Low stress n = 10		
	SCI	SDI	SOI	SCI	SDI	SOI	SCI	SDI	SOI
1 month before dissertation	5	0	5	56	-2	54	28	-13	15
During dissertation	6	-1	5	65	-3	62	29	-11	18
One month after dissertation	17	-14	3	57	-1	56	34	-12	22
6 months after dissertation	23	-25	-2	62	-2	60	37	-9	28
1 year after dissertation	12	-17	-5	65	-2	63	45	-3	42

Legend: n = number of people in a group

As we can see from the table, dissenters who are experiencing severe stress are characterized before the presentation and during the presentation, first of all, by an extremely low organization index of the MSA system, but this is achieved due to almost zero levels of divergence and minimal levels of coherence. After the presentation of the thesis, the index of organization of the system begins to decline and six months after the presentation becomes negative, i.e. MSA system practically ceases to exist as a system capable of providing scientific activity with energy and senses. Moreover, this is achieved on the one hand due to the growth of SCI and SDI, but the divergence and destruction of the system become decisive.

Dissertants with an average degree of stress state are characterized by rather high SOI values that are achieved due to high coherence indices and extremely low levels of divergence of the MSA system. In other words, the MSA system is in a frozen state, its structure is quite rigid, which allows you to maintain its integrity and achieve the goal of scientific activity.

Researchers with low stress are characterized by positive SOI values, although lower than those with moderate stress. This is achieved due to the high SCI values and rather high SDI values, while the containment and conservation forces of the MSA system exceed the destruction forces of the system. In other words, intra-system communications are broken, but at the same time, the MSA system does not lose its integrity, which allows it to provide scientific activity with senses and energy and maintain functional reliability.

The presence of structural dynamics can be established by comparing the structures of MSA systems and establishing their differences from measurement to measurement.

Table 2

Values of the $\chi 2$ index reflecting the degree of similarity of the structural characteristics of the system of motivation for scientific activity at different stages of the presentation of the dissertation for people with severe stress

Time intervals	$\chi 2$ index values			
1 month before dissertation	0,456, P=0,01			
During dissertation		0,431 P = 0,03		
One month after dissertation			0,356 P=0,023	
6 months after dissertation				0,021 P=0,234
1 year after dissertation				
Resource Index after 1 year	0,64			

The results show that in individuals with severe manifestations of stress (Table 2), the intra-systemic connections are rather rigid, i.e. the MSA system is not being rebuilt; there is a gradual weakening of the coherence forces and an increase in divergence forces. Such dynamics lead to qualitative changes in a year, when the MSA system finally disintegrates. It should also be noted that the resource index at this moment for such dissertants is quite low, respectively, the probability of restructuring and building up functionality in the MSA system tends to zero.

Table 3

The values of the $\chi 2$ index reflecting the degree of similarity of the structural characteristics of the system of motivation for scientific activity at different stages of the presentation of the dissertation for people with moderate stress

Time intervals	$\chi 2$ index values			
1 month before dissertation	0,578, P=0,001			
During dissertation		0,601 P = 0,001		
One month after dissertation			0,556 P=0,001	
6 months after dissertation				0,467 P=0,01
1 year after dissertation				
Resource Index after 1 year	0,76			

In individuals with moderate stress (table 3), the structure of the MSA system remains unchanged throughout the study period, which confirms our assumption that the MSA system was in a frozen state. At the same time, the resource index after a year of such dissertants is also low, which suggests that maintaining the MSA system in this state required dissenters to have a sufficiently high stress of psychophysical resources and their readiness for further scientific activity was not high.

Table 4

The values of the χ2 index reflecting the degree of similarity of the structural characteristics of the system of motivation for scientific activity at different stages of the presentation of the dissertation for people with low stress

Time intervals	χ2 index values			
1 month before dissertation	0,103, P=0,324			
During dissertation		0,121 P = 0,223		
One month after dissertation			0,043 P=0,323	
6 months after dissertation				0,128 P=0,199
1 year after dissertation				
Resource Index after 1 year	1,25			

In people with low stress (table 4), at each stage of the study, the MSA system shows qualitative differences in structure. This suggests that high divergence forces ensured the restructuring of intra-system ties, the transition to a new system structure. Apparently, the system of motivation for scientific activity is being transformed in a certain way, bringing to the fore those motivational subsystems (qualitatively different groups of motives) that are most able to supply scientific activity with motivational energy and inner senses. As a result, such a restructuring leads to the preservation of functional reliability and readiness for further creative research work almost immediately after the presentation of the dissertation, due to the fact that the MSA system was adaptive at any given time and adequate to the corresponding tasks.

Thus, in the course of the study, three models of changes in the MSA structure were established, which ensure the functional reliability of researchers and help reduce the destructive effects of stress caused by the dissertation. The most optimal is the mechanism of constant restructuring of MSA intrasystem communications. This is reflected in the fact that the MSA system flexibly and quickly responds to the situation, as a result of which various motivational subsystems become functionally significant, while the absolute strength of motives may not be so high. The second most effective model is the strict preservation of the MSA structure, subject to the high strength of individual motives, but this requires a high degree of psychophysical resources, which ultimately reduces the effectiveness of scientific activities. The least effective is the model in which the intrasystem relationships of the MSA are weak but there is no restructuring of the MSA system. It does not matter whether individual MSA motives are strong or weak.

Thus, metacognitive regulation mechanisms expressed in the ability of the MSA system for flexible and continuous restructuring of intra-system connections will be the decisive mechanism, the condition for confronting the destructive effect of presentation stress among dissertants.

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EMOTIONAL BURNOUT, HEALTH CONDITIONS AND BOUNDARIES OF HUMAN ACTIVITY

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Abstract. Work stresses lead to a deterioration in the efficiency of work activities, a decrease in the quality indicators of manufactured products, as well as to a deterioration in the mental health of individuals, their instability and a decrease in the parameter of subjective comfort. *The purpose of the article* is to consider the relationship between various aspects of health and the boundaries of human activity. *The methodology of the article* is based on the analysis of burnout and stress as factors determining the state of health and the boundaries of human activity. *The results of the study* show that the scope of professional activity determines the characteristics of the health of workers. In turn, the characteristics of the health of workers serve as a predictor that defines the boundaries of human activity. *Conclusions*: the experience of reduced emotional tone, increased mental exhaustion and affective lability leads to a loss of interest and positive feelings for others, a feeling of satiety with work, dissatisfaction with life in general and a decrease in overall life activity.

Keywords: activity, health, stress, organization, burnout, subjective comfort

In recent years, a serious impact of work stresses on employees has been observed all over the world, which leads not only to an increase in staff turnover, a decrease in the efficiency of work activities, a decrease in the quality indicators of products, but also to a deterioration in the mental health of individuals, their instability and a decrease in the parameter of subjective comfort.

The appearance of professional destructions and deformations among employees leads to distortion of labor, its interruption, or even complete halt. Employees become simply incapable of fulfilling their duties (employee leaving for sick leave due to the development of an occupational disease).

Thus, employee stress directly affects the organization and its functioning. The presence of stress in many employees leads to adverse consequences for the entire organization: staff turnover increases, the number of disciplinary violations, industrial injuries, manufacturing errors increases, conflict increases, the number of absenteeism increases, asocial behavior, unwanted workaholism, etc. [1; 2; 4; 10; 12].

It is believed that burnout, like stress, is a loss of mental energy and a condition in which it cannot be replenished in the proper amount [3; 8; 9]. In the process of professional activity, a person often invests a large number of various resources in his work, including his own, mental ones - he invests himself. If for a long time, he only invests and does not receive returns or, at least, does not have time to make up for what was spent, he has exhaustion, which develops burnout syndrome [11; 13].

When a person is in a state of burnout, he is not able to experience subjective comfort. This is due to the fact that when burned out, he gets tired not only psychologically, but also physically, in reality exhausting his resources and losing health. When there are no forces to restore resources, they are also not able to "rejoice" in life, therefore, in a state of burnout, a person does not feel comfortable and safe, even when being outside the workspace [5].

Some stages of burnout include aspects such as blaming yourself or others, anger, and longing and loneliness. Due to burnout, communication ties, business and personal contacts are disrupted, conflicts can be provoked, life activity decreases [6; 7]. All this leads to the fact that a person ceases to feel acceptable and adequate in all spheres of his life. Burnout is like a disease that makes a person weak, but at the same time aggressive, embittered. Often, a burned out or burning out employee "blows off steam" on those who are weaker, who is easy to blame. This way he loses social support, which at least somehow prevented burnout, and the situation is aggravated by the fact that this happens against the background of a catastrophic decrease in activity [14].

METHODS AND ORGANIZATION OF RESEARCH. We conducted a study of the state of health and the boundaries of human activity, in which two samples of respondents took part. The first sample included 160 respondents working in the social sphere; Of these, 75 respondents carry out

labor activities through indirect contact with other people, 85 respondents carry out their labor activities through direct contact. The second sample included 120 respondents working in a commercial organization; Of these, 54 respondents carry out labor activities through indirect contact with other people, 66 respondents carry out their labor activities through direct contact. Using the methodology for detecting emotional burnout, K. Maslach, S. Jackson (Vodopyanova N.E., 2009) we determined the presence of professional burnout and the degree of its severity among employees (scales "Emotional exhaustion", "Depersonalization", "Reduction of professional achievements"). The scale of assessment of subjective comfort by A. B. Leonova (Vodopyanova N.E., 2009) revealed the general level of subjective comfort among respondents. Using the general health questionnaire SF - 36 (Nedoshivin A.O., 2000), the quality of life associated with mental health was determined by such parameters as social and role functioning and life activity. Processing of statistical data was carried out using SPSS programs.

RESULTS AND ITS DISCUSSION. An analysis of the results obtained by the Method for identifying emotional burnout K. Maslach (Vodopyanova N.E., 2009) showed that employees of both the social sphere and commercial organizations who carry out their activities directly in contact with other people are most prone to burnout and development to a high degree, as they often find themselves in a situation of uncertainty due to the ambivalent behavior of their customers, they can be stressed due to aggression and conflict with customers, as well as end up in situations They feel that the psychological contract is unfair, when they invest more in contact with another person, carrying out their work function, and at the same time do not receive proper feedback. A similar trend was also established on the Scale of assessment of subjective comfort by A. B. Leonova (N. Vodopyanova, 2009). Employees of both the social sphere and a commercial organization that carry out their labor activities through direct contact with other people are most likely to develop professional burnout syndrome. They are more susceptible to regular stress due to interacting with other people and getting aggression and negative emotions from them. Contact with customers requires great endurance and vitality from employees, however, with regular contact and constant stress, the person's mental and physical resources become thinner and his self-awareness and subjective comfort, and psychological well-being are undermined. Stress, one way or another, affects all employees in the organization, however, employees who regularly contact customers experience it most often and determine their level of comfort at a lower level compared to employees with indirect contact.

A study of the general health status of workers revealed the presence of some interesting features depending on the field of activity of the respondents. The results are presented in table 1.

Table 1.

General health indicators for workers (health questionnaire SF–36)

Indicator		Social workers			Commercial organization workers	
		Direct contact N = 85	Indirect contact N = 75		Direct contact N = 66	Indirect contact N = 54
Physical functioning	μ	83,6	82,0	μ	71, 5	68,1
	σ	14,8	19,3	σ	19,6	15,4
Role functioning	μ	70,4	80,9	μ	64,5	63,3
	σ	29,8	29,5	σ	22,8	20,1
Corporal pain	μ	72,8	79,6	μ	48,3	37,5
	σ	22,3	23,4	σ	24,9	16,7
General health	μ	59,2	65,1	μ	48,0	49,2
	σ	15,6	18,1	σ	18,9	16,7
Life activity	μ	50,8	73,7	μ	54,8	62,7
	σ	17,61	15,15	σ	19,8	20,1
Social functioning	μ	60,6	74,0	μ	51,4	45,1
	σ	25,1	20,6	σ	13,6	10,1
Emotion-related role-playing	μ	71,1	89,1	μ	66,3	57,1
	σ	30,5	22,1	σ	11,2	10,9
Mental health	μ	60,8	73,5	μ	62,0	60,9
	σ	16,9	16,1	σ	21,4	21,2

It can be assumed that the constant interaction of social workers with customers leads them to receive negative emotions from customers, experience stress, aggression from customers and the inability to deviate from their work activities, which makes employees constantly in the background stress. Over time, they begin to have a total lack of resources to deal with the effects of stress and develop professional burnout syndrome. Employees of a commercial organization have some health indicators that are significantly higher in the group that operates often interacting with customers through direct contact: role-based functioning associated with emotions and social functioning. These results show that direct contact with customers can, in some cases, contribute to the manifestation of activity, reduce professional burnout and increase the success of daily activities.

Statistically significant differences were found between employees of different fields of activity on the scales of "Role functioning", "Body pain", "Social functioning", "Role functioning associated with emotions" and "Mental health" at the level p = 0.001. In our opinion, these differences are due to the peculiarities of the interaction of specialists from various fields of professional activity with clients, as well as the specifics of client behavior.

The results of the correlation analysis suggest that there are interconnections of individual indicators of emotional burnout with the level of various types of human activity, limited by the state of health (linear Pearson correlations were considered at a significance level below p = 0.01).

In particular, emotional exhaustion as a key indicator of burnout has a negative relationship with the subjective level of comfort, role-related functioning associated with health, vitality, social functioning and role-related functioning related to mental health. These results can be explained by the fact that a high level of emotional exhaustion causes problems with mental and physical health, which, in turn, leads to a limitation of overall life activity, social functioning and role activity, since emotional exhaustion implies a shortage of vital resources in human, loss of balance and well-being, violation of vitality.

Further, the second indicator of - burnout - "depersonalization", has negative connections with the subjective level of comfort, role-based functioning associated with health, vitality, social functioning and general mental health. In our opinion, this is explained by the fact that the interpersonal relations of respondents go to the formal level, interpersonal relationships are violated, which leads to a deterioration in the person's well-being and self-perception, his vitality is undermined, as the person is deprived of the opportunity to request help from the environment in a difficult situation. In addition, a person experiences aggression as an emotional response to a stressful situation, which is not possible to cope with due to lack of resources and tension in contact with other people. All of this in combination, can lead to health problems, in the form of various psychosomatic diseases.

Finally, one of the manifestations of burnout is the reduction of professional achievements. Negative connections were found for the reduction of professional achievements with a subjective level of comfort, general health, general mental health, vitality, role-related functioning related to health, role-related functioning related to mental health. The reduction of professional achievements reveals a person's dissatisfaction with himself as a person and a professional, and therefore is negatively associated

with the above parameters. On the contrary, low values of this indicator reflect a positive assessment of one's own competence and work motivation, which, in turn, may be associated with overall life activity, social functioning and the fulfillment of work roles. In addition, the presence of positive emotions in the performance of their duties (often due to the fact that a person considers himself a professional in his field) helps to cope with stressful situations, while maintaining a high level of general and mental health.

Regression analysis revealed that the strongest negative relationships are observed in indicators of emotional exhaustion with role-based functioning, due to the emotional state and low level of experienced pain intensity. This confirms our assumptions that, in the presence of a high level of emotional exhaustion, we can observe the respondent's problems with the successful fulfillment of their labor duties and the manifestation of various psychosomatic reactions that cause pain (Figure 1).
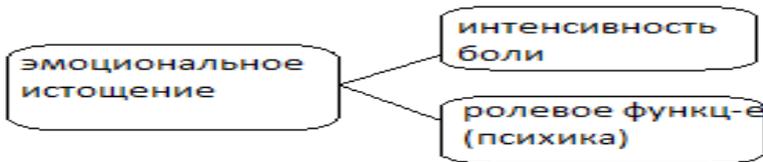
Figure 1. Regression model of emotional exhaustion

CONCLUSIONS: 1) There are differences between employees of different fields of activity in terms of assessing their own health (indicators "Body pain", "Mental health"), as well as in terms of assessing their own activity ("Social functioning", "Role functioning", "Role functioning associated with with emotions. "2) Burnout, which manifests itself in the experience of reduced emotional tone, increased mental exhaustion and affective lability, leads to a restriction in the level of a person's overall life activity, and that the activity in social functioning and performance of job roles.

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ANTIANAMNESTIC EFFECTS OF NOOTROPICS AND NORMOBARIC HYPOXIC TRAINING IN EXPERIMENTAL TRAUMATIC BRAIN INJURY

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Abstract. In experimental animals, the model of contact traumatic brain injury (TBI) investigated the antiamnestic properties of nootropic drugs and normobaric hypoxic training (HT). It has been found that under TBI conditions, hypoxic training enhances the noostimulating effect of nooglutil and runlimin, improving the process of developing adaptive skill and restoring short-term and long-term memory to the level of intact animals.

Keywords: experimental traumatic brain injury, piracetam, nooglutil, beglimin, normobaric hypoxic training, conditioned reaction of passive avoidance.

One of the most important problems of medicine, both in our country and around the world, is injuries. The leading place in the structure of injuries by the severity of medical and social consequences currently belongs to traumatic brain injury (TBI) [1, 2]. Neurological manifestations of PTS include low psychomotor activity, cognitive impairment, sleep disturbances, apathy, depression, anxiety, headache, and dizziness. At the same time, the development of adaptive reactions is the main indicator of the restoration of neuropsychiatric homeostasis in traumatic brain injury. Therefore, the study of changes in cognitive behavior in the post-traumatic period can indicate both the occurrence of cognitive defects and the state of adaptive processes in the central nervous system [3].

In brain injuries, an effective pharmacotherapy strategy has not been developed that helps restore regulatory functions. According to some authors, there is no convincing evidence that neuroprotectors with one or another mechanism of action improve neurological outcomes in patients with brain injury [4, 5]. Therefore, the urgent task is to find new approaches to neuroprotective therapy of brain injury. In this regard, the use of normobaric hypoxic training (HT) can be promising, which can positively affect the adaptive reactions of the body [6-11]. One of the mechanisms of this may be the activation of endogenous regulators of sanogenetic processes.

Purpose of the study. Evaluate the features of the influence of nootropic drugs on cognitive processes in animals with experimental traumatic brain injury under conditions of normobaric hypoxic training.

Materials and methods

Studies were performed on sexually mature white laboratory mice weighing 20-30 g. The experiments were carried out in compliance with the basic regulatory and ethical requirements for conducting laboratory experiments with animals, in accordance with the "Rules of laboratory practice in conducting preclinical studies in the Russian Federation" (GOST 3 51000.3 - 96 and 51000.4 - 96) and Order of the Ministry of Health of the Russian Federation № 267 of 19.06. 2003

Laboratory animals were divided into groups: intact, control (animals after traumatic brain injury), experimental (animals that were administered nootropic drugs from 2 to 12 days after the time of the brain injury, or underwent hypoxic training, or were prescribed nootropic drugs together with hypoxic training).

In the present work, the antiamnestic properties of nootropic drugs with different neurochemical mechanisms of action were investigated. Piracetam (50 and 200 mg/kg) and nooglutil (100 mg/kg) - positive AMPA receptor modulators; beglemin (50 mg/kg) - agonist of the glycine site of NMDA receptors [13].

In the experiment, traumatic brain damage was performed under nembutal anesthesia (50 mg/kg ip) using the modified Allen method [3]. Contact TBI was applied by dropping a load of 1.5 g in a vertical tube from a height of 1.0 meter onto a drummer. Damage to the bones of the skull and the sensorimotor region of the brain was carried out symmetrically on both sides.

Normobaric hypoxic training (HT) was carried out from the 2nd to the 12th day of the post-traumatic period in a cyclically fractionated mode of 9 cycles in a row every day. One cycle consisted of breathing a hypoxic mixture in a pressure chamber for 15 minutes followed by 5 minutes of breathing with atmospheric air. For hypoxic training, a 250 ml pressure chamber was used. The oxygen level in the pressure chamber during the hypoxic stage of each cycle was measured using a StephanNGM 1000 gas analyzer from Drager Medical. The oxygen concentration in the pressure chamber progressively decreased from 16 vol% by 5 minutes to 13 vol% by the 15th minute of hypoxic training.

Nootropic drugs were administered 30 minutes before hypoxic training. To assess the state of cognitive functions in experimental animals, the standard method of conditional passive avoidance reaction (CPAR) was used. The CPAR was produced according to the method of J. Bures [12]. The latent period and the total time spent in the "dangerous" compartment for 200 sec served as indicators and delayed conservation of the developed reaction. They were registered after 1 hour (short-term memory) and 7 days after the training session (long-term memory).

Statistical data processing was performed using the Microsoft Office 2000 software package. The correspondence of the data to the Gaussian distribution was investigated using the Kolmogorov-Smirnov test. The significance of differences (control-test) was assessed by Student's criterion (t) and Mann-Whitney nonparametric criterion (U).

Results and its discussion

The most convenient and widely used method for assessing cognitive behavior is the recording of learning and memory processes. In the post-traumatic period, the development of simple adaptive responses and their preservation in short-term and long-term memory is experimental animals was studied.

Table 1

The effect of piracetam, beglimin, nooglutil on the production of CPAR in mice in the post-traumatic period

Group (n - the number of animals)	Dose of the drug (mg/kg)	Before training		After training	
		Latent reaction period (sec)	Total time spent in the dark compartment (sec)	Latent reaction period (sec)	The total time spent in the dark compartment (sec)
Intact group (intact mice) (n=11)	-	13,1±1,79	140,4±9,86	187,9±7,69	9,3±5,95
Control group (mice with TBI) (n=10)	-	11,2±2,01	147,9±7,93	138,6±9,56#	44,4±7,23#
Experimental group 1 (piracetam) (n=10)	50	12,2±1,91	159,3±8,67	189±5,27*	6,5±2,46*
Experimental group 2 (piracetam) (n=10)	200	11,6±2,44	165,3±8,37	190,4±3,95*	7,1±2,46*
Experimental group 3 (runlimin) (n=10)	50	14,3±2,03	150,2±7,31	195,8±3,98*	3,2±2,98*
Experimental group 4 (nooglutil) (n=10)	100	10,8±1,49	154±8,51	190,9±4,64*	6,2±3,39*

Note. # - significance of differences intact group (intact mice) - control group (mice after TBI) at P <0.05; * - significance of differences control group (mice after TBI) - experimental group (mice after TBI + nootropics) at P <0.05

Initially, the impact of a traumatic brain injury on the development of a conditioned passive avoidance response (CPAR) was assessed. When performing CPAR, the latent period (the time interval from the moment of placement in the bright compartment to the moment of transition to the dark compartment of the camera) and the total time spent in the dark compartment for 200 seconds of observation were recorded.

Testing of the intact and control groups of animals before training showed that, in accordance with the biological significance of the light and dark compartments, they preferred to be in the dark compartment of the chamber (Table 1). In the study of the effectiveness of memorizing the dark "dangerous" compartment of the camera after a single application of painful electrodermal irritation, it was found that after the training session all the animals in the intact group remained in the bright compartment for 200 seconds. The latent period of transition to the "dangerous" compartment of the chamber in the control group was 26.2% shorter compared to intact animals. At the same time, only 30% of the mice remained in the bright compartment during the entire recorded period of time.

As can be seen from table 1, all nootropic drugs restored CPAR training rates to almost the level of intact animals, significantly increasing, compared with the control, the latent period of entry into the "dangerous" compartment of the unit and decreasing the total time spent in it.

In the next series of experiments, we studied the dynamics of indicators of delayed reproduction of CPAR (Table 2). A comparative analysis of the reproduction indices of the conditioned reaction of passive avoidance in intact animals 1 hour and 7 days after training showed a clear decrease in the latent period of transition to the "dangerous" compartment of the chamber. In intact mice, after 7 days, the latent period of CPAR decreased to 113.3 ± 17.17 sec. At the same time, as the period of delayed CPAR playback increased, the time spent in the dark compartment of the camera also increased. At the same time, 1 hour after training, 36.4% of intact mice entered the dark compartment of the chamber. On the seventh day after training, the analyzed indicator reached 72.8%. In mice with traumatic brain injury, the latent period after 1 hour and 7 days after a single training was less than the corresponding indices of intact animals by 33.2% and 55.9% ($P < 0.05$).

As can be seen from table 2, piracetam at a dose of 200 mg/kg contributed to the improvement of delayed reproduction of CPAR. Against the background of its course introduction, the latent period of entry into the "dangerous" compartment after 7 days from the time of training increased by 78% compared with the control ($P < 0.05$). When course administration of injured animals piracetam at a dose of 50 mg/kg anti-amnestic effect was not recorded. The course use of nooglutil and especially beglimine significantly weakened amnesia in animals caused by traumatic brain damage. It was found that after the administration of these drugs, the latent time to go to the "dangerous" compartment of the experimental setup significantly increased 1 hour after the training session, respectively, by

41% and 46%, and after 7 days - by 97% and 118%. In addition, against the background of the introduction of nooglutil and beglemin, the number of visits to the "dangerous" compartment and the total time spent in it at all CPAR reproduction periods decreased.

Table 2

The effect of piracetam, beglimine, nooglutil on the reproduction of CPAR in mice after traumatic brain injury

Group (n - the number of animals)	Dose of the drug (mg/kg)	1 hour		7 days	
		Latent reaction period (sec)	Total time spent in the dark compartment (sec)	Latent reaction period (sec)	Total time spent in the dark compartment (sec)
Intact group (intact mice) (n=11)	-	180,9±8,99	12,5±5,52	113,3±17,17	80±15,89
Control group (mice with TBI) (n=10)	-	121±10,29#	55,6±9,46#	50±10,81#	132,6±13,42#
Experimental group 1 (piracetam) (n=10)	50	148,9±14,26	40,6±11,75	85,2±20,32	94,8±19,64
Experimental group 2 (piracetam) (n=10)	200	149,0±17,38	44,3±16,07	89,3±19,85*	90,4±18,52*
Experimental group 3 (runlimin) (n=10)	50	177,0±10,69*	13,5±7,07*	109,8±21,97*	66,1±15,74*
Experimental group 4 (nooglutil) (n=10)	100	170,5±10,00*	21,3±8,76*	98,3±20,44*	82,4±17,35*

Note. # - significance of differences intact group (intact mice) - control group (mice after TBI) at $P < 0.05$; * - significance of differences control group (mice after TBI) - experimental group (mice after TBI + nootropics) at $P < 0.05$

The task of the next stage of the experiments was to study the features of the effects of hypoxic training (HT) in combination with nootropic drugs on the process of acquiring simple adaptive skills in animals in the post-traumatic period.

When analyzing CPAR training indicators, it was found that against the background of HT, the administration of nootropic drugs, with a high degree of certainty, restored the development of the adaptive skill of mice (Table 3). However, in comparison with the results of the isolated administration of nootropic drugs, there was a tendency towards shortening of the latent period of entry into the hazardous compartment of the experimental setup immediately after CPAR training in all groups.

Table 3

The effect of hypoxic training and piracetam, beglimin, nooglutil on the production of CPAR in mice in the post-traumatic period

Group (n - the number of animals)	Dose of the drug (mg/kg)	Before training		After training	
		Latent reaction period (sec)	Total time spent in the dark compartment (sec)	Latent reaction period (sec)	Total time spent in the dark compartment (sec)
Intact group (intact mice) (n=11)	-	13,1±1,79	140,4±9,86	187,9±7,69	9,3±5,95
Control Group 1 (mice with TBI) (n=10)	-	11,2±2,01	147,9±7,93	138,6±9,56^	44,4±7,23^
Control group 2 (mice with TBI + HT) (n=10)	-	10,8±1,59	144,6±7,99	141,5±14,16	41,4±10,68
Experimental Group 1 (HT + Piracetam) (n=12)	50	9,8±1,60	152,7±6,97	179,9±7,76*	13,4±4,71*
Experimental Group 2 (HT + Piracetam) (n=10)	200	13,7±3,68	163,7±7,08	188±6,98*	10,8±6,09*
Experimental group 3 (HT + beglimin) (n=10)	50	12,6±1,93	151,7±10,42	193,3±3,56*	5,4±3,37*
Experimental group 4 (HT + nooglutil) (n=12)	100	11,7±1,79	155,2±7,84	188,6±5,69*	10,4±5,22*

Note. ^ - significance of differences in the groups: intact - control 1 at P <0.05; * - significance of differences control group 1 - experimental groups at P <0.05

After the course appointment, the combination of HT with nootropic drugs showed no shifts in the time spent in the dark, "dangerous" compartment of the experimental chamber compared to nootropic drugs. At the same time, in comparison with the isolated use in the post-traumatic period of HT, the recovery of CPAR production to the level of intact animals is observed.

In the study of delayed reproduction of CPAR in animals with traumatic brain injury, it was found that the administration of HT against the administration of 200 mg/kg of piracetam in mice with TBI increased the latent period 7 days after CPAR training by 83.6% (Table 4). In animals that underwent a course of beglimine 50 mg/kg and nooglutil 100 mg/kg against

HT, the latent period of CPAR a week after the development of adaptive skill exceeded the control parameters by 138% and 102.8%. The duration of stay in the dark compartment of the experimental chamber for the recorded period of time decreased by 55.7% and 38.4%, respectively (P <0.05) in comparison with the control group of injured animals.

Table 4

Effect of hypoxic training and piracetam, beglimine, nooglutil on CPAR reproduction in mice after traumatic brain injury

Group (n - the number of animals)	Dose of the drug (mg/kg)	1 hour		7 days	
		Latent reaction period (sec)	Total time spent in the dark compartment (sec)	Latent reaction period (sec)	Latent reaction period (sec)
Intact group (intact mice) (n=11)	-	180,9±8,99	12,5±5,52	113,3±17,17	80±15,89
Control group 1 (mice with TBI) (n=10)	-	121±10,29^	55,6±9,46^	50±10,81^	132,6±13,42^
Control group 2 (mice with TBI + HT) (n=10)	-	128,7±15,24	53,2±11,29	64,7±9,85	116,4±9,80
Experimental Group 1 (HT + Piracetam) (n=12)	50	139,9±9,36	48,2±8,57	78,3±12,16	102,3±12,67
Experimental Group 2 (HT + Piracetam) (n=10)	200	144,1±10,19	38,9±9,28	91,8±13,62*	90,5±11,07*
Experimental group 3 (HT + beglimin) (n=10)	50	176,4±10,09*	16,1±6,62*	118,8±20,01*	58,7±15,95*
Experimental group 4 (HT + nooglutil) (n=12)	100	169,9±9,32*	22,4±7,25*	101,4±14,98*	81,8±12,40*

Note. ^ - significance of differences in the groups: intact - control 1 at P <0.05; * - significance of differences control group 1 - experimental groups at P <0.05

Thus, the combined use of HT with beglimin and nooglutil stimulates the process of acquiring adaptive skills and fully normalizes the delayed reproduction of CPAR 1 hour and 7 days after the training session, which indicates the elimination of post-traumatic amnesia.

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CLINICAL MANIFESTATIONS OF HYPOCALCEMIA IN CRITICALLY ILL PATIENTS

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Summary. The ionized calcium level results in 683 critically ill patients are presented. It has been shown that patients after thyroidectomy more often have a clinical picture of hypocalcemia even with a slight decrease in the ionized calcium level compared with other surgical critically ill patients.

Keywords: Hypocalcemia, critically ill patients, thyreoidectomy.

There are a lot of patients with hypocalcemia, the manifestations of which can be from asymptomatic to life-threatening, in intensive care units. Unrecognized or untreated hypocalcemia can lead to increased mortality [1].

The true spread of hypocalcemia is difficult to estimate. Reduced ionized calcium occurs in 15-88% of critically ill patients [2, 3].

It is reported that hypocalcemia can act as a marker of the disease severity, and the calcium level spontaneously normalizes with the resolution of the main process [4]. Low calcium level in critical conditions can be protective, and attempts to correct it are harmful [5].

A systematic review and meta-analysis of hypocalcemia after thyroidectomy showed that the median frequency of transient hypocalcemia was 27% (19-38%), and persistent hypocalcemia occurred in 1% of cases (0-3%)[6].The greater the degree of enlargement of the thyroid gland and the higher the damage probability to the parathyroid glands, the brighter the calcium metabolism disturbance [7]. The most manifest decrease in calcium is observed on the first day after surgery [8]. Vitamin D deficiency aggravates hypocalcemia in the postoperative period in patients operated on the thyroid gland [7, 9].

Calcium level is very important for the normal cell functioning, neuromuscular transmission, stability of membranes, bone structures, blood coagulation and intercellular signal transduction systems[10]. The level of ionized calcium remains stable due to tight control, which is carried out by parathyroid hormone, vitamin D, calcitonin through a feedback mechanism. These regulators primarily act on the bones, kidneys and intestinal wall. Calcium levels are also associated with magnesium and phosphorus [11].

Most cases of hypocalcemia have a mild severity and require only laboratory supervision. Severe hypocalcemia can manifest as muscle cramps, generalized seizures, refractory hypotension, arrhythmia, heart failure, which will require not only intravenous calcium, but also additional intensive therapy.

Hypocalcemia treatment depends on the cause, severity of symptoms and the hypocalcemia evolution rate [11].

Aim: to study the hypocalcemia prevalence and the frequency of its clinical manifestations in critically ill patients.

Materials and methods.

A prospective study of 683 patients aged 19 to 92 years in the intensive care unit was made. All patients gave voluntary informed consent to participate in the study. Men - 381 (55.8%), women - 302 (44.2%). Patients were divided into two groups. The first group (n = 81) consisted of patients after surgery on the thyroid gland due to multinodal colloid goiter (n = 52, 64.2%), diffuse toxic goiter (n = 29, 35.8%). The second group (n = 602) included patients with acute pancreatitis (n = 113, 18.8%), acute pyelonephritis (n = 102, 16.9%), gastrointestinal bleeding (n = 361, 60%) acute intestinal obstruction (n = 26, 4.3%).

A study of ionized calcium was carried out during the first day of being in the intensive care unit (stage 1) and when transferred to the specialized department (stage 2). The normal level of ionized calcium was 1.15–1.27 mmol/L. Mild hypocalcemia - 1.05 - 1.14 mmol/L, moderate hypocalcemia - 0.9 - 1.04 mmol/L, severe - 0.7 - 0.89 mmol/L.

The level of parathyroid hormone and vitamin D was not studied due to the absense these tests in a hospital laboratory.

Statistical data processing was carried out using "Microsoft Excel" and the program "Statistica 6.0" using the Student t criterion. The critical level of significance in testing statistical hypotheses is $p < 0.05$.

Results.

At 1 research stage laboratory-confirmed hypocalcemia was significantly more often revealed in patients of group 2 (54.2%) compared with patients of group 1 (19.8%), p = 0.006. Patients of the 1st group were initially prepared for surgery, compensated for the main and concomitant pathologies, since thyroidectomy was performed as planned. Hypocalcemia in this category of patients can be associated with a dysregulation of calcium metabolism due to a change in the parathyroid hormone concentration in the blood with unpremeditated damage or removal of the parathyroid glands, and a change in their blood supply.

This situation is due to the technical surgical difficulties such as various topographic location of the parathyroid glands and the cicatricial process in case of relapse in the area of operation[8]. In patients of group 2 hypocalcemia developed secondary as a result of hypoalbuminemia, hyperbilirubinemia, hypomagnesemia, hyperphosphatemia, acid-base disorders, renal and hepatic insufficiency. Also, part of patients of group 2 underwent blood transfusion, which can lead to a decrease in calcium levels.

Clinical manifestations of hypocalcemia were in 9.88% of patients of group 1 and in 1% of patients of group 2, $p = 0.011$ (Table 1). Moreover, moderate and severe hypocalcemia was significantly more often detected in patients of group 2, compared with patients of group 1 ($p = 0.007$). But clinical symptoms were more widely presented in patients of group 1. Paresthesia of hands and faces was observed in 7.4% of patients of group 1 and 1% of group 2. Muscle cramps in the extremities - in 1.23% of the 1st group. Generalized seizures were presented in 1.23% of group 1. There were no seizures in the second group; hypocalcemia was manifested by paresthesia of the hands, face in 1%.

At the 2nd stage of the study, there were no clinical manifestations of hypocalcemia in any patient, but mild hypocalcemia was laboratory diagnosed in 2.46% of patients of group 1 and in 2% of patients of group 2, no significant differences were noted, $p = 0.76$.

Table 1. Hypocalcemia manifestations prevalence in critically ill patients

		mild		moderate		severe	
		group 1	group 2	group 1	group 2	group 1	group 2
Stage 1	Laborat.	11,1%	16,78%	7,4%	26,24%	1,23%	11,2%
Stage 2	Clinical	6,17%	–	2,46%	0,66%	1,23%	0,33%
Stage 1	Laborat.	2,46%	2%	–	0,17%	–	–
Stage 2	Clinical	–	–	–	–	–	–

Hypocalcemia severity comparison in patients within groups by the period of stay in intensive care units in the winter-spring months and summer-fall (for the indirect assessment of vitamin D deficiency) did not reveal significant differences, $p = 0.83$.

The treatment was carried out in all cases of hypocalcemia with clinical manifestations and in the case of moderate and severe hypocalcemia and consisted of intravenous administration of calcium chloride or calcium gluconate, depending on the available dose of 100-300 mg in terms of elemental calcium. Calcium chloride 10% and calcium gluconate 10% were introduced in a solution of 50-100 ml of 5% dextrose.

There were no deaths. There were no repeated admissions of patients to the intensive care unit with clinical symptoms of hypocalcemia.

Conclusions.

Thus, hypocalcemia was detected in 20 - 55% of patients in the intensive care unit. In patients who underwent thyroidectomy, hypocalcemia is less frequently detected in the laboratory than in other critically ill patients.

The clinic of hypocalcemia after thyroidectomy manifests significantly more often even with a slight decrease in the level of ionized calcium. Likely, abrupt change in the concentration of parathyroid hormone in the blood, entailing a disturbance of calcium metabolism, does not allow adaptation mechanisms in the body to turn on quickly, which is manifested by symptoms of hypocalcemia.

Obligatory screening of calcium levels in the postoperative period should be recommended for patients after thyroidectomy for the early detection and treatment of hypocalcemia.

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THE PREVALENCE OF DRUG ABUSE DISORDERS IN THE ADULT RURAL POPULATION

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Narcological disorders are an important medical and social problem and characterize the health status of the population from the perspective of socially significant diseases. Of considerable interest is the study of the prevalence of narcological disorders among the adult rural population, taking into account the demographic, socio-economic, and infrastructural characteristics of the countryside.

The purpose of this study was to examine the prevalence of drug addiction disorders in the rural population of the Samara region aged 18 years and older during 2013-2018. Statistical and analytical research methods were used.

The population of the Samara oblast in 2018 amounted to 3193.5 thousand people, decreasing by 0.6% compared to 2013 to 3193.5 thousand inhabitants. Compared with the Russian Federation, the Samara oblast should be attributed to a highly urbanized area, since the share of the urban population in 2018 was 80.0%, having slightly decreased over the study period (80.3% in 2013), which is significantly higher than the proportion of the urban population countries (74.4%). Against the background of a decrease in the population of the Samara oblast, the rural population of the region living in 27 municipalities increased from 632.2 thousand people in 2013 to 639.3 thousand people in 2018, or 1.0%.

The largest in population rural municipal areas of the oblast (2018) are Volzhsky (99.5 thousand people), Kinelsky (90.7 thousand people) and Stavropol (73.8 thousand people), located near the two largest cities of

the oblast - Samara and Tolyatti. These areas are characterized by high population growth rates for 2013-2018, an average of 9.2%. The smallest population was registered in Elkhovsky (9.4 thousand people), Kamyshlinsky (10.6 thousand people) and Isaklinsky (12.4 thousand people) districts located at a distance from the oblast center mainly in the north and northeast. This group of districts is characterized by a population loss in 2011-2018 by an average of 12.0%.

The overall morbidity of the rural population of the Samara oblast with alcoholism, drug addiction, substance abuse (that is, all diseases associated with the use of psychoactive substances (PAS), or drug addiction disorders) decreased from 3362.1 by 100 thousand inhabitants in 2013 to 1183.2 in 2018 year, or 64.8%.

The highest rates of the overall incidence of drug addiction disorders in general were observed in 2018 in the Chelno-Vershinsky district (2900.7 diseases per 100 thousand inhabitants), the Borsky district (2344.3) and the Shentalin district (2251.6), which exceeds the average in rural areas 1.9 - 2.5 times. The lowest values of the overall incidence were generally observed in the Hvorostyansky district (451.6), Volzhsky district (614.1) and Bolshe-Chernigovsky region (697.2). This is 1.7-2.6 times lower than the average for the countryside.

In the Samara oblast, in general, indicators of the general adult morbidity rate of narcotic disorders and similar dynamics with the countryside are noted: for example, from 2013 to 2018 they decreased from 3879.7 per 100 thousand inhabitants of the oblast to 993.0, or 74.4%.

In the structure of the overall morbidity of the oblast rural population with drug addiction disorders by groups of diseases associated with the use of PAS, in 2018 the majority of cases occurred in the group of diseases associated with alcohol consumption (alcoholism, alcoholic psychoses and alcohol consumption with harmful consequences (86.1% of total number of registered). For drug addicts and people who use narcotic substances with harmful consequences, 13.6% of cases occurred, for drug addicts and people who use non-narcotic skie psychoactive substance (PAS) with harmful consequences - 0.3%.

Six years ago, in 2013, diseases related to alcohol use (85.9%) also prevailed in the structure of the general incidence of the rural population, followed by diseases associated with the use of drugs (13.8%) and the last group were diseases. associated with the use of non-narcotic drugs (0.3%). Thus, in 2013-2018, the nature of the structure of the total incidence of rural population of drug addiction disorders has not changed significantly.

A significant proportion of the total morbidity of the rural population with narcological disorders is alcoholism (37.0% in 2013 and 53.4% in 2018, while the proportion of alcoholism increased statistically significantly, p <0.01). The prevalence of alcoholism per 100 thousand population of the rural municipal districts of the oblast decreased from 1242.4 in 2013 to 632.1, or 49.1%.

The highest rates of the total incidence of alcoholism in 2018 were observed in the Chelno-Vershinsky (1870.6 diseases per 100 thousand inhabitants), Krasnoarmeysky (1483.7) and Klyavlinsky (1425.4) districts of the oblast, these figures exceed the average for rural areas more than half. The smallest values of the general incidence of alcoholism were noted in the Hvorostyansky (154.7), Elkhovsky (190.6) and Bolshe-Chernigovsky (245.7) areas, which is 2.5-4 times lower than the average level of the oblast.

A significant part of narcological disorders among the adult population in rural areas occurs in the pernicious use of alcohol with harmful consequences (46.3% in 2013 and 31.2% in 2018, a decrease in the proportion by almost 1.5 times, p <0.01). The prevalence of this pathology decreased from 1556.9 per 100 thousand inhabitants in 2013 to 369.5 in 2018, or by 76.3%.

The highest rates of the total incidence of pernicious alcohol consumption (with harmful consequences) in 2018 were observed in Borsky (1020.4 cases of diseases per 100 thousand inhabitants), Shentalinsky (981.8) and Chelno-Vershinsky (813.3) districts, in In these areas, indicators exceed the average for rural areas by 2.2-2.8 times. The smallest prevalence of harmful use of alcohol was observed in Krasnoyarsk (1.7), Stavropol (58.3) and Volzhsky (161.8).

The overall incidence of alcoholic psychoses per 100 thousand of the population of rural municipalities of the oblast decreased from 87.7 in 2013 to 17.5 or five times. The share of alcoholic psychoses in the structure of the overall incidence of diseases associated with the use of PAS decreased, respectively, from 2.6% to 1.5% (p <0.05).

The highest rates of the general incidence of alcoholic psychoses in 2018 were observed in Bogatovsky (62.7 cases of diseases per 100 thousand inhabitants), Kamyshlinsky (47.0) and Koshkinsky (36.2) districts, which exceeds the average values for rural areas in 2 -4 times. The minimum values of the general incidence of alcoholic psychoses were noted in Neftegorsk (2.2), Sergievsky (2.2) and Chelno-Vershinsky (6.8) districts of the oblast.

Against the background of a decrease in the overall incidence for all groups of diseases associated with alcohol consumption, in 2013-2018, the indicators of the total incidence of alcohol consumption with harmful consequences (4.2 times) and alcoholic psychosis (five times) relative to alcoholism (two times).

The total incidence of drug addiction in the rural population of the Samara oblast decreased from 268.7 per 100 thousand inhabitants in 2013 to 104.6 in 2018, or by 61.1%. The proportion of drug addiction in the structure of the overall incidence of drug addiction disorders remained virtually unchanged at 8.0% in 2013 and 8.8% in 2018.

We can distinguish a number of rural areas of the Samara oblast with the highest rates of the total incidence of drug addiction in 2018: Pohvistnevsky (228.2 cases of diseases per 100 thousand inhabitants), Krasnoyarsk (176.5) and Kinelsky (176.2), in which the incidence rate exceed the average in rural areas by 1.7-2.2 times. The lowest prevalence of drug addiction was observed in the Volga (4.3), Isaklinsky (16.2) and Neftegorsky (15.6) districts.

The overall incidence of drug use with harmful consequences was reduced even more rapidly: from 195.8 per 100 thousand inhabitants in 2013 to 56.6 in 2018, or 71.1%. The proportion of this pathology group in the structure of the overall incidence of narcotic disorders slightly decreased from 5.8% in 2013 and 4.8% in 2018.

The highest rates of the total incidence of drug use in 2018 were observed in Syzran (182.9 cases of diseases per 100 thousand inhabitants), Sergiev (123.9) and Pokhvistnevsky (97.3) districts; these indicators exceed the average for rural areas 1.7-3.2 times. The smallest prevalence of harmful drug use was noted in Koshkinsky (13.6), Bogatovsky (13.9) and Bolshe-Glushitsky (10.8) districts.

The total incidence of rural drug addiction has decreased more than four times from 2.9 per 100 thousand inhabitants in 2014 to 0.8 in 2018, or by 72.4%. The share of this pathology among all drug addiction disorders is insignificant and does not exceed 0.1% in 2013-2018.

Areas with the highest prevalence of substance abuse in 2018 were: Shigonsky (10.3 cases of diseases per 100 thousand inhabitants), Krasnoyarsk (3.5) and Kinel-Cherkassky (2.3), these figures exceed the average in rural areas by 2.9-12.9 times. In 24 municipal rural areas of the Samara oblast, diagnoses of substance abuse were not recorded.

The total incidence of the use of non-narcotic substances with harmful consequences among the rural population decreased from 7.7 per 100 thousand inhabitants in 2013 to 2.4 in 2018, or by 68.8%. The share of this pathology among all drug addiction disorders is small and amounts to 0.2% in 2013-2018.

The highest rates of the total incidence of the use of non-narcotic substances with harmful consequences in 2018 were observed in Pestravsky (18.1 cases of diseases per 100 thousand inhabitants), Borsky (12.7) and Kamyshlinsky (9.4) districts, these figures exceed the average for rural areas 3.9-7.5 times. In 16 municipal rural areas of the Samara oblast, diagnoses of the use of non-narcotic substances with harmful consequences were not recorded.

Against the background of a decrease in the overall incidence for all groups of diseases associated with the use of narcotic and non-narcotic PAS, in 2013-2018, the rates of the total incidence of the use of non-narcotic substances with harmful consequences (3.6 times) relative to the incidence of drug addiction decreased most times).

The primary incidence of alcoholism, drug addiction, substance abuse (all drug addiction disorders) per 100 thousand of the population of rural areas of the Samara oblast decreased from 694.5 in 2013 to 169.7 in 2018, or by 75.6%.

There is a decrease in the proportion of the primary incidence of narcological diseases in the total incidence of narcological diseases from 20.7% in 2013 to 14.3% in 2018, that is, the primary incidence is decreasing more rapidly than the overall incidence.

In the Samara oblast as a whole, there are lower rates of primary incidence of adult drug addiction disorders compared to rural areas with a similar tendency to reduce them. From 2013 to 2018, indicators decreased from 450.7 per 100 thousand of the oblast residents to 145.9, or 67.6%.

Trends in the dynamics of primary adult morbidity in the Samara oblast with narcological disorders as a whole are close to those in relation to the overall morbidity.

The highest rates of primary incidence of drug addiction disorders in 2018 were observed in Shentalinsky (602.2), Volga (557.4 diseases per 100 thousand inhabitants), Klyavlinsky (422.1) districts, which exceeds the average indicators in rural areas in 2.5-3.5 times. The smallest values of the primary incidence of narcological diseases were generally observed in the Krasnoyarsk district (66.4), Koshkinsky district (86.1), Neftegorsky district (111.3), which is 1.5-2.6 times lower than the average for rural areas.

Most of the initially registered patients in 2018 are patients with alcoholism, alcoholic psychoses and patients with harmful use of alcohol (84.4% of the total number of registered). For drug addicts and drug abusers accounted for 14.9%, substance abuse and drug abusers for non-narcotic PAS - 0.7%.

In 2013, this structure was somewhat different: the group of diseases associated with alcohol consumption accounted for 90.7% of the primary morbidity, drug addiction and drug use with harmful consequences - 8.9%, substance abuse and non-narcotic PAS use - 0.4 %

Thus, in the structure of primary morbidity for the period of 2013-2018, the proportion of diseases associated with the use of narcotic drugs is statistically significantly increased from 8.9% to 14.9% (p <0.01) and non-narcotic psychoactive substances from 0.4 % to 0.7% (p <0.05) with a decrease in the proportion of diseases associated with alcohol consumption from 90.7% to 84.4% (p <0.01).

Most of the primary incidence of drug abuse disorders in rural areas is attributable to harmful alcohol consumption (76.3% in 2013 and 54.9% in 2018, p <0.01). The primary incidence of this pathology decreased from 529.6 per 100 thousand inhabitants in 2013 to 93.2 in 2018, or 82.4%.

A significantly lower proportion in the primary morbidity of the rural population with narcological pathology has alcoholism (10.8% in 2013 and 3.2% in 2018, p <0.01). The primary incidence of alcoholism decreased from 74.7 per 100 thousand rural people in 2013 to 38.1 in 2018, or by 49.0%.

The share of alcoholic psychoses in the primary incidence was 3.7% in 2013 and 7.1% in 2013 (p <0.01), with a twofold decrease in the initial incidence of alcoholic psychoses from 25.5 to 12.0 per 100 thousand residents.

With a decrease in the primary morbidity for all groups of diseases associated with alcohol consumption, in 2013-2018 the rates of primary morbidity of alcohol consumption with harmful consequences (5.7 times) relative to alcoholic psychosis (2.1 times) and alcoholism (two times) decreased most intensively.

The primary incidence of drug addiction among the rural population of the Samara oblast decreased from 15.7 per 100 thousand inhabitants in 2013 to 7.5 in 2018, or by 52.2%. The proportion of this pathology in the primary incidence increased markedly from 2.3% in 2013 to 4.4% (p <0.01).

The primary incidence of drug use with harmful consequences reduced significantly: from 46.2 per 100 thousand inhabitants in 2013 to 17.9 in 2018, or by 61.3%. The share of this pathology increased from 6.7% in 2013 to 10.5% in 2018 (p <0.01).

The primary incidence of substance abuse in 2013 amounted to 0.4 per 100 thousand inhabitants (recorded only in three rural areas), in 2018 amounted to 0.1 per 100 thousand inhabitants (registered only in one, Volzhsky district), the proportion of this pathology in the structure of the primary incidence of narcological disorders is insignificant (less than 0.1% for 2013-2018).

The primary incidence of the use of non-narcotic substances with harmful consequences was more than halved (from 2.4 per 100 thousand inhabitants in 2013 to 0.8 in 2018, or 66.7%. The proportion of this pathology in the primary incidence increased from 0.3% in 2013 to 0.5% (p <0.05).

With a decrease in the primary incidence for all groups of diseases associated with the use of narcotic and non-narcotic PAS, in 2013-2018, the rates of primary incidence of substance abuse (four times), the use of non-narcotic substances with harmful consequences (three times) relative to the incidence of drug addiction decreased most intensively (2.1 times).

Thus, the dynamics of the general and primary morbidity of the adult population in rural areas of the Samara oblast with narcological disorders shows a significant decrease, largely due to a change in the regulatory framework for the organization of this type of specialized medical care, when people who are not attending appointments with a psychiatrist-narcologist are subject to withdrawal from drug abuse surveillance.

CELLULAR AND MOLECULAR ASPECTS
OF AIRWAYS ALLERGIC INFLAMMATION

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Annotation. The article discusses experimental models of bronchial asthma. The cellular and molecular basis of inflammation in human bronchial asthma is analyzed. The role of Th2 lymphocytes in allergic airway inflammation is presented. Disclosed the biological basis of allergenic sensitization. The main events responsible for the onset and full manifestation of bronchial inflammation are presented. The enhancement and, maintenance of bronchial inflammation is described. The biological background and genetic features predisposing to allergic inflammation and bronchial asthma have, been established.
Key words: bronchial asthma, lymphocytes, cytokines, allergic inflammation, sensitization, receptors, genes.

The increased use of bronchoscopy with bronchoalveolar lavage (BAL) and bronchial biopsies as research tools in asthma studies has facilitated the accumulation of information about the role of various inflammatory cells and their mediators in the disease process. An important acquisition has been the demonstration that the same inflammatory' features, even though attenuated, occur in patients with mild or intermittent bronchial asthma (BA). Histopathological, immunohistochemically, and molecular studies of bronchial and nasal biopsies and BAL obtained in baseline disease or taken sequentially following experimental or natural exposure to allergens have shown particular alterations in atopic individuals with BA and/or rhinitis, characterized by the presence of activated CD4+T-helper (Th-cells), degranulated mast cells and activated eosinophils. Moreover, BAL fluid examinations and biopsy studies carried out on the airway mucosa in extrinsic (or allergic), intrinsic (or non-allergic), and occupational BA have demonstrated that the profile of inflammatory cells is similar in all the disease forms [3, 10].

However, only the knowledge of involvement of cytokines and chemokines has enabled better understanding of the pathogenesis of chronic bronchial inflammation. In fact, cytokines are able to influence consistently cell functions in a marked and persistent way. They induce de novo expression of multiple genes and subsequently the production of many factors, including cytokines and receptors, as well as maintain up-regulation of particular adhesion molecules on endothelial and epithelial cells. Multidirectional cellular and molecular interactions can thus occur [9]. The cytokines and chemokines involved in allergic inflammation can explain the characteristic and persistent histological, pathophysiological and clinical aspects of allergic BA.

The identification in humans of different functional characteristics of two principal subsets of Th-lymphocytes gave considerable impulse to these studies. Th1-lymphocytes, capable of producing IL-2, IFNγ and TNF-β and Th2-lymphocytes, capable of secreting IL-4, IL-5, IL-6, IL-13 and IL-10, but not IL-2 an IFN-γ were described. Even though the distinction between Thl- and Th2-lymphocytes as the two most "polarized" Th-cells remains valid, the existence of a multiplicity of functional phenotypes, with different cytokine production profile, which blend from one to another should be remembered. In this paper, recent results concerning experimental models of BA will first be reviewed, then, die cellular and molecular aspects of bronchial inflammation responsible for the human BA, will be examined; subsequently, the mechanisms of Thl-type lymphocyte differentiation and the possible basis of genetic predisposition to BA will be discussed.

Recent studies on experimental asthma in mice deficient of T- and B-cells, of IgE and of single cytokine genes have contributed to a better understand-ing of bronchial inflammation. Evidence for the absence of antigen-induced BA in mice with severe combined immunodeficiency disease, in mice depleted of CD4+ T-cells or of major histocompatibility complex (MHC) class II has been re-ported. Passive transfer of antigen sensitization and experimental allergic BA is possible only by T-cells. On the other hand, analyses of mast cell-deficient mice have demonstrated degrees of bronchial eosinophilia and inflammation not sig-nificantly different from those of normal mice, even though antigen-induced pul-monary eosinophilia can be delayed. IL-4 -/- mice produced antigen-specific IgE only when reconstituted with IL-4-producing T-cells, but not with IL-4-producing non-T-cells. Stat-6 -/- mice have been shown to be deficient in IL-4-mediated functions including Th2-cell differentiation, expression of cell surface markers, and immunoglobulin class switching to IgE. In IL-5-/-mice, eosinophilia, airway damage, and airway hyper responsiveness (AHR) normally resulting from chal-lenge with inhaled antigen were completely abolished [5].

Caution should; be taken into account in comparing mice models and humans. However, knockout mice are very useful in evaluating the functional role of cell types, cytokines and mediators in the complex cascade of interactions responsible for the airway inflammation. The above results therefore indicate that IL-5 is required for the induction of eosinophilic inflammation and airway damage and AHR. Experimental allergic airway inflammation and AHR can also occur in CD40-/-mice, in B cell-deficient mice as well as in mice with a null mutation of Cε-locus independently of IL-4 and antigen-specific IgE. IL-4 does not seem to be essential for the development of IL-5 - but not IL-4-producing CD4+T-cells.

Studies on experimental models have lent support to the results of research on human BA. As is well known, the pathogenesis of allergic inflammation does not depend only on the reactions of allergens with IgE antibodies bound to high affinity receptors (FcεRI) of mast cells and basophils, with subsequent release of histamine and other traditional mediators. There also exist much more complex mechanisms involving lymphocytes and inflammatory cells, mainly eosinophils, as well as resident cells such as epithelial, endothelial cells, fibroblasts and smooth muscle cells. As has long been known, Th2-lymphocytes are required for IgE antibody production by B-cells. The phenotype of cytokine production by T-cells from peripheral blood (PB) and target tissues of atopic subjects has been, extensively investigated. Summarize the results of these investigations can, as follows [3, 11, 13]:

• in atopic subjects allergens preferentially expand T-cell clones (TCC) with Th2-phenotype of cytokine secretion;

• CD4+ TCC from atopic subjects display an aberrant in vitro production of IL-4 and IL-5 even in response to antigens other than allergens;

• TCC derived from umbilical cord blood of new-boms from atopic parents consistently proliferate in vitro in response to allergens; they show, in a significant percentage, the Th2-profile of cytokine production;

• TCC established from PB of atopic subjects can produce concordant concentrations of IL-3, IL-4, IL-5 and GM-CSF;

• Late-phase cutaneous reactions to allergens, allergen-induced rhinitis and asthma associate with the activation of the IL-3, IL-4, IL-5, IL-13 and GM-CSF gene cluster;

• allergen exposure induces the activation allergen-specific Th2-cells in the airway mucosa of patients with allergic respiratory disorders, increased Th2-type cytokine mRNA expression, and eosinophil recruitment in BAL;

• increased levels of allergen-specific γδ+T-cells of Th2-type have recently, been demonstrated in BAL fluid from patients with allergic BA.

These data suggest that Th2-cells are, expanded mainly at the level of target tissues of atopic subjects. Aeroallergen sensitization can occur during fetal life; in fact, allergen-specific Th2-cells can be already, expanded at birth [11]. Thus, in atopic subjects, overexpression not only of the IL-4 gene, but also of other genes of the IL-4 gene family, namely of IL-3, IL-5 and GM-CSF genes occur. It has been demonstrated that in primary responses to allergens, during the sensitization phase, the inhaled allergen molecules are captured and processed in small peptidic fragments by CD1+dendritic cells (DC) of medullary origin, present in large numbers in the epithelium and submucosa of asthmatic airways, rich in MHC class II antigens and appropriate costimulatory molecules. After taking up the allergen DC, which can be, considered as the most efficient "antigen presenting cells (APC)", migrate through afferent lymphatics to paracortical areas of the regional lymph nodes where they present selected allergen peptides to specific "naive" Th-lymphocytes, inducing, in the appropriate microenvironment, their differentiation into Th2-lymphocytes.

These cells can therefore migrate to respiratory mucosa through the circulatory system. CD express on the surface both high affinity IgE receptors (FcɛRI) and low affinity IgE receptor (FcɛRII) that increase their allergen capturing and processing capacity. In the secondary responses, the allergens are more easily, captured by DC with specific IgE bound to FcɛRI on the cell membrane and also by B-lymphocytes with specific IgE bound to FcɛRII (CD23) on the cell membrane. The latter cells are capable of cooperating with Th2 memory cells and inducing the production of Th2-type cytokines. Allergen-IgE complexes bound to CD23 allow B-cells to facilitate allergen presentation to allergen-specific T-cells, resulting in greatly amplified T-cell responses. IgE-CD23 allergen presentation, which leads to an induction of Th2-cytokine production, to represent a positive feedback loop responsible for amplifying an allergic asthmatic response [8].

The expansion of allergen-specific Th2-lymphocytes induces both IgE-antibody production through the cooperation of these cells with allergen-specific B-cells and the release of Th2-cytokines, in particular IL-5, leading to eosinophil differentiation and the priming of these cells for subsequent chemotaxis and bronchial mucosa infiltration. In the effector phase of allergic bronchial inflammation causing the beginning of asthmatic symptoms or their exacerbations, airway mucosa mast cells, stimulated by aeroallergen molecules reacting with specific IgE on their membrane, with subsequent cross-linking of FcɛRI, are induced to release mediators and cytokines. Th2-lymphocytes too, stimulated by allergen peptides presented by DC or B-cells, release Th2-cytokines. B-lymphocyte/Th2-memory lymphocyte cooperation results in greatly amplified Th2- lymphocyte responses.

Eosinophil differentiation and survival are, influenced by cytokines. In fact, IL-5, IL-3 and GM-CSF secreted by Th2-lymphocytes promote maturation, activation and prolonged survival of eosinophils. IL-5 acts specifically on eosinophils inducing their activation and terminal differentiation. IL-5 must, be considered the most important cytokine for eosinophil differentiation. Eosinophil migration from the bronchial mucosal microcirculation is initiated by interaction between receptors, on the cell surface with their ligands on the surface of vascular endothelial cells. These ligands are represented by particular adhesion molecules overexpressed by endothelial cells. The overexpression of adhesion molecules depends on the local release of some cytokines and mediators. In particular, TNF-α and IL-1 induce overexpression of intercellular adhesion molecule (ICAM)-l on endothelial and epithelial cells; IL-4 and IL-13 of vascular cell adhesion molecule-1 on endothelial cells; histamine and platelet activating factor (PAF) of E- and P-selectin on the endothelial cells. Respiratory viral infections – respiratory syncytial virus during early infancy and other respiratory viruses later- are frequently involved in the outbreak and exacerbations of BA. These viruses induce the release of cytokines (IL-1β, IL-6, IL-8, IL-11, GM-CSF, RANTES, Eotaxins, MCPs, MIP-lα) from epithelial and mononuclear cells, with subsequent activation of mast cells, eosinophils and other inflammatory cells [2].

Eosinophils usually migrate towards epithelial cells and damage the epithelial structures. Non-damaged or regenerated epithelial cells actively participate in inflammatory process. Stimulated by TNF-α and IL-1β produced by mast cells and macrophages, these epithelial cells release numerous cytokines, chemokines and mediators (IL-1β, IL-6, IL-8, IL-11, GM-CSF, RANTES, Eotaxins, MCP-3, MCP-4, LTs, PGs, ET-1), which in association with similar factors produced by mast cells, Th2-lymphocytes, inflammatory cells and other resident cells, amplify the inflammatory lesions. In fact, they act on microvascular endothelial cells (vasodilation and edema), as well as on smooth muscle cells and facilitate the continuous migration of eosinophils, T-lymphocytes and basophils. Chemoattraction of inflammatory cells from the blood and the cellular infiltration is favored not only by the overexpression of adhesion molecules on endothelial cell membrane but also by the activity of a particular subgroup of β-chemokines. The histopathological characteristics of asthmatic inflammation are mainly dependent on the activity of both IL- 5, able to induce differentiation and to prime the eosinophils, and of the β-chemokines subgroup capable of binding to specific cellular receptors, particularly to CCR-3. Eosinophils, basophils and mast cells express CCR-3 on their membrane. Th2-lymphocytes express CCR-4, CCR-8 and to lesser extend CCR-3. Thl-cells preferentially express CCR-5 and CxCR-3 [12].

Atopic, intrinsic and occupational BA show many similarities from pathophysiological, clinical and histological points of view. A wide spectrum of forms can be considered. The typical atopic BA can be located on one side of the spectrum: on the opposite side the typical intrinsic BA. Aspirin induced BA is much more frequent in the subgroup of intrinsic BA. However, many forms exist with aspects, which blend from atopic to intrinsic BA. In this connection, it has been recently shown that Th2 cytokines, C-C chemokines, IL-4 Ra, IL-5 Ra, as well as FcεRI+ cells and Iε/Cε (epsilon germline transcript; mRNA encoding e heavy chain), are expressed at level of bronchial mucosa in atopic and intrinsic asthmatics. In intrinsic BA there is a prominence of submucosal activated macrophages expressing GM-CSF receptor. Therefore, all subjects with BA share many common immunopathological mechanisms. The most prominent direction of future research should concern the identification of the role of unidentified antigens or allergens or autoantigens or viruses possibly involved in the etiopathogenesis of intrinsic asthma. Another indirect way may be the determination of the frequency of usage of the TCR variable (V) gene families and junctional analysis among T- cells isolated from airway of intrinsic asthmatics.

While IL-4 is the cytokine necessary for the development of the atopic state and IL-5 and other Th2-cytokines as well as mast cell mediators are important for the beginning of bronchial inflammation and therefore for the clinical expression of BA. The cytokines TNF-α and IL-1, sometimes acting in association with GM-CSF and IFN-γ, play a fundamental role in inducing numerous cellular interactions, also involving bronchial resident cells, with consistent amplification and maintenance of inflammation and clinical symptoms. TNF-α and IL-1 act by inducing the production of ubiquitous nuclear transcription factor NF-κB, often acting in association with nuclear factors activating protein-1 (AP-1) and nuclear factor-IL-6 (NF-IL-6), capable of activating the promoters of genes which code for many cytokines, chemokines and for enzymes involved in the production of nitric oxide (NO) and inflammatory mediators [7].

The mediators produced by mast cells, basophils and eosinophils continue to act on the microvascular endothelium and to induce vasodilation and mucosal edema. Ongoing histamine release from basophils is induced by the chemokines MCP-1, MCP-2, MCP-4, MIP-lα independently of allergen stimulation. These chemokines can, be considered as the most important histamine releasing factors active on basophils. Disruption of the epithelium with the secretion of a range of growth factors for epithelial cells, smooth muscle cells and fibroblasts, together with matrix degradation, re-

sults in a tissue regenerative and remodeling response [14]. Proteolytic destruction of the epithelial basement membrane and stimulation and proliferation of subepithelial myofibroblasts lead to the deposition of interstitial collagen types III and V. In fact, myofibroblasts, activated by ET-1 released by epithelial cells as well as by TNF-α derived from macrophages, eosinophils and mast cells, produce collagen proteins, fibronectin and TGF-β which are responsible for epithelial basement membrane thickening and for the infiltration of the smooth muscle interstitium [14].

Amyelinic C sensory fiber endings, located under the epithelium, being continue sly stimulated **– espe**cially where epithelial lesions are mere pronounced - by mediators derived from mast cells and eosinophils, release neuropeptides (substance F, neurokinine-A, neurokinine-B, calcitonin gene related peptide, etc.), which amplify bronchial inflammation by the association of so-called ''neurogenic inflammation'' [4]. Sensory neuropeptides are capable of producing neurogenic inflammation with many of the features of asthma such as smooth muscle contraction, vasodilation, plasma extravasation and mucus hypersecretion. Axon reflexes may amplify immunopathological mechanisms via humoral interactions. Recent data, obtained in humans and in experimental models, strongly suggest that neurotrophins such as "nerve growth factor (NGF)", upregulated in allergic inflammation, produced by both neuronal and immune cells and can provide a link between airway inflammation and neuronal control of smooth muscle contractility and AHR in BA.

Mucus hypersecretion is stimulated by LTs, PGs, PAF, histamine, IL-6, neuropeptides. Mainly mediators produced by mast cells, basophils and eosinophils as well as by ET-1, IL-1β and some chemokines, induce smooth muscle contraction. Smooth muscle hyperplasia and hypertrophy, present in the most serious forms of BA, is caused by LTs, ET-1, IL-6 and chemokines MCPs and MIP-lα produced by eosinophils, fibroblasts and epithelial cells, platelet derived growth factor (PDGF) released by inflammatory cells, and neuropeptides. Proliferation of airway smooth muscle and the microvascular tissue leads to a structurally altered airway that over time contributes to disease chronicity [4].

It is possible to suppose that in the primary responses allergen-specific naive Th-cells from atopic Subjects, when stimulated by allergen epitopes within lymphoid structures, are much more able than similar cells from normal individuals to produce enough IL-4 to start their differentiation into Th2- lymphocytes. The demonstration of the capacity of IL-4 production by "naive" T-lymphocytes activated by antigens or polyclonal activators, without the intervention of extracellular IL-4 is further evidence of this pos-

sibility. In the secondary and ongoing responses, allergen-specific memory Th-cells, when stimulated by IL-4, also produced by FcεRI+-cells, such as mast cells, basophils, eosinophils, can be more susceptible to differentiation into Th2 effector cells. However, according to recent results, not only IL-4, but also other cytokines (IL-6; IL-7; IL-10) seem to be involved in the differentiation of Th2 cells from their precursors.

There is consensus that the cause of BA is multifactorial and genetically heterogeneous. Several genes, along with an array of environmental factors, influence disease expression. A number of different genes or combinations of genes determine the disease phenotype. Clinical manifestations can appear when etiologic environmental precipitating factors intervene in certain ways (exposure to large allergen concentrations; respiratory virus infections; intense exposure to environmental respiratory irritants). According to the common clinical and epidemiologic experience, environmental factors acquire a greater triggering capacity when they act in various associations.

At present, on the basis, of the results obtained, multiple genes have been, considered as possible candidates. They are located mainly on the chromosome 5q31-33, which code for the cluster of IL-4 family member cytokines; on chromosome 6 (subregions DR and DQ of the HLA-system); on chromosome 11q13 (P chain of FcεRI); on chromosome 12q (IFN-γ; LTs); on chromosome 14q (a chain of TCR; NF-κB); on chromosome 16p12 (a-chain of the IL-4 receptor); on chromosome 17q11-12 (P-chemokines) [1]. Taking into account the results concerning both the intrinsic properties of T-lymphocytes from atopic subjects to produce, when stimulated by allergens, IL-4 and the other cytokines of the same family and the expansion of Th-cells at level of the target tissues. Of allergic diseases, a great attention has been, paid on the possible deregulation in subjects with atopy and BA of cytokine genes present on chromosome 5 (5q 31-33) coding for IL-4 family gene members.

At present considering the results obtained in mice and humans, six transcription factors (Stat-6, c-Maf, NF-IL-6, nuclear factor activated T-cells (NF-AT), CP-2, activating protein (AP-1) and GATA-3) seem to be mainly involved in Th2 cell differentiation. In humans, multiple nuclear factors involved in the regulation of IL-4 gene transcription have been identified. It has been, suggested that the possible alterations directly leading to the deregulated overexpression of the IL-4 gene in atopic Subjects could be present at the level of signal transduction pathways and/or at the level of the molecular complexes formed by transcription factors and their corresponding promoter regulatory elements.

The existence of a polymorphism at the level of the IL-4 gene distal and proximal promoter, which mediates IL-4 gene overexpression has been shown directly. Nucleotide substitutions have been, identified in the proximal IL-4 promoter that influence promoter activity in transfected cells and affect the interaction of DNA-binding proteins with the polymorphic sites. However, recent findings in humans and in some experimental models seem to support also the possibility that deficient regulatory activity by cytokines responsible for the inhibition of Th2 development (i.e. IFN-α/γ and IL-12, and possibly, IL-18) may account for the preferential Th2 responses. At present state of knowledge, the two possibilities cannot be, considered as mutually exclusive.

Of great interest are the recent results concerning the association of atopy with a gain-of-function mutation in the α-subunit of the IL-4, receptor. This allele was common among patients with allergic inflammatory disorders and in patients with the hyper-IgE syndrome. This so-called R576 mutation is associated with enhanced signaling of the IL-4 receptor, leading to greater IL-4 activity [6]. On the basis of above data. It is possible to conclude that in a complex syndrome such as BA, single genes or even a very small number of genes are unlikely to be exclusively involved. A more credible scenario would involve the interaction of multiple sets of genes, each contributing to the inunnopathological and pathophysiologic conditions of BA.

Advanced knowledge of the cellular and molecular basis of airway inflammation characteristic of BA - and this consideration may also be true for other diseases such as organ-specific autoimmune diseases, rheumatoid arthritis, chronic gastrointestinal inflammatory diseases, etc. - has allowed better understanding of the multistep and gradual sequence of biological events leading to AHR and clinical manifestations of BA. It has been possible to distinguish the primary events from the secondary ones. The primary events are absolutely, necessary for the initiation of the biological history, which constitutes the background of the clinical history. Secondary events are important for the pathogenesis of inflammatory lesions but they cannot occur without the primary ones. Taking into account only the sequence and importance of the various biological events involved in the pathogenesis and clinical manifestations of BA. It is possible to carry out correct diagnostic procedures and therapeutic interventions and to propose rational future directions.

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DESTRUCTIVE OSTEONECROSIS OF THE JAW AND THE REGULATORY ROLE OF CERTAIN BIOCHEMICAL AND IMMUNOLOGICAL PARAMETERS IN PREDICTING TREATMENT OUTCOMES

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Abstract. The number of patients with osteonecrosis of the jaw is increasing. The proposed classification allows osteo-destructive organization of various pathological manifestations and development of operation protocols. Patients' self-estimation for the internal picture of the disease complements the results of the treatment check.

The relationship of the dynamics of pro- and anti-inflammatory cytokines and immunoglobulin's of the oral fluid with the effectiveness of surgical treatment in patients with chronic destructive processes of the jaw has been studied. A decrease in IL-4 at high IL-8 levels after the completion of treatment indicates an imbalance of pro-and anti-inflammatory cytokines, and against the background of an increase in the level of immunoglobulins in the oral fluid, can be considered as a sign of the ineffectiveness of the treatment followed by a relapse of osteonecrosis. With successful treatment, there is a restoration of interdependence between pro- and anti-inflammatory cytokines against the background of a decrease in initially higher levels of IgG and sIgA in the oral fluid. In parallel, biochemical and immunological studies are objective prognostic tests.

Keywords: osteonecrosis of the jaw, classification, surgery, cytokines, immunoglobulins.

Introduction

Over the past decades, there has been an increase in the number of atypical and severe forms of jaw osteodestructions associated with chemotherapy (bisphosphonate osteonecrosis), radiation therapy (radiation osteonecrosis), alcoholism, drug addiction (desomorphine osteonecrosis), immunodeficiency states (HIV infection)[3, 4, 5, 7, 8].

The study of biochemical and immunological parameters in patients with osteo-destructive processes of the jaw is also important for the diagnosis and prognosis of medical treatment.

Inhibition of angiogenesis and impaired blood supply to the bone is considered a classic cause of aseptic necrosis. The state of microcirculation in areas of pathological foci is evidenced by the dynamics in the blood of markers of bone metabolism: synthesis (osteocalcin) and resorption (Beta-CrossLaps) and dynamics of indicators of endothelial dysfunction (level of homocysteine, D-dimers, von Willebrand factor antigen, antithrombin III).

Chronic osteodestructive necrosis may be due to an imbalance of cytokine regulation [6] or a result of a violation of the local immune defense of the oral cavity, represented by immunoglobulins (sIgA, IgM, IgG). IgM and IgG mainly enter saliva from the blood through passive diffusion [1,2].

Purpose of the study - study of the prognostic value of the dynamics of the above indicators in patients operated on by us with chronical osteomyelitis and osteodestructive necrosis of the jaw.

Material and research methods

Patients were treated at the Maxillofacial and Plastic Surgery Center of the City Multidisciplinary Hospital № 2, immunological studies were performed at the Pavlov First Saint Petersburg State Medical University Research Institute of Dentistry and Maxillofacial Surgery, and biochemical studies were performed at the "ImmunoBioService" laboratory.

To systematize the variety of clinical manifestations of osteodestructive necrosis of the jaw, an appropriate classification and stages of the pathological process have been developed. A glossary (questionnaire) was compiled for patients to self-evaluate the internal picture of the disease at the stages of treatment. This, along with clinical and radiological indicators, made it possible to judge the results of treatment.

A comparative assessment of the results of the operation, the dynamics of biochemical and immunological parameters was carried out in 48 patients (average age 54 ± 2.2 years, 36 men, 12 women). 24 of them were diagnosed with chronic bisphosphonate, desomorphine and post-radiation osteonecrosis, and 24 patients with traumatic, primary chronic, secondary chronic osteomyelitis necrosis. The control group (23 people, average age 52 ± 3.1 years, 15 men, 8 women) - an arbitrary sample of people without chronic destructive osteomyelitis of the jaw.

Saliva and blood were taken for examination upon admission to treatment and before discharge, the resulting material was stored at -20°C. To determine the state of local immune defense in saliva, sIgA, IgG, IgM (enzyme-linked immunosorbent assay with monoclonal antibodies) and cytokines IL-4 and IL-8 (enzyme-linked immunosorbent assay (ELISA) were determined using test systems manufactured by "Protein contour") To identify endothelial dysfunction in blood plasma, the primary physiological coagulants were determined - Antithrombin III and Protein C (automatic coagulometric analyzer ACL-200); markers of endothelial dysfunction - D-dimers (ELISA "Biotech" analyzer) and von Willebrand factor antigen (ELISA using the "vWFAg" kit, Siemens; Homocysteine (ELISA "Biotech"). The determination of osteocalcin was carried out on an enzyme-linked immunosorbent assay analyzer AIFR-01 "Uniplan" (Russia) using reagents from the company N-MID (Great Britain). Collagen degradation products were determined in serum by enzyme-linked immunosorbent assay using Nordic Bioscience Diagnostics A/S CrossLaps TM test systems.

The obtained indicators of values in the samples had a close to normal form of distribution of attributes. In this regard, we used parametric methods of mathematical statistics with the calculation of t-student test. The differences were considered statistically significant at $p < 0.05$. The correlation analysis was carried out using Pearson's correlation coefficients (g).

Research results and discussion

Destructive processes of the jaw mainly occurred in men, with the exception of bisphosphonate osteonecrosis, which in most cases was diagnosed in women - 64 relative to 36%. In 36 (75%) patients, destruction was observed in the lower jaw, in 11 (23%) cases the upper jaw was affected, in 1 (2%) case, the upper and lower jaw was also affected. With bisphosphonate and desomorphine osteodestructive necrosis, 25% of the patients noted a spontaneous appearance of a pathological focus, in 75% this was preceded by tooth extraction.

Based on experience with patients suffering from destructive osteonecrosis of the jaw, we have proposed a working classification of osteodestruction depending on the length and depth of damage to the bone and surrounding tissues (mucous membrane, skin integument) and structures (maxillary sinus). On this basis, the stages of the disease are formulated and an algorithm for conservative surgical treatment is developed (table 1).

Table 1.

Surgical treatment options depending on the prevalence of chronic osteo-destructive process

Stages	Surgical Treatment Options
0 stage	Endodontic treatment of the causative tooth
1 stage (OD)	Removing the causative tooth. FRP-clot, closure (plastic) of the socket with a mucoperiosteal flap with suturing
2 stage (OD)	Sectoral resection within the alveolar ridge of the jaw, sometimes in combination with improved microcirculation + FRP-clot, sutures.
3 stage (OD 3, OD 4) - upper, lower jaws; (OD1,2 S – upper jaw	Segmental resection of bone tissue to healthy areas while maintaining the continuity of the lower jaw. Improving microcirculation surrounding bone defect. On the upper jaw, the closure of the oroantral communication by traditional methods of plastic surgery. FRP-clot, sutures.
4 stage (OD 3,4S1. OD 5S2) – upper jaw (OD 4F. OD3,4FM) – lower jaw	Resections of the lower and upper jaw using various types of plastics: Bisha fatty lump, a fragment of the temporal muscle with preserved blood supply. Osteosynthesis of the lower jaw with a reconstructive plate with the creation of a soft tissue bed "wrapping" it in the skin, muscle, skin-fat-muscle, fat-platy islet flaps from the neck, from the chin. According to the testimony, directed regeneration of bone tissue (bone auto and allogeneic shavings in the case membrane) in the defective area (Patent for invention RU 2 645 944 C1)

Upper jaw. OD 1 - osteodestruction in the area of the tooth socket. OD 2 - osteodestruction in the area of one segment (three teeth) of the alveolar process. OD 3 - osteodestruction in the zone of 2 segments of the alveolar process. OD 4 - osteodestruction of the entire alveolar process of the upper jaw, without communication with the maxillary sinus. OD 1,2S - osteodestruction of the alveolar process with limited perforation of the bottom of the maxillary sinus. OD 3,4S1 - osteodestruction of the alveolar ridge with extended perforation of the bottom of the maxillary sinus. OD 5S2 - osteodestruction of the upper jaw (total osteonecrosis of the alveolar bone and body of the upper jaw).

Lower jaw. OD1 - osteodestruction in the zone of the tooth cavity with preservation of continuity. OD2 - osteodestruction in the area of one segment (three teeth) of the alveolar process with preservation of continuity. OD3 - osteodestruction in the zone of 2 segments of the alveolar process with preservation of continuity. OD4 - osteodestruction the alveolar process of the half of the lower jaw with preservation of continuity. OD 3,4FM

- osteodestruction of the alveolar process, the body with a pathological fracture of the lower jaw (fraction (F) and with an extended defect of the mucous membrane of the oral cavity (mucosa, M).

Positive results, according to closer observations (within 1 month after surgery) were obtained in the treatment of 40 (83.3%) patients. Long-term results of treatment were tracked in 36 patients. When observed in terms exceeding 6-12 months after surgery, treatment was effective in 29 patients. Accordingly, the effectiveness of complex treatment according to long-term results was 80%.

The best results were obtained in patients after BLOCK resection, with a PRF clot and careful suturing of the wound with a mucoperiosteal flap in isolation or in combination with additional soft-tissue flaps for reliable isolation of the flaw from the oral cavity (OD2B, OD3.4 B - stage 2.3) In these situations, the efficiency of the operation exceeded 85%.

In operations with BLOCK resection, osteosynthesis with a reconstructive plate and with methods of wrapping the plate and dissecting the wound with the oral cavity using soft tissue blood supply flaps, the result was slightly lower than 75-80% (stage 4 OD 3,4S1., OD 5S2 - upper jaw) (stage 4 OD 4F.OD3,4FM - lower jaw).

A parallel study of biochemical and immunological parameters was an important additional factor reflecting the outcome of operations and the prognosis for the future.

The dynamics of markers of bone metabolism in the general group of patients was manifested as a decrease in the level of osteocalcin immediately after surgery (from 6.99 ± 0.48 to 3.93 ± 0.24 ng/ml, with pp≤0.001), which may be associated with operational trauma, while the level of Beta-CrossLaps did not statistically significantly change. At the control examination after 4 months, the level of osteocalcin increased to the initial level, in some cases, in patients with osteonecrosis, it increased to 50%, and Beta-CrossLaps decreased from 0.17 ± 0.01 to 0.13 ± 0.01 ng/ml ($p \leq 0.001$). These indicators show an increase in bone synthesis relative to resorption and confirm the effectiveness of the treatment.

We carried out therapy aimed at improving microcirculation in tissues, according to the method proposed by M.S. Bogomolov for the treatment of "diabetic foot." In the dynamics of treatment, there was a statistically significant decrease in the blood of patients with chronic destructive processes of the jaw, of homocysteine levels (from 29.2 ± 1.4 to 14.18 ± 0.84 at $p \leq 0.001$) and von Willebrand factor antigen (from $2.45 \pm 0, 15$ to 1.18 ± 0.06 IU/ml at $p \leq 0.001$). The level of D-dimers significantly exceeding the reference interval before treatment decreased greatly during the follow-up

examination after 4 months from 1068.05 ± 43.44 to 213.7 ± 53.6 ng/ml (p ≤ 0.001). Antithrombin III level, with initial values below the reference interval (48.8 ± 3.36%) statistically significantly decreased after surgery (35.2 ± 2.9%) and returned to its previous level at the follow-up examination after 4 months, and still not reaching the normal range, which may be due to the specifics of the underlying diseases.

Analysis of the dynamics of the level of cytokines and oral fluid immunoglobulins was carried out according to the results of studies at admission and 30 days after the operation. The study of correlation relationships at admission in the general group of patients (48 people) revealed statistically significant correlation relationships (at p≤0.05) IL-8 with IgG (r = 0.47) and IgM (r = 0.49), which confirms the relationship of inflammation with these immunoglobulins. Within the group of immunoglobulins, sIgA and IgG had statistically significant correlations with IgM (r = 0.49 and 0.55, with p ≤ 0.05). There was no correlation between IL-4 and IL-8.

30 days after surgical treatment, a positive correlation between the pro-inflammatory IL-8 and anti-inflammatory IL-4 (r = 0.62, at p ≤0.01) was restored against the background of an increase in the positive correlation of sIgA and IgM (r = 0.9, with p ≤ 0.001) A repeated study revealed a decrease in IL-8 and IL-4, which was statistically significant only for IL-4 in the group of patients whose treatment was ineffective - from 88.2 ± 25.4 to 30.7 ± 3, 8 pg/ml (at p <0.05).

Assessment of the state of local immunity of the oral cavity upon admission showed that in the group of patients whose treatment was successful, the level of IgG and sIgA was initially higher than in patients whose treatment was ineffective - 0.04 ± 0.004 relative to 0.027 ± 0.005 μg/ml and 392.5 ± 37.4 with respect to 220 ± 60 μg/ml (at p <0.05). When studying the content of immunoglobulins in the oral fluid of patients, statistically significant differences with the indices of the control group were not established. In the dynamics of patients with effective treatment, a statistically significant decrease in IgG from 0.04 ± 0.004 to 0.023 ± 0.004 μg/ml (at p <0.02), IgM from 0.028 ± 0.004 to 0.018 ± 0.003 μg/ml (at p <0.05) and IgA from 392.5 ± 37.4 to 260.0 ± 54.3 μg/ml. With an ineffective IgA treatment, on the contrary, rises from 220 ± 60 to 480.0 ± 20.3 μg/ml (at p <0.001).

At all stages of the study, patients with chronic osteo-destructive processes in the jaw established an increase in IL-8 and IL-4. A decrease in IL-4 at high levels of IL-8 after completion of treatment indicates an imbalance of pro- and anti-inflammatory cytokines, and against the background of an increase in the level of immunoglobulins in the oral fluid can be considered a sign of treatment failure with subsequent relapses of osteonecrosis.

With successful treatment, a restoration of the interdependence between pro- and anti-inflammatory cytokines is observed against the background of a decrease in initially high levels of IgG and sIgA.

Discussion. Unfortunately, as before, the number of patients with chronic osteo-destructive processes of the upper and lower jaws is increasing. Due to the variety of pathological manifestations of these processes, it was necessary to systematize the severity of damage in the form of creating a classification of osteodestructions of the jaws and the staging of the disease. This allowed us to create a protocol (algorithm) for surgical treatment. Along with traditional methods of clinical and radiological evaluation of treatment results, self-estimation by patients of the internal picture of the disease at the treatment stages is of great importance. Parallel biochemical and immunological studies have allowed not only to confirm the effectiveness of conservative surgical therapy, but also to determine the estimated prognosis for the future.

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POSSIBILITIES OF HYPERAMMONEMIA CORRECTION IN PATIENTS WITH LYMPHOMAS AGAINST THE BACKGROUND OF CYTOSTATIC THERAPY

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Purpose. Study of the level of hyperammonemia in patients with lymphomas, the clinical efficacy of L-ornithine-L-aspartate (LOLA, Hepa-Merz) and its effect on the biochemical parameters of liver function at the stages of polychemotherapy (PCT).

Material and methods. The study included 48 patients with an established diagnosis of lymphoma, confirmed by clinical, instrumental, morphological and immunohistochemical studies of biopsy material (in accordance with the revised WHO classification 2017). The control group consisted of 25 relatively healthy individuals, the average age of 43.4±4.5 years without lymphoproliferative diseases and liver pathology. The main group consisted of 31 patients, the average age of 49.4±13.2 years, as an accompanying therapy for PCT courses, patients took LOLA 3 g 3 times a day for 1 month, the comparison group consisted of 17 patients with lymphomas, the average age of 55, 7±12.2, without LOLA therapy. The effectiveness of treatment was evaluated spectrophotometrically with the determination of the concentration of ammonium ion in the blood plasma, numbers connection test (NCT) to determine the minimum liver encephalopathy (MLE), a biochemical blood test to assess impaired liver function.

Results and discussion. Admissionof LOLA (Hepa-Merz) has demonstrated good efficacy, tolerability and safety in patients with lymphomas. Patients showed a decrease in the severity of asthenic (from 82.8% to 54.6%, p = 0.035) and dyspeptic syndrome (from 65.5% to 45.3% p = 0.007).

After the course of treatment with LOLA, a significant decrease in the concentration of ammonium was found (from 124.8±14.8 to 94.9±8.5 µmol/L; p = 0.056), compared with the comparison group, which was not accompanied at the PCT stages LOLA therapy (124.7±6.5 and 117.7±21.2 µmol/L; p = 0.362). In the main group, there was also a significant decrease in the speed of the numbers connection test (from 97.4±14.4 to 71.9±9.2 sec; p = 0.029), the results of the comparison group showed a significant difference, the execution speed of the NCT was significantly reduced, test execution time increased from 82.7±2.8 to 105.1±14.2 seconds, p = 0.380.

Conclusions. Conclusions L-ornithine-L-aspartate (LOLA, Hepa-Merz) is an effective drug in the correction of hyperammonemia, significantly improves liver function indices, reduces the severity of asthenic syndrome, and promotes better tolerance of polychemotherapy in hematologic patients due to restoration of liver detoxification function.

Keywords: hyperammonemia, minimal hepatic encephalopathy, lymphomas, polychemotherapy.

Hyperammonemia is a metabolic disorder, manifested by an excessive content of free ammonium ions ($NH_4 +$) in the blood due to a violation of the ammonia neutralization reactions in the liver. Ammonia is a product of nitrogen metabolism that has a high toxic potential for a large number of cells. The most susceptible to this effect are liver cells and cells of the central nervous system. Normally, the ammonia content in the blood does not exceed 50 µmol/L [2,4,5].

The main process of ammonia detoxification in the body is carried out mainly by the binding of periportal hepatocytes in the mitochondria in the ornithine cycle, where, in reactions with amino acids, it forms urea, which is not toxic to the body. In addition, the neutralization of ammonia occurs in muscle tissue due to the synthesis of glutamine with the participation of glutamine synthetase. With the lowest intensity, the same reaction occurs in astrocytes of the brain and perivenous hepatocytes of the liver [7].

Excessive ammonia in the blood leads to its penetration through the blood-brain barrier, where it exerts its damaging effect on astrocytes, the function of which is to ensure the normal functioning of brain neurons. The neutralization of ammonia in astrocytes occurs in reaction with glutamate with the formation of glutamine, the excessive accumulation of which contributes to the development of neuroglia edema. At the same time, a decrease in glutamate reserves leads to a disruption in the synthesis of neurotransmitters and, as a result, a violation of nerve conduction occurs [5,6,8]. From the foregoing it follows that hyperammonemia is a life-threatening condition

leading to a disruption in the adequate functioning of the central nervous system. The clinical picture in this condition is manifested by a decrease in concentration of attention, insomnia, lability of behavior, slowing of motor skills and speech and even impaired memory, impaired consciousness. The combination of these symptoms defines the concept of encephalopathy. In the early stages of the development of encephalopathy, clinical symptoms may not be present or detected only upon careful examination and during psychometric or neurophysiological tests that can diagnose the latent stage of encephalopathy [1,3,5]. Kholodova N.B. et al. in their study of the effect of polychemotherapy on the central nervous system, cite the term "post-chemotherapeutic encephalopathy", which is a cognitive deficit that develops after treatment with cytostatic drugs [15]. It is known that a number of cytostatic drugs used to induce and consolidate remission of lymphomas, such as methotrexate, cytarabine, procarbazine, cisplatin, can cause encephalopathy with insomnia, agitation, drowsiness, depression, headache, dizziness, confusion (VIDAL 2018). Doxorubicin and cyclophosphamide reduce attention, learning, processing speed, adriamycin potentiates the development of cognitive dysfunction of consciousness [15]. Damage to the liver and the development of liver failure in patients with lymphoproliferative diseases include many components, some of which are infiltration by tumor cells and the toxic effect of metabolites arising from tumor decay under the influence of cytostatic therapy. Infiltration of the liver by tumor cells in hematologic diseases is approximately 15-20% [14]. Thus, hyperammonemia and, as a result, arising encephalopathy are components of polymorbid pathology in patients with lymphomas both before and during cytostatic therapy.

Purpose of the study: study of the level of ammonia in patients with lymphomas, the clinical efficacy of L-ornithine-L-aspartate (LOLA, Hepa-Merz) and its effect on biochemical parameters of liver function at the stages of polychemotherapy (PCT).

Study objectives:

1. To study the degree of hyperammonemia in the blood by microdiffusion in patients with lymphomas at the stages of polychemotherapy.

2. To investigate the clinical efficacy of the drug L-ornithine-L-aspartate (LOLA, Hepa-Merz) against PCT and in the dynamics of observation.

3. To evaluate the speed of the numbers connection test and biochemical parameters of liver function in the dynamics of observation.

Material and methods. The randomized trial included 48 patients with an established diagnosis of lymphoma, confirmed by clinical, instrumental, morphological and immunohistochemical studies of biopsy material. The main study group consisted of 31 people who took LOLA 3 g 3 times a day

for 1 month as an accompanying therapy at the PCT stages, the average age of the examined patients was 49.4±13.2 years. The comparison group included 17 patients who were without accompanying LOLA therapy at the PCT stages, the average age was 55.7±12.2 years. PCT was carried out according to standard treatment protocols, including drugs such as doxorubicin, vincristine, cytosar, cisplatin, cyclophosphamide, bortezomib, dacarbazine, etc. The control group consisted of 25 relatively healthy individuals, without lymphoproliferative diseases and liver pathology, the average age was 43.4±4,5 years. Exclusion criteria for the study were: viral, autoimmune hepatitis, alcohol abuse (the GAGE questionnaire was used), liver cirrhosis, decompensated diabetes mellitus, pregnancy, lactation, the administration of other hepatoprotectors, and the serious condition of patients.

Methods of examination and therapy effectiveness monitoring:

• Gathering information about the state of health, measuring the level of ammonia in the blood by microdiffusion, conducting a numerical test to assess the presence of minimal hepatic encephalopathy before inclusion in the study (for all groups);

• Assessment of the condition using a specially designed questionnaire of complaints, general examination of the patient;

• General blood analysis;

• Blood biochemical analysis (alanine aminotransferase - ALT, aspartate aminotransferase - AST, gamma-glutamyl transpeptidase - GGTP, lactate dehydrogenase - LDH, alkaline phosphatase, albumin, bilirubin, glucose, cholesterol, triglycerides);

• Coagulogram (prothrombin index (PTI), Activated partial thromboplastin time (APTT), fibrinogen, prothrombin time (PTT), thrombin time (TT), international normalized ratio (INR).

• Determination of the concentration of ammonia in capillary blood by spectrophotometric method on a PocketChemTM BA analyzer (Japan);

• Statistical processing of the results was carried out using the software package SPSS-23 version;

The endpoint for evaluating efficacy is clinical and hematologic remission of lymphomas.

Results

Against the background of LOLA therapy (Hepa-Merz), a positive dynamics was observed in the reduction of hyperammonemia, the concentration of ammonia decreased to 94.9±8.5 μmol, at the initial level of 124.8±14.8 μmol/l for 1 month of taking the drug Positive results were noted after 2 weeks - 117.3±5.7 μmol/L compared with the initial level (Fig. 1).

Dynamics of the concentration of ammonia in the LOLA (Hepa-Merz) treatment against the background of PCT
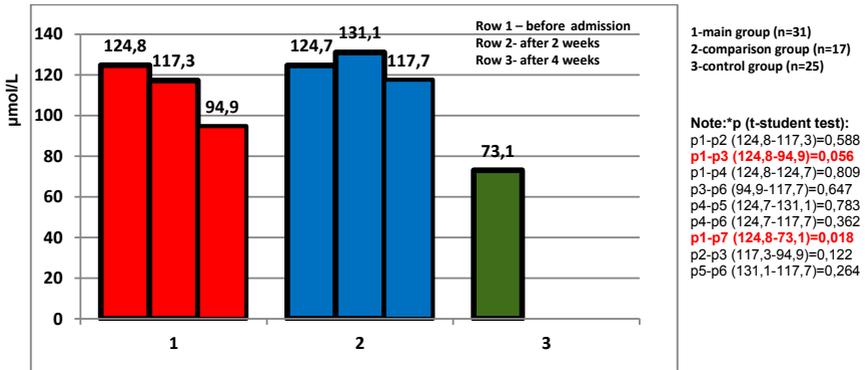
Fig.1

The performance indicators of psychometric tests (the numbers connection test) also showed significant improvement; there was an increase in the reaction rate, concentration, and accuracy of the task performance (Fig. 2).

Dynamics of the numbers connection test under the influence of treatment with LOLA (Hepa-Merz) against the background of PCT
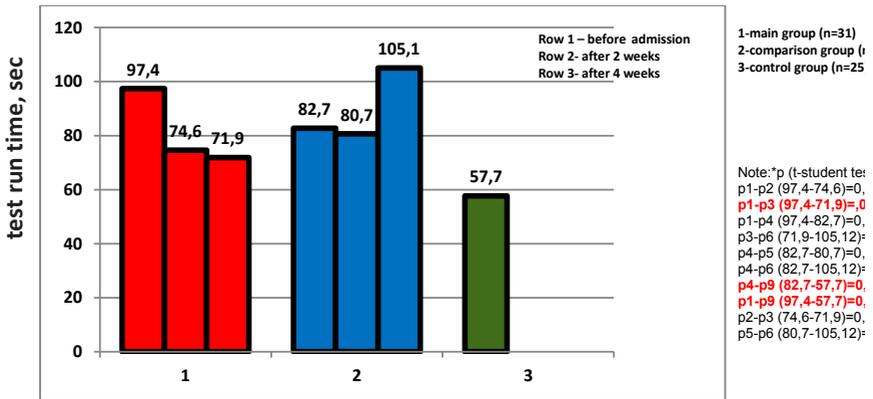
Fig.2

Indicators of aminatransferases while taking LOLA (Hepa-Merz) remained stable within the reference values, despite the ongoing chemotherapy, which has significant hepatotoxicity. At the same time, in the comparison group, ALT indices increased significantly, which once again indicates toxic liver damage during the period of PCT (Fig. 3.4).

Dynamics of aminotransferases under the influence of treatment with LOLA (Hepa-Merz) against the background of PCT

ALT

1-main group (n=31)
2-comparison group (n=17)
3-control group (n=25)

Row 1 – before admission
Row 2- after 2 weeks
Row 3- after 4 weeks
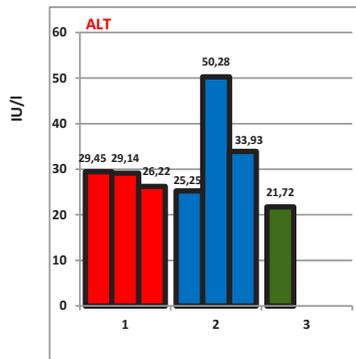
ALT:Note:*p (t-student test):
p1-p4(29,45-25,25)<0,480
p1-p2(29,45-29,14)<0,711
p1-p3(29,45-26,22)<0,803
p4-p5(29,14-50,28)<0,054
p3-p6(26,22-33,93)<0,263
p2-p5(29,14-50,28)<0,071
p2-p3(29,14-26,22)=0,905
p5-p6(50,28-33,93)=0,299

Fig.3

AST
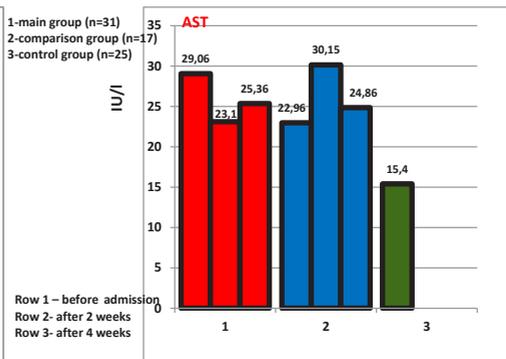
AST:Note:*p (t-student test):
p1-p4(29,06-22,96)<0,066
p1-p2(29,06-23,1)<0,181
p1-p3(29,45-26,22)<0,479
p4-p5(23,1-30,15)<0,118
p3-p6(25,36-24,86)<0,697
p2-p5(29,14-50,28)<0,288
p2-p3(29,14-26,22)=0,372
p5-p6(30,15-24,86)=0,203

Fig.4

The dynamics of other biochemical parameters of liver function under the influence of LOLA (Hepa-Merz) treatment with PCT showed an unreliable change in these indicators.

Clinical efficacy of LOLA (Hepa-Merz)

Admission of LOLA (Hepa-Merz) has demonstrated its good efficacy, tolerability and safety in patients with lymphomas. Patients noted the cessation of headaches, decreased fatigue and irritability, improved sleep, and decreased discomfort in the right hypochondrium (Fig. 5).


Ряд1 –до приема препарата
Ряд2- через 4 нед

Note:*p (Student's test, pairwise comparison of the indicator
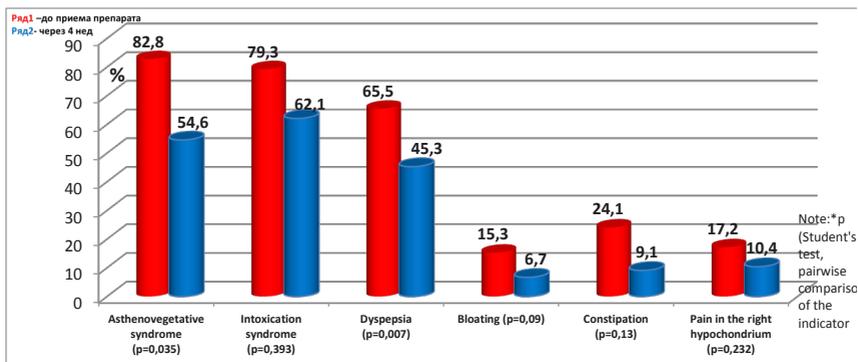
Fig.5

Discussion

Modern polychemotherapy provides tremendous opportunities for the treatment of hematologic diseases. However, most cytotoxic drugs have a low selectivity of action, which leads to a wide range of damage to organs and systems [11,12]. Most often, the hepatobiliary system is exposed to this effect, which subsequently leads to liver cell failure and the accumulation in the body of an excessive amount of intermediate metabolic products, one of which is ammonia [12]. A large number of studies have shown that ammonia is one of the important neurotoxins [10]. Currently, the ammoniogenic theory of the occurrence of encephalopathy of hepatic origin is recognized as the most proven [9].

The pathogenetic therapy of hyperammonemia, regardless of its severity, is aimed at treating the underlying disease, including a diet with restriction of the animal and a sufficient amount of vegetable protein, according to indications, the appointment of intestinal non-absorbable antibiotics (rifaximin-alpha), pre - and probiotics (Russian Consensus of the Gastroenterology Scientific Society of Russia (GSSR) and the Russian Scientific Medical Society of Therapists (RSMST) "Hyperammonemia in Adults" presented at the XII RSMST Congress on November 20, 2019). LOLA (Hepa-Merz) is a basic drug, as mono- or polytherapy, which allows you to adjust the level of hyperammonemia, and can be used as a hepatoprotector that improves the functional state of the liver, reduces the encephalopathy caused by cytostatic polychemotherapy [13].

Against the background of the accompanying therapy with LOLA (Hepa-Merz) for 1 month in patients with lymphomas during the chemotherapy period, a decrease in the level of ammonia was noted (Fig. 1), which was noted after two weeks of taking the drug. The aminotransferase indices remained stable within the reference values (Fig. 3, 4). Moreover, a significant increase in these indicators was noted in the comparison group, which indicates hepatotoxicity of the ongoing antitumor therapy. Reception of LOLA (Hepa-Merz) has demonstrated good efficacy, tolerability and safety in patients with lymphomas. In patients, the manifestations of asthenovegetative and dyspeptic syndrome were significantly reduced (Fig. 5).

Our study allows us to recommend LOLA (Hepa-Merz) as an accompaniment therapy in hematologic patients to prevent the development of minimal encephalopathy and liver damage with cytostatic drugs.

Conclusions

Even minor hyperammonemia is an important life-threatening condition, leading to minimal encephalopathy, requiring immediate correction. It is recommended to use LOLA (Hepa-Merz), a drug with a direct hypoammonia effect, as a prophylaxis and treatment of this pathology that develops against the background of lymphoproliferative disease and progresses against the background of cytostatic therapy. The results of the study indicate a positive effect of LOLA (Hepa-Merz) on hyperammonemia after two weeks of use.

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METODOLOGICAL ASPECTS OF THE STUDY OF OVICIDAL DISINFECTANT ACTIVITY AND ASSESSMENT OF THE VIABILITY OF HELMINTH EGGS

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Abstract. Metodological aspects of the study of ovicidal disinfectant activity and assessment of the viability of helminth eggs

In solving the problem of disinvasion of environmental objects, the search for effective ovicides plays an important role. A multifunctional microcamera is proposed, which allows to carry out all stages of testing the ovicidal activity of a disinfectant in one volume, determining the number of viable eggs after exposure to optical and luminescent microscopy, egg cultivation methods.

The proposed multifunctional microchamber, designed to test the ovicidal activity of disinfectants, to determine the level of inactivation of helminth eggs with a disinfectant in one volume, allows at all stages of the work to comply with all biological safety requirements in scientific laboratories.

The disinvasive potential of the disinfectant "GLAVHLOR EXTRA" was evaluated. The concentration-time parameters of inactivation of pork roundworm eggs are established.

Keywords: disinvasion, ovicidal activity, Ascaris suum, sodium hypochlorite based disinfectant.

Prevention of helminthiases - is one of the main tasks of sanitary parasitology. Its important component is the protection of the environment from pollution by invasive material. Of all the elements of the environment, soil, along with water bodies, is most often seeded with helminth eggs. From contaminated soil, they can fall on hands, herbs, vegetables. There is a great danger of the transmission of invasive material through household items in children's and other public institutions. There is a high likelihood of infection through the surrounding objects of laboratory staff in which studies of invasive material are conducted. In this regard, a very important and urgent task is the development of new effective anthelmintic ovicides.

Determining the viability of helminth eggs is an important stage of sanitary-parasitological studies. In particular, the need to determine the viability of eggs arises in case of their detection, in the process of monitoring of 2environmental objects (soil, water, vegetables, etc.), when conducting sanitary supervision of preschool and school institutions, food industry and trade enterprises; in assessing the effectiveness of recreational activities in foci of parasitic diseases, in assessing the effectiveness of the disinfection of sewage, household waste, wastewater and their rainfall in wastewater treatment plants; when testing the ovicidal properties of chemical and biological agents.

In parasitology, the following classical research methods are used to determine the viability of helminth eggs:

− optical microscopy of egg morphology (shape, size, integrity of the shell), larval motility and other structural features;

− cultivation of helminth eggs in optimal conditions;

− staining eggs with vital dyes;

− luminescent research method;

− biological test method.

Determination of the viability of helminth eggs in appearance, morphology, larval motility and other signs is carried out under a light microscope at various magnifications. The shell of live eggs retains the correct shape, has no folds, sagging and tearing, the internal structure is visible quite clearly. Dead eggs can sometimes be deformed, their shell is torn or bent inward, and the contents are cloudy or loosened. The loss of viability of eggs at the stage of crushing can be indicated by the fact that the balls of crushing (blastomeres) in them are of different sizes, irregular shapes, often shifted to the same pole. However, it should be borne in mind that abnormal, ugly eggs can sometimes develop normally, and dead eggs often look like viable [7, 10].

To determine the viability of mature (containing formed larva) eggs of ascaris, whipworms, pinworms, a glass slide with eggs is heated to 37-40°C on a thermostated microscope stage. This causes an active movement of the larvae.

The viability of helminth eggs is also determined by cultivation. Helminth eggs are placed in optimal conditions and, with periodical observation of the development of the embryo, they are kept until the formation of larvae [7, 10, 11, 14].

A sign of the development of eggs is their passage through the stages of crushing - dividing the protoplast into blastomeres, then the developing egg passes to the morula stage, etc. Development ends with the formation of a mature larva, coiled inside the egg in a spiral or crosswise fashion. Evidence of the viability of eggs at this stage is the mobility of the larvae, which can be established by one of the methods: pressing on a coverslip, heating the preparation with eggs, etc. The absence of signs of development of eggs within 2-3 months indicates their nonviability [1, 7, 10, 11].

The viability of helminth eggs is also determined by staining with vital dyes. It is known that dead and living tissues do not receive colors in the same way. This feature is used in helminthology to determine egg viability. In this regard, a colored embryo is considered reliable evidence of egg death.

It is also known that living and dead cells luminesce (glow when illuminated with short-wavelength rays of the spectrum) differently. This phenomenon makes it possible in helminthological practice to differentiate by luminescent microscopy viable and dead parasite eggs. Both primary and secondary luminescence are used. Primary luminescence is the natural glow of the objects themselves, and secondary luminescence occurs after interaction with special dyes (fluorochromes) [7, 9, 10, 11, 12].

However, when conducting experiments on the effects of ovicides on helminth eggs, as well as determining the viability of helminth eggs exposed to ovicides by optical and luminescent microscopy, cultivation methods found that the existing methodological base has a number of disadvantages:

– high error in the results of evaluating the disinfecting (disinvasive) effectiveness of the studied chemicals and disinfectants;

– the complexity of the methods, due to the numerous technically imperfect stages of preparation, washing and manipulation of egg samples at the stages of exposure to ovicides, cultivation and research in optical and luminescent microscopes;

– complete loss of damaged, destroyed and lysed eggs (floating eggs with a lower density in an aqueous suspension of the sample) at the stages of centrifugation and repeated washing of the biomaterial from the chemical reagent, dyes in Petri dishes, or on glass slides, or in boxes by draining or aspirating the liquid from the surface of the sediment of the biosample, which significantly distort the results of a quantitative analysis of the content of live and dead eggs after exposure to ovicides;

– high labor and material costs at numerous stages of preparation and research on the above research methods;

– technical imperfection of methods for testing ovicides, determining the viability of helminth eggs, multi-stage preparation and manipulation of samples for research is often a source of violations of biological safety requirements in parasitological laboratories, etc.

The purpose of the study - is to simplify and improve the process of testing ovicides, increase the reliability of the results of assessing the viability of helminth eggs by cultivation methods, optical and luminescent microscopy, and ensure compliance with biological safety requirements when performing research.

Materials and methods

A pure culture of non-invasive eggs of Ascaris suum pork ascaris was used as an object of study.

As an ovicide, the "GLAVHLOR EXTRA" disinfectant was used, which is a clear liquid from colorless to light yellow in color with the smell of chlorine and perfume used. The composition of the product includes sodium hypochlorite and other auxiliary components. Mass fraction of active chlorine in the product: 5.5-6.5%.

Tests of the ovicidal activity of the agent were carried out according to standard methods [3-6, 13, 15]. The viability of the eggs after treatment with the drug was determined by cultivation. Egg development was monitored twice a week, while paying attention to egg crushing and larval formation. With the beginning of the formation of larvae, the experimental samples were examined using a Leica DM 1000 light microscope (Leica, Germany) in the transmitted light mode on a thermostated table. The detection of motile larvae in the sample indicated the absence of disinvasive activity of the agent in this experiment. Egg viability after treatment with the agent was also determined in the regimes of primary and secondary luminescence [8, 9].

Research results

To test the ovicidal activity of the "GLAVHLOR EXTRA" disinfectant on pork roundworm eggs and to determine the viability of helminth eggs at different stages of exposure, a multifunctional microcamera was proposed, which is a solid cast conical shape made from light-transmitting polymer with a volume of 0.8 ml, a radius is provided in the base area a chamfer, which is aimed at eliminating the optical meniscus that occurs when working with liquids, and a trapping membrane is provided at the base (track membrane), which is a thin polymer film with pores of different diameters (from 0.4 to 2 microns). The track membrane is attached to the base of the microchamber by the gapless fusion method or by the attachment method using chemical compounds [2].

All stages of testing the effect of a disinfectant on a pure egg culture of roundworm eggs were carried out in the proposed multifunctional microcamera as follows.

About 0.1 ml of suspension of washed pork roundworm eggs in the amount of about 450-500 pieces was introduced into three microchambers; all microchambers were placed in a Petri dish with a small amount of dechlorinated water; 0.1 ml of sterile distilled water was added to the first microchamber (control), 0.1 ml of 2.0% "GLAVHLOR EXTRA" disinfectant solution (active chlorine) was added to the second microchamber and held for 240 minutes,0.1 ml of a 4.0% solution of the drug at an incubation time of 120 minutes was added to the third microchamber; after the exposure time, the disinfectant was removed from the microchamber by adding 0.1 ml of sterile tap water to the microchamber, and then quickly removeing the water, the microchamber was transferred to a strip of sterile dry filter paper; neutralization of chemical residues (disinfectant) in the test sample was carried out by introducing into the microchamber 0.1 ml of a universal neutralizer with a holding time of 1 min; and to remove the neutralizer, 0.1 ml of sterile water was introduced into the microchamber, and the water with the neutralizer from the microchamber was also removed by contacting the bottom of the microchamber with a strip of dry filter paper.

Thus, multiple tests of ovicidal activity in the proposed multifunctional microchamber showed that all stages of testing the drug's ovicidal activity on helminth eggs can be carried out in one microvolume, including washing the sample from the disinfectant, neutralizing the disinfectant after exposure to the eggs, treating the eggs with dyes, and repeatedly washing the sample with water. It should also be noted that any loss of biomaterial at the stages of exposure to the disinfectant, product neutralization, staining of the sample and repeated washing with water is completely excluded, the filter element of the microchamber retains all intact eggs damaged and lysed, including egg fragments and fragments.

In multifunctional microchambers, the content of live and dead helminth eggs in the samples was determined by optical and luminescence microscopy and culture methods after exposure to ovicide.

The number of live and dead helminth eggs was determined in a microcamera using an optical microscope using a typical set of morphological criteria: the number of eggs with a typical shape and size and eggs of an abnormal shape and size; the number of eggs with an intact and undeformed shell and the number of eggs at various stages of shell deformation and damage, the presence of eggs and shell fragments in the samples; the number of eggs with a larva and the number of eggs with a destroyed larva or with a homogeneous (heterogeneous) content.

The determination of the viability of helminth eggs by cultivation was carried out in a microchamber; to activate the larvae in helminth eggs, 0.1 ml of sterile water was introduced into each microchamber and thermostated at 24°C for 10 days; daily helminth eggs were viewed directly in the microchamber using an optical or luminescent microscope to identify actively moving larvae in the eggs.

After the temperature control of the samples was completed, 0.1 ml of an aqueous solution of acridine orange in a dilution of 1:10,000 was added to each microchamber and kept for 120 min at room temperature (19±2)°C. After treatment with fluorochrome, the biosamples were also washed in a microchamber with sterile distilled water. Viewing in a luminescent microscope was carried out directly in a multifunctional microcamera.

Egg viability was determined by luminescence of the embryo. A living larva always emits a dull green light: from gray-green to dark green, and a dead one glows with bright colors: light green, green, yellow, orange, red. The shell of both living and dead eggs is colored the same green.

Testing a multifunctional microchamber at the stages of determining the viability of helminth eggs also eliminates any loss of biomaterial at the stages of dyeing and washing from dyes, viewing in optical and luminescent microscopes, and at the stages of cultivation.

Viewing and counting live and dead helminth eggs in samples using an optical and then luminescent microscope after cultivation showed that in the control microchamber the number of live eggs was no more than 92% of the total number of eggs in the sample. In the microchamber, where the eggs were treated with a 2.0% "GLAVCHLOR EXTRA" disinfectant solution, approximately 100% egg death was established over 240 minutes. When treating eggs with a 4.0% solution of a chemical compound for 120 min, the number of dead eggs in the microchamber was at least 99.0% of the total number of eggs in the sample.

The results of the studies give reason to believe that the disinfectant "GLAVCHLOR EXTRA", along with high bactericidal, fungicidal and sporocidal activity, has a pronounced disinvasive effect. The active substance that is part of the "GLAVCHLOR EXTRA" disinfectant is active chlorine. Active chlorine easily penetrates the dense five-layer shell of eggs, causes destruction of yolk cells inside helminth eggs, inactivation of the blastomere in the egg, damage to its structural elements, and then lysis and decay of eggs. The rate of damage and destruction of helminth eggs directly depends on the concentration of active chlorine in the working solution of the disinfectant. The fastest inactivation of roundworm eggs occurs when exposed to the "GLAVCHLOR EXTRA" disinfectant at a concentration of 4.0% active chlorine.

The studies also showed that an improved methodology for testing the ovicidal activity of disinfectants, determining the number of viable helminth eggs using optical and luminescent microscopy, culturing in one volume of a multifunctional camera, completely eliminates the loss of biomeral at different stages of preparation, testing and determining the number of viable eggs, which provides reliable results for evaluating the ovicidal activity of the drug. The proposed methodology eliminates the numerous stages of preparation and washing of biomaterial, excludes the use of various laboratory glassware little adapted for such work (test tubes, Petri dishes, watch glasses, glass jars, glass slides, etc.) when testing the ovicidal properties of disinfectants and determining the number of viable eggs in bioassays. Performing all stages of the work on testing the ovicidal properties of disinfectants and determining the number of live and dead eggs in biological samples in one closed multifunctional microchamber will allow you to safely perform all work with pathogenic material.

Conclusions

1. A multifunctional microcamera is proposed, which allows to carry out all stages of testing the ovicidal activity of a disinfectant in one volume, determining the number of viable eggs after exposure to optical and luminescent microscopy, egg cultivation methods.

2. The proposed multifunctional microchamber, designed to test the ovicidal activity of disinfectants, to determine the level of inactivation of helminth eggs with a disinfectant in one volume, allows at all stages of the work to comply with all biological safety requirements in scientific laboratories.

3. The disinvasive potential of the disinfectant "GLAVHLOR EXTRA" was evaluated. The concentration-time parameters of inactivation of pork roundworm eggs were established.

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COMBINED PALLIATIVE METHOD OF REVASCULARIZATION OF THE LOWER EXTREMITIES IN PATIENTS WITH PURULENT-NECROTIC COMPLICATIONS OF CHRONIC ISCHEMIA

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Abstract:

Purpose: assessment of the effectiveness of the proposed palliative method of revascularization of the lower limb.

Materials and methods: In 53 patients in the treatment complex, revascularization operations were performed according to the technique we proposed. To compare the results of treatment, a control group of 56 patients was formed. They had standard vascular therapy to correct ischemia. Morphological studies of the muscle tissue of the lower extremities included determining the density of the capillary bed and the spatial orientation of the capillaries before and after the treatment. To assess changes in the microvasculature, spiral computed angiography of the lower extremities was performed with perfusion index identification. Clinical evaluation of treatment results was carried out according to the R. Rutherford scale.

Results and discussion: Statistically reliable data were obtained on an increase in the density of the capillary bed and the number of functioning capillaries in the muscle tissue of the affected limb after revascularization. This was accompanied by an increase in perfusion index and T_cRO_2 indices. The effect of treatment manifests itself 12-14 days after surgery, and persists for a long time. The best results were achieved in patients with ischemia of IIb – III stages. Application of the method allowed more than 2-fold reduction in the number of amputations of the lower extremities compared with the control group.

Conclusion. The proposed method of palliative revascularization, including mechanical tunneling of the muscles of the affected limb and the use of platelet-rich plasma, is effective, can be used in the treatment of patients with complications of chronic ischemia of the lower extremities when direct arterial reconstruction is impossible.

Introduction: The vast majority of necrotizing infections of soft tissues of the lower extremities occurs against a background of impaired arterial circulation and microcirculation, which determine the course of the purulent-septic process [1]. The implementation of the organ-preserving concept in the complex treatment of such patients is possible only if the restoration of adequate main blood circulation and microcirculation of the affected limb takes place. The use of direct methods of revascularization, including the use of endovascular technologies, is possible in 65-70% of patients with complications of chronic ischemia, and standard vascular therapy is effective only in stages I – II of ischemia [2]. Under these conditions, the development of alternative methods for restoring blood flow in the lower extremities, including various palliative operations aimed at stimulating neoangiogenesis and improving microcirculation in the affected limb, is of particular relevance [3,4,5]. The consequences of these interventions are poorly understood, and the effectiveness is questionable. In recent years, in connection with the development of regenerative medicine and cell technologies in various fields of medicine, the use of autogenous platelet-rich plasma (PRP) has become widespread [6]. Activated PRP platelets produce growth factors, of which angiogenic growth factor, fibroblast growth factor and platelet growth factor are the most significant and studied. Due to this, in the tissues with the introduction of PRP stimulation of regenerative processes and the growth of the vascular microcirculatory network occur.

In order to improve the results of treatment of patients with purulent-necrotic lesions of the lower extremities against the background of ischemia, in the absence of opportunities to restore adequate tissue perfusion, the clinic developed a combined method of stimulating angiogenesis [9]. The essence of the proposed method is to create tunnels in the muscle-fascial cases of the lower leg, followed by filling the formed tunnels with activated autoplasma enriched with platelets and the therapeutic effect of protein growth factors contained in activated autoplasma platelets.

Purpose: evaluate the immediate results of the application of the proposed method of stimulation of neoangiogenesis.

Materials and research methods: The treatment results in 109 patients with necrotizing infections of the lower extremities against the background of chronic ischemia were analyzed. In 53 patients in the treatment complex, surgical interventions were performed using the proposed technologies for stimulating neoangiogenesis. For a comparative assessment of the results, a control group of 56 patients was formed, in which a conservative medical correction of ischemia was performed. The groups were comparable in age, gender and nature of purulent-necrotic process. The average age of the patients was 66.7±6.4 years. A standard comprehensive examination included ultrasound triplex scanning of blood vessels, with ankle-brachial index (ABI) determination, transcutaneous oximetry (TcRO$_2$) using the TCM 2 "Radiometer" ™ device (Denmark). To assess changes in the microvasculature, spiral computed angiography of the lower extremities was performed on CT Philips Brilliance 64 with 3D modeling and determination of perfusion index (PI):

$$PI = \frac{SD2}{SD1} \tag{1},$$

where SD1 - densitometric density of muscle tissue before the introduction of contrast on the G.N. Hounsfield; SD2 - densitometric density of muscle tissue after the introduction of contrast on the G.N. scale Hounsfield. Clinical evaluation of treatment results was carried out according to the R. Rutherford scale.

Morphological studies of the muscle tissue of the lower extremities included determining the density of the capillary bed and the spatial orientation of the capillaries before and after the treatment. Material for the study was obtained during surgery to stimulate neoangiogenesis, during staged surgical treatments and amputations of the limb. Sections of muscle tissue were stained with hematoxylin-eosin. Image processing was carried out using a Leica™ DM 2000 digital microscope and Leica Suite 2.0 software. The bulk density of capillaries was determined by the "field method" by applying a grid with equidistant points to a section of muscle tissue. The spatial orientation of the capillaries was evaluated as follows: a guide line corresponding to the direction of the muscle fibers was applied to a section of muscle tissue. The long axes of the sections of the capillaries and the angles of their deviation from the guide were determined, with the calculation of the mean square deviation and the dispersion index. Clinical evaluation of treatment results was carried out according to the R. Rutherford scale.

Statistical analysis methods: Data are presented as mean ± standard deviation. Intergroup differences were evaluated using the nonparametric bilateral Mann – Whitney test. For repeated measurements, the Wilcoxon test was used. To identify differences in the frequency of qualitative characteristics in two independent groups, the Fisher's two-sided exact test was used. The differences were considered significant at $p < 0.05$. To ensure representativeness of the sample during morphological studies, we used the nomograph of A.K. Mitropolsky and random selection of histological sections and fields of view using a random number table [10].

Results and discussion: In the main group (n = 53), the cause of chronic lower limb ischemia in 14 (26.4%) cases was atherosclerosis, in 5 (9.4%) type 2 diabetes mellitus with neuroischemic diabetic foot syndrome. In 34 (64.2%) patients, a combination of atherosclerotic vascular lesion and diabetic angiopathy was revealed. In the control group (n = 56), atherosclerosis was diagnosed in 14 (25%) patients, complications of the neuroischemic diabetic foot in 11 (19.6%). The combination of atherosclerosis and type 2 diabetes mellitus with the development of diabetic foot syndrome was noted in 31 (55.4%) cases.

In all patients of the main and control groups, IIb - IV degree of Fontaine-Pokrovsky ischemia was detected, while in all patients of both groups, direct reconstructive surgery on the vessels to restore the main arterial blood flow was not possible due to infected "outflow paths" or multiple occlusion -stenotic changes in the vascular bed.

Table 1

The distribution of patients by to the degree of ischemia in the observation groups

Obser-vation groups	Degree of ischemia						Total	
	IIb		III		IV			
	abs.	%	abs.	%	abs.	%	abs.	%
Main	11	20,8%	23	43,4%	19	35,8%	53	(100%)
Control	14	25%	22	39,3%	20	35,7%	56	(100%)
Total	25	22,9%	45	41,3%	39	35,8%	109	(100%)

The average ABI values in the main group were 0.35 ± 0.02 units, in the control group 0.36 ± 0.06 units, and $TcRO_2$ in the main group was 28.7 ± 0.4 mm Hg, in the control group - 30.4 ± 0.8 mm Hg, PI in the main 1.17 ± 0.02 units, in the control 1.19 ± 0.05 units.

After clarifying the nature and level of damage to the vessels of the lower extremities for all patients of the main group for 2-3 days of treatment, along with staged surgical treatments of the purulent-necrotic focus, an operation was performed according to the original methodology of the department, aimed at stimulating neoangiogenesis. The operation was carried out as follows: Under epidural or general anesthesia with a 0.6 cm diameter tube scalpel, a lateral tunnel about 20-30 cm long was formed in the muscle tissue of the lower leg. The volume of the resulting tunnel was equal to an average of 7 cm^3. After the formation of the tunnel, the end of the tube scalpel is excreted through a separate puncture and the "column" of muscle tissue from the lumen of the scalpel is removed by mandrin. The resulting muscle tissue was sent for morphological examination. Subsequently, the tube scalpel was pulled back 2-3 mm and a catheter with an inner diameter of 0.3 mm was drawn through its lumen on a rigid conductor so that the end of the catheter 2-3 mm protruded beyond the lumen of the tube scalpel. The hard conductor was removed. After this, the scalpel with the catheter was removed from the muscle tissue. As the scalpel was removed through the catheter, pre-prepared and activated autologous platelet-rich plasma was introduced. 5-7 ml of plasma was injected into the cavity of each tunnel. Similarly, the medial and middle tunnels were formed. The preparation of 20-25 ml of autologous platelet-rich plasma was carried out immediately before the operation by centrifuging the blood in a vacuum tube mixed with 3.8% sodium citrate at a speed of 4600 rpm. within 8 minutes, and at the stage of activation, a solution of calcium chloride was used.

During morphometric studies of the material obtained during revascularizing operations and surgical treatment of the purulent-septic focus in all patients, a large number of neglected, spasmodic and non-functioning capillaries were determined - an average of 25.5±1.7% of their total number in the main group and 22, 4±2.2% in the control. The volumetric density of capillaries was 2.3±0.09 cu, in the main group, 2.5±0.07 cu in the control. No evidence of a preferred spatial orientation of capillaries was found in any case. The deviation angle of the long axes of the capillaries from the guide was 74.2±15.3° with a standard deviation of 40.4±6.6°. There was no statistically significant difference between the studied morphological parameters of muscle tissue of the lower extremities between the main and control groups. At the same time, a direct relationship was established between an increase in the severity of ischemia and the number of non-functioning, empty, and spasmodic capillaries (table 2)

Table 2

Morphometric indicators of muscle tissue of the affected limb
in the observation groups depending on the degree of ischemia

Indicator	Degree of ischemia			Average
	IIb	III	IV	
Bulk density of capillaries (c.u.)	2,4±0,06	2,4±0,04	2,1±0,07	2,3±0,09
Non-functioning capillaries (%)	19,2±2.2	23,9±2,3	26,1±1,7*	24,1±5,7
Capillary axis deflection angle (°)	78,7±12,9	69,5±11,2	70,1±13,7	74,2±15,3
Standard deviation (°)	37,7±4,4	47,2±7,1	38,5±5,4	40,4±6,6

* Note - the indicator is statistically significantly different from the same of the IIb deg. of ischemia

Purulent-septic complications after surgery were not observed. In the early postoperative period (1-4 days), a deterioration of 62.3% of the operated patients was subjectively noted. This was due to postoperative pain and post-traumatic edema of the soft tissues of the lower extremities after surgery. The first clinical signs of improvement in patients of the main group were noted by 10-12 days of the postoperative period. This was expressed in a decrease in ischemic pain syndrome in 38 (71.7%) patients. Clinical assessment of the condition according to the R. Rutherford scale 2 weeks after surgery showed a significant improvement in 8 (15.1%) patients, moderate improvement in 29 (54.7%), minimal in 9 (17%) cases. No changes in the general condition of 2 (3.8%) patients were noted. In the control group of patients within 2 weeks after the start of treatment, significant improvement was not achieved in any case. A moderate improvement was noted in 8 (14.3 %) patients, a minimum of 11 (19.6%). There were no statistically significant changes in the indices of the main blood circulation in patients of the control group.

The average $TCRO_2$ values were 30.6±0.6 mm Hg. An increase in PI by an average of 1.7±0.4% was statistically unreliable (p> 0.05). No changes in condition were observed in 10 (17.9%). In 27 (48.2%) patients, a deterioration was noted, and in 12 (21.4%) of them, forced amputations were performed against the background of progression of the purulent-septic process and lower limb ischemia. Clinical improvement in patients of the main group was confirmed by an increase in blood circulation in the form of an increase in $TcRO_2$ by an average of 12.5±0.3% to 42.3±0.4 mm Hg. in patients with IIb degree of ischemia, by 11.7±0.2% in patients with III

degree of ischemia. In cases of IV degree of ischemia, the increase in oxygen tension in the tissues was 5.6±0.4%. and an increase in PI by 12.8±1.5%.

Improving microcirculation in the distal parts of the affected limb directly affected the course of the wound process. In the first 5-7 days after surgical treatment of the purulent-septic lesion, all patients of both groups determined the necrotic or inflammatory-degenerative type of cytogram of the wound smear of the fingerprint, was characterized by complete cellular activity, the presence of a large amount of detritus and the number of neutrophils in a state of destruction or cytolysis. By 10-12 days of the postoperative period, 43 (81.1%) patients of the main group showed a change in the nature of the cytogram to regenerative or regenerative-inflammatory. The number of neutrophils decreased to 60 - 70%, and their safety increased. An increase in the number of macrophages to 10-15% made it possible to determine the beginning of the wound cleansing phase. Microflora was observed in a small amount, mainly intracellularly.

The lack of effect from the operation and the progression of the purulent-necrotic process with its spread to functionally important parts of the foot and lower third of the lower leg made it impossible to maintain support function of the limb in 5 (9.4%) patients of the main group. In this regard, forced high amputations of the lower limb were performed on them on average on 10-12 day of treatment. In the control group, high amputations were performed in 11 (19.6%) patients.

The positive dynamics of the course of the wound process and the improvement of microcirculation in the affected limb in patients of the main group allowed 19 (35.8%) to completely close the wound defect by the time of discharge from the hospital. In the remaining 29 (54.7%) cases, the wound defect was epithelized on its own. Supporting limb function was preserved in 90.6% of cases.

The average length of hospital stay for patients was 28.7±7.8 days for the main patients, and 22.4±11.5 for the patients in the control group. By the time of discharge from the hospital, all patients of the main group showed progression of positive changes in the general condition. The average $TcRO_2$ was 39.8±0.7 mm Hg. During the control ultrasound study, a decrease in the indicators characterizing the degree of peripheral resistance of the vascular bed by an average of 24.2±6.7% was determined, in the absence of significant ABI dynamics. In addition, a continuing increase in perfusion index according to spiral CT angiography by 22.2 ± 5.6% was noted.

Conclusion: The mechanical creation of tunnels stimulates neoangiogenesis in the muscle tissue of the legs and improves the state of microcirculation in the affected limb. The formation of tunnels in the immediate vicinity of the vascular bundle and along its course creates the prerequisites for the development of a new vasculature and the possibility of collateral blood flow below the site of occlusion. Activated autoplasma platelets release a large number of substances that provide primary hemostasis, which avoids the formation of extensive hematomas in the area of tunnel formation. Morphologically, the effect of treatment manifests itself 12-14 days after surgery and is determined as an increase in the density of the capillary bed and the number of functioning capillaries in the muscle tissue of the affected limb. Application of the proposed method in the treatment complex allowed to halve the frequency of forced high amputations of the lower extremities and improve treatment results

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THE CIRCADIAN RHYTHM OF OXYGEN CONSUMPTION BY THE MYOCARDIUM IN THE ACUTE PERIOD OF SEVERE TRAUMATIC BRAIN INJURY IN CHILDREN

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Abstract. Based on the analysis of long-term monitoring of hemo-dynamic parameters, the authors found an increase in MOC by 13 - 50% at the age of 3 years in 1 day of STBI, by 10-33% at the age of 3.1-7 years, by 8-45% in children over 7 years in increasing order de-pending on the severity of the condition. In children of the 3rd group, the circadian rhythm mesor MOC remained elevated by 20% for 30-40 days. The most favorable indicators of circadian rhythm bathyphase migration in the dark period of the day showed myocardial oxygen de-mand in children of the 1st group over 7 years old and the lowest in infancy. In the 3rd group of patients of all ages, pathological changes in the acrophase of circadian rhythm MOC were revealed over half the duration of treatment in the ICU.

Keywords: circadian rhythm, myocardial oxygen consumption, severe traumatic brain injury, childhood

Relevance

Myocardial oxygen consumption (MOC) is determined by the mus-cle tension of the heart wall, its contractility and heart rate. Accurate MOC measurement requires cardiac catheterization. During a stress-ful reaction to external influences, the physical load of the MOC can be evaluated by the product of the achieved HR and systolic BP, which is called the double product (DP) [1]. DP is closely correlated with

a wide range of values whose changes in oxygen consumption by the myocardium can be measured. The authors found that there is a linear relationship between MOC and coronary circulation. During physical exertion, coronary circulation increases fivefold compared with its value at rest [1,2,3]. The lack of information on the features of the phase structure of the circadian rhythm of the myocardial oxygen demand in children after a severe traumatic brain injury prompted us to conduct this study.

Purpose

Study the dynamics of the circadian rhythm of oxygen consumption by the myocardium in the acute period of severe traumatic brain injury in children.

Material and research methods

Patients with severe traumatic brain injury (STBI) (100) are presented in three age groups: group 1 - from 9 months to 3 years (30), 2 - 3.1-7 years (31), older than 7.1 to 18 years old (39). Depending on the severity of the condition, which we determined by the duration of intensive care under ICU conditions, each age group was studied, dividing them into 3 groups: in 1 subgroup, the duration of treatment in the ICU was from 5 to 10 days - only 43 children (43%); in the 2nd subgroup included 29 (29%) patients (the length of stay in the ICU was 11-20 days); Subgroup 3 - 28 children (28%). We studied the indicators of central and peripheral hemodynamics: systolic (SBP), diastolic (DBP), mean blood pressure, minute blood volume (MBV), and total peripheral vascular resistance (TPVR). The double product index DP = HR * SBP / 100 closely correlates with myocardial oxygen consumption (MOC) and also reflects the state of the ANS and its increase indicates the predominance of sympathetic tone [1,2]. All patients were monitored for laboratory and clinical indicators, such as general analysis, biochemical blood parameters, coagulography. The components of the circadian rhythm, such as the median, the value of acrophase, bathyphase, the range of daily fluctuations, the amplitude of the oscillations, were studied. A more detailed analysis of reliably significant deviations, intergroup differences of the studied parameters was carried out. The results were obtained by monitoring with hourly recording of the studied parameters. The research data were processed by the method of variation statistics using the Excel program by calculating arithmetic mean values (M) and mean errors (m). To assess the significance of differences between the two values, Student's parametric criterion (t) was used. The critical level of significance was taken equal to 0.05.

Results and its discussion

Applied respiratory support was started upon admission in the first hours in 5 children from 12 in group 1 (41% of patients), in group 2 in 8 out of 9 (88%), and in 4 immediately upon admission in A / C mode (IPPV). In group 3, upon admission, all 8 patients by severity of condition immediately upon admission were transferred to artificial lung ventilation (100%). The duration of hardware ventilation in group 1 was 3.3 ± 1.6 days (out of 5.9 ± 1.5 days spent at the ICU), in group 2 - 8.25 ± 4.6 days (out of 14.6 ± 3, 1 day). In group 3, the duration of mechanical ventilation was 21.4 ± 7.3 days (out of 39.8 ± 15.5 days). Thus, the severity of the condition and the effectiveness of intensive care corresponded to the duration of mechanical ventilation. So, in group 1, the duration of mechanical ventilation was 55%, in group 2 - 36%, in group 3 - 54% of the total duration of treatment in the ICU. However, this problem requires a separate study, since 30% of children had to change ventilation regimes depending on the dynamics of the condition, the need for repeated surgical intervention, and hospital pneumonia.

Table 1.

Dynamics of the circadian rhythm mesor of myocardial oxygen demand in the acute period of STBI in children

days	9 months - 3 years			3,1-7 years			7,1-18 years		
	1 group	2 group	3 group	1 group	2 group	3 group	1 group	2 group	3 group
1	128,6±4,4	129,4±10,9	126,8±13,3	126,6±6,7	119,6±8,0	124,7±5,4	139,3±6,1	115,9±7,5"	132,4±8,2°
2	129,0±5,4	150,6±8,6*"	140,3±5,2	123,9±4,2	131,7±4,5	145,8±3,6*"°	135,9±3,4	119,8±5,2"***	147,4±5,2*"°
3	127,0±3,7	140,7±8,5"	146,9±6,8"	116,1±3,8	114,4±6,5	134,6±5,6"°	120,6±4,3*	122,6±6,9**	134,9±5,8"
4	118,8±3,7*	125,8±6,6	138,9±5,1"	118,2±4,0	108,8±6,8	129,2±4,1"°	118,9±3,9*	116,9±3,5	131,5±4,9"°
5	114,7±3,2*	130,1±6,9"	141,6±6,8"	101,5±3,9*	114,2±4,8	131,4±3,9"°	112,9±3,4*	113,2±5,6**	130,0±3,2"°
6	123,8±5,4	122,7±4,5	136,3±3,7"°	110,0±4,3*	121,2±5,6	126,4±4,2°	123,8±3,5*	113,1±4,7	130,4±4,7°
7	113,4±7,7	117,7±4,8	139,9±4,6"°	118,5±4,1	124,8±6,3	125,8±4,5	114,0±4,3*	114,5±3,2	137,3±4,0"°
8		129,1±7,8	137,4±5,6	114,6±6,5	127,9±5,3	127,1±4,0"	117,2±4,2*	111,2±3,1**	137,9±4,8"°
9		125,5±7,4	133,0±4,8	97,8±3,6*	118,3±4,7	132,1±4,4"°	111,8±5,4*	114,2±3,3	133,7±6,4"°
10		110,6±3,6	148,9±4,9*°		116,7±4,4	130,1±7,2°		120,0±4,1	135,3±2,7°
11		120,5±6,2	126,2±5,1		115,4±4,9	133,4±6,2°		120,2±6,9	128,1±5,6
12		116,9±6,7	147,3±3,0*°		115,5±7,1	125,6±4,9		113,5±4,5	129,8±4,5°
13		121,4±7,3	134,8±5,1°		108,2±6,3	118,1±2,6		106,1±5,1	127,3±3,8°
14		118,8±5,7	132,6±6,7		101,4±8,9*	122,1±4,3°		105,4±5,4	129,1±6,1°
15		126,8±8,2	126,5±6,0		104,3±13,0**	124,0±6,5		107,4±4,7	126,8±5,4°
16			123,7±6,2		112,1±7,8	125,4±3,7°		107,0±4,8	127,0±5,0°
17			115,0±3,5		105,4±5,7	125,8±5,7°		118,7±8,5	130,2±7,3
18			122,8±3,0		106,5±5,4	126,4±6,0°		118,7±8,5	129,6±4,5
19			125,7±4,6		109,5±6,9	123,1±2,9°			130,0±5,3
20			132,1±4,5			125,9±9,7			129,3±4,3
21			125,9±3,6			129,3±3,7			128,5±4,1
22			122,6±3,2			121,5±4,0			133,5±7,1
23			129,2±4,9			118,7±4,2			135,9±4,2
24			132,5±4,8			124,8±7,2			126,0±7,0
25			116,4±4,9			123,1±4,1			126,0±4,9
26			132,7±4,6			116,0±6,4			129,6±6,7

days	9 months - 3 years			3,1-7 years			7,1-18 years		
	1 group	2 group	3 group	1 group	2 group	3 group	1 group	2 group	3 group
27			155,5±11,1			119,7±4,2			129,2±5,0
28			135,7±3,4			118,1±5,2			132,5±5,6
29			127,2±3,5			119,3±3,8			131,8±8,2
30			130,4±5,7			115,1±5,9			128,4±4,8
31						114,6±6,6			137,7±7,0
32						112,6±5,8			135,7±4,9
33						115,6±7,6			127,9±4,9
34						129,8±7,1			129,9±6,0
35						126,7±5,2			130,3±5,0
36						121,7±6,0			120,8±3,9
37						115,9±3,8			125,9±5,9
38						117,1±3,9			131,2±5,4
39						121,0±6,0			129,8±5,4
40						119,2±4,8			124,8±4,8
41									121,0±5,9
42									121,4±5,3

*- difference is significant relative to 1 day indicator

"- difference is significant relative to the indicator in group 1

°- difference is significant relative to the indicator in group 2

**- difference is significant relative to the group of the same name under the age of 3 years

As can be seen from the data presented in table 1, on the 1st day of STBI, the average daily oxygen demand for myocardium was increased by 13-50% at the age of 3 years, by 10-33% at the age of 3.1-7 years, by 8-45 % in children over 7 years old. During intensive therapy, a group difference in the severity of the condition was manifested by a corresponding increase in oxygen consumption by the myocardium, affecting changes in the indicator during treatment. The increase in the MOC circadian rhythm mesor corresponded to the severity of STBI, that is, the heavier the trauma, the higher the MOC circulatory rhythm mesor index and the normal parameter was restored later in group 2 than in group 1. And in children of group 3, regardless of age, even by 30- For 40 days, the MOC circadian rhythm mesor remained elevated by 20%. So, in group 1 of infants, a significant decrease in MOC was detected on days 4, 5 by 10% and 14% (p <0.05). In the group of the same name at the age of 3.1-7 years, the restoration of the normal MOC mesocircular rhythm was observed on 5.6.9 days (p <0.05, respectively). In schoolchildren of the first group, despite a significant decrease of the MOC circadian rhythm by 19%, 11%, 17%, 16%, 25%, 22%, 28% (p <0.05, respectively), the indicator remained elevated by 9 days for 6-16%.

In STBI group 2, under the age of 3 years, the mesocircular rhythm mesor MOC increased by 21% (p <0.05), compared to the first day, remaining significantly higher than in group 1 by 2.3.5 days by 21%, 13%, 16% (p <0.05). In the 2nd group of children from 3.1 to 7 years old, the mesocircular rhythm MOC decreased to normal by only 14 days. Significant differences in the average daily MOC from the data of group 1 of this age were not detected. However, the significant difference between the MOC circadian rhythm in older children and the results obtained in infancy draws attention. So, on day 15 in group 2 of 3.1-7 years, 22% was less (p <0.05) than in the group of the same name in infancy. That is, the more mature anatomophysiological properties of hemodynamics of preschool children, in contrast to the less perfect structural and functional characteristics of the infant period, restored the normal level of MOC by 15 days due to more efficient work of compensatory mechanisms. In children under 3 years of age, on the 15th day, the MOC mesor remained in more than 14 groups by 26% (p <0.05). Thus, the change in MOC depends not only on the severity of STBI, but also on age-related features that allow a better restoration of oxygen consumption by the myocardium, reducing oxygen debt, and disposition to impaired heart function, due to hypoxia, ischemia of a vital organ, especially expressed in infancy.

In group 2, at school age, relative to data in the group of the same name

Amplitude and magnitude of the circadian rhythm of myocardial oxygen demand in children with STBI (%) at the age of 9 months- 3 years
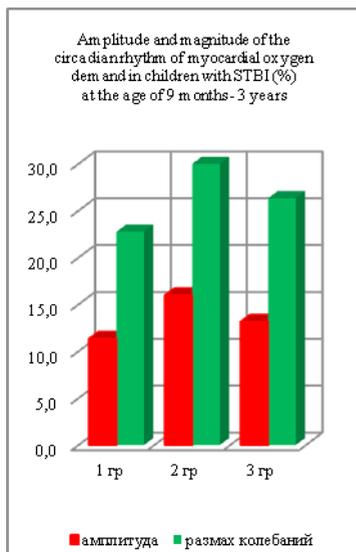
up to 3 years, a significant decrease in the MOC circadian rhythm mesor by 2,3,5,8 days was found by 30%, 18%, 17%, 18% (p <0.05, respectively). That is, from the second day of the acute STBI period in school-age children, myocardial oxygen demand was significantly less than in infancy.

In the 3rd group of children under 3 years old, the mesocir of the circadian rhythm MOC increased relative to the value on the 1st day and was higher than the parameters on the same day by 2,3,4,5,6,7,10,12 days in a comparatively greater degree than in 1 and 2 groups by 14%, 20%, 12%, 15%, 10%, 13%, 22%, 21% (p <0.05), with a tendency to increase on the 30th day of the acute STBI period.
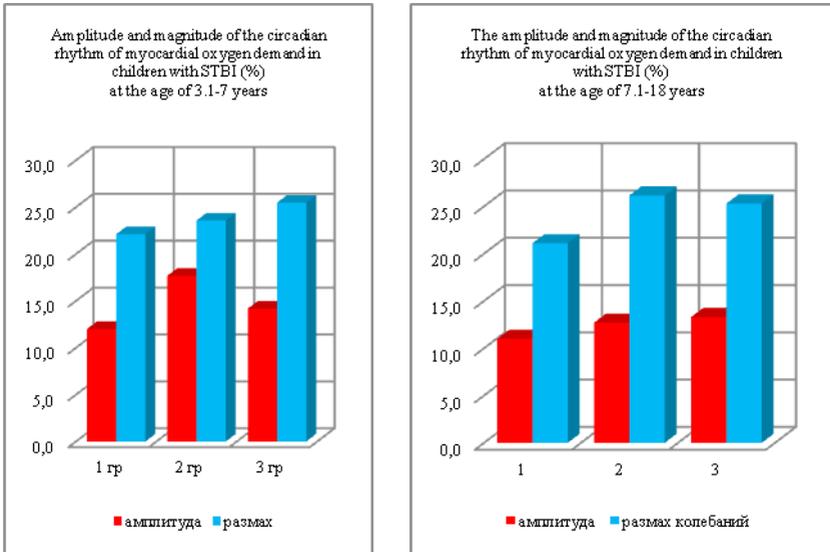
Fig.1

At the age of 3.1-7 years, in children of the 3rd group, an increase of 20% MOC on the second day remained significantly higher than in the 2nd group until the fifth day, by 9.10, 11, 14, 16-19 days (p <0.05, respectively), which corresponded to the more severe condition of children of group 2 after STBI.

Reliably significant differences were found in the amplitude and magnitude of the diurnal fluctuations in myocardial oxygen demand in all infants, in groups 1 and 3 at the age of 3.1-7 years, in all patients who received STBI at the age of 7.1-18 (fig. 1). The lack of reliability in intergroup and age differences is due to deviations from the average (Table 2).

Table 2

The amplitude of diurnal fluctuations in oxygen consumption by the myocardium in the acute period of STBI

Parameters	9 months - 3 years			3,1-7 years			7,1-18 years		
	1 group	2 group	3 group	1 group	2 group	3 group	1 group	2 group	3 group
Amplitude	11,3±3,2	16,0±3,9	13,1±4,1	12,0±2,4	17,7±3,1	14,2±3,6	11,0±3,3	12,7±3,3	13,3±2,8
Magnitude	22,8±6	30,9±5,8	26,3±6,7	22,1±3,9	23,6±6,9	25,5±5,4	21,1±5,0	26,2±5,2	25,3±4,4

The revealed direct correlation between the magnitude and amplitude of daily fluctuations in 1 (0.6616), in 2 (0.8774) and 3 groups (0.8305) up to 3 years, in 1 (0.9308) and 3 groups (0, 8542), as well as in 1 (0.9542), 2 (0.6325) and 3 groups (0.7440) over the age of 7 years, while the correlation of indicators in the 2 group of children aged 3.1 -7 years old was 0.3725. The revealed direct correlation connections allow us to judge the severity of changes in the amplitude of the circadian rhythm by the magnitude of the range of daily fluctuation in the studied patients.

Table 3

Projections of acrophase and bathyphase circadian rhythm myocardial oxygen demand in the acute period of STBI in children (number of days in% of the duration of intensive care in ICU)

	Up to 3 years			3,1-7 years			7,1-18 years		
	1 group	2 group	3 group	1 group	2 group	3 group	1 group	2 group	3 group
Acrophase									
8-14 hours	71%(5 out of 7)	46% (7 out of 15)	53% (16 out of 30)	55% (5 out of 9)	37% (7 out of 19)	55% (22 out of 40)	66% (6 out of 9)	61% (11 out of 18)	47% (20 out of 42)
15-23 hours	29% (2 out of 7)	46% (7 out of 15)	43% (13 out of 30)	45% (4 out of 9)	46% (9 out of 19)	35% (14 out of 40)	34% (3 out of 9)	22% (4 out of 18)	35% (15 out of 42)
24-7 hours	0	8% (1 out of 15)	4% (1 out of 30)	0	17% (3 out of 19)	10% (4 out of 40)	0	17% (3 out of 18)	18% (7 out of 42)
Bathyphase									
8-14 hours	14% (1 out of 7)	8% (1 out of 15)	23% (7 out of 30)	22% (2 out of 9)	11% (2 out of 19)	22% (9 out of 40)	0	33% (6 out of 18)	16% (7 out of 42)
15-23 hours	57% (4 out of 7)	26% (4 out of 15)	16% (5 out of 30)	44% (4 out of 9)	31% (6 out of 19)	32% (13 out of 40)	11% (1 out of 9)	5% (1 out of 18)	38% (16 out of 42)
24-7 hours	29% (2 out of 7)	56% (10 out of 15)	61% (18 out of 30)	34% (3 out of 9)	58% (11 out of 19)	46% (18 out of 40)	89% (8 out of 9)	62% (11 out of 18)	46% (19 out of 42)

As can be seen from the data presented in table 3, the most pronounced myocardial oxygen demand in the morning was detected in group 1 at the age of 3 years for 71%, at the age of 3.1-7 years 55%, over 7 years 66% of the duration of treatment.

The minimum indicators of myocardial oxygen demand at night, which is normal, in group 1 were observed up to 3 years in 29%, at the age of 3.1-7 years, 34%, and over 7 years in 89% of the duration of intensive care. That is, favorable indicators of the bias of the near-normal time of day decrease in myocardial oxygen demand in the dark period of the day turned out to be the biggest in older children and the smallest in infancy. In the most severe patients of group 3, the projection of acrophase in the morning hours of the circadian rhythm of MOC up to 3 years old was 53%, at the age of 3.1-7 years - 55%, over 7 years old - 47%. In the 3rd group of patients, a near-normal position of the bathyphase at night in infancy was found to be 61%,

3.1-7 years old 46%, over 7 years old - 46% of the time. Thus, there were no significant differences depending on the severity of the condition and age in the migration of the acrophase of the circadian rhythm of the MOC, while the normal position on the dial in children of different groups was found in almost half the duration of treatment, regardless of the length of stay in the ICU. The revealed features of changes in the components of the circadian rhythm of the MOC suggest the advisability of supplementing intensive care, especially in the younger groups, with corrective actions that contribute to preventing the development of heart failure due to oxygen debt, followed by an energy-deficient state in the myocardium.

Conclusions

On day 1 of STBI, the average daily oxygen demand for myocardium was increased by 13-50% at the age of 3 years, by 10-33% at the age of 3.1-7 years, by 8-45% in children over 7 years of age, increasing depending on the severity of the condition, a later restoration of the normal parameter in group 2 than in group 1. And in children of group 3 in all age groups, the mesocircular rhythm mesor MOC remained elevated by 20% for 30-40 days. The most pronounced oxygen debt was found in 3 groups of infants. Favorable indicators of bias close to normal decrease in myocardial oxygen demand in the dark period of the day was found in children of the 1st group over 7 years old and the smallest in infancy. In the 3rd group of patients of all ages, pathological changes in the acrophase of the circadian rhythm of the MOC were revealed over half the duration of treatment in the ICU.

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COMPARISON OF THE EFFECT OF VARIOUS TREATMENT METHODS ON THE PROTEIN SYNTHESIZING FUNCTION OF THE LIVER ON AN EXPERIMENTAL MODEL OF PEPTIC ULCER BLEEDING

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Abstract. Despite the achievements of recent decades in the field of conservative and endoscopic therapy, mortality from ulcerative bleeding remains stable at a high level. This is due to an increase in elderly and senile patients with concomitant diseases. A significant role in the outcome of the disease is played by the state of the liver. Adding antioxidant therapy to a standard treatment for ulcerative bleeding can improve the condition of the liver and subsequently the prognosis of the disease. The aim of this study was to compare various treatment methods, including antioxidant therapy for protein-synthesizing liver function in ulcerative bleeding.

An experimental model of a bleeding gastric ulcer in "Chinchilla" rabbits was created, antioxidants and a protein preparation were used against the background of hemostatic therapy. The results, namely the concentration of total protein, albumin, globulin and fibrinogen in the blood, were compared with the indices of the intact group and with each other. The best results were obtained in rabbits with the combined use of hemostatic, albumin and glutathione antioxidant.

Keywords: peptic ulcer, bleeding, liver, antioxidants, glutathione, blood proteins

Relevance

Acute upper gastrointestinal bleeding (AUGIB) is a common, costly, life-threatening pathology and requires immediate and aggressive medical intervention. In most cases, the main cause of such bleeding is a peptic ulcer of the stomach and duodenum [1]. Despite the achievements of recent decades in the field of conservative and endoscopic therapy,

mortality from ulcerative bleeding remains in the range of 4-14%, and in hospitalized patients with concomitant diseases it can reach 27%. 25% of all patients with AUGIB are elderly patients and this percentage is growing steadily [2]. This is due to both the aging of the population as a whole and the shift in the complications of peptic ulcer disease to an older age, due to the effectiveness of modern therapy. Elderly and senile age, along with concomitant diseases, are one of the main factors directly associated with a high risk of repeated bleeding and death [3].

In many regions of the world there is an increase in the proportion of idiopathic ulcers as a cause of bleeding. Idiopathic ulcers are ulcers that occur without the participation of H.pylori or ulcerogenic medicines, as well as other known etiological factors. It was found that they are poorly suited to acid-suppressive therapy, have a higher risk of primary and repeated bleeding, morbidity and mortality, and are also more common in the elderly. This shows that there are previously unknown factors that require the study and optimization of treatment strategies for ulcer bleeding [4,5].

As noted above, concomitant diseases play an important role both in the onset and in the complicated course of ulcerative bleeding. Here, the special situation of liver diseases should be noted [6]. In many scales for assessing the severity and outcome of AUGIB, markers of the functional state of the liver are used, which confirms its significance [7]. It is also known that in connection with the features of functioning, the liver is one of the organs most susceptible to free radical oxidation. Almost all of its known chronic and degenerative diseases are pathogenetically based on damage to liver cells by free radicals [8]. In turn, ischemia with bleeding and the subsequent reperfusion syndrome exacerbate oxidative stress, which leads to a vicious cycle and can affect the patient's condition [9]. Adding antioxidant therapy to standard treatment for ulcerative bleeding can significantly improve the condition of elderly patients with comorbidity.

Purpose of the study is a comparison of various treatment methods, including antioxidant therapy for protein-synthesizing liver function in ulcerative bleeding

Materials and research methods

The experiments were carried out on 38 sexually mature rabbits of the "Chinchilla" breed of both sexes. At the same time, the requirements of the European Commission on Bioethics, which are used for experimental and other scientific purposes concerning the humane attitude to experimental animals, were observed.

Previously, all animals had blood taken from the marginal vein of the ear and a biochemical analysis was performed for the protein composition of the blood. The data obtained were accepted as intact indicators (1st group). Then, in all individuals, a gastric ulcer complicated by bleeding (group 2) was modeled and, again, a biochemical analysis was performed. After that, the animals were divided by random sampling into the following groups and preparations were administered over 3 days: group 3 consisting of 9 individuals — aminocaproic acid, group 4 - 9 individuals, aminocaproic acid and glutathione solution, group 5 - 8 individuals, aminocaproic acid and mexidol, group 6 - 6 individuals, aminocaproic acid and albumin solution, 7th group - 6 individuals, aminocaproic acid, glutathione and albumin.

After this, a biochemical blood test was performed, and the results were compared with an intact group, with animals with a simulated bleeding ulcer without treatment, and with each other. Statistical analysis was performed using the program "Statistica for Windows ver. 6.0. "By Stat Soft. Inc "and the MS Excel database editor was used. Comparison of groups of laboratory animals was carried out with the determination of median (Me) and percentiles (25% and 75%), using the Student t-test with reliability level of P <0.05.

Results

In animals in which ulcer bleeding was modeled, the amount of total protein in the blood was 32.0% (P<0.001), albumin 29.5% (P<0.001), globulin 14.5% (P <0.01) and fibrinogen is 34.5% (P <0.01) less than in the intact group. In all animals (100%), the concentration of total protein decreased. In the 3rd group, where only hemostatic (aminocaproic acid) was used, the total protein was 31.4% (P<0.001), albumin 28.4% (P <0.001), globulin 14.1% (P < 0.01), fibrinogen is 35.0% (P <0.01) lower than in the intact group. But these indicators were respectively 0.9% (P> 0.05), 1.7% (P (0.05), 0.5% (P>0.05) higher, and only the amount of fibrinogen was 0, 8% less (P>0.05) than in the 2nd group.

In the 4th group, where along with the hemostatic, the animals were injected with the antioxidant glutathione, the following results were obtained: the amount of total protein was reduced by 26.4% (P <0.001), albumin by 19.4% (P <0.001), globulin by 5.6% (P> 0.05) and fibrinogen by 30.6% (P <0.01) compared with the intact group. Moreover, these parameters were higher by 8.2%, respectively (P>0.05), 14.3% (P <0.01), 10.5% (P>0.05) and 6.0% (P>0.05%) compared with the second and higher by 7.3% (P>0.05), 12.5% (P <0.01), 9.9% (P>0.05) and 6.8% (P>0.05) compared with the 3rd group.

In group 5, rabbits were given aminocaproic acid and another antioxidant, Mexidol. Even with this treatment, in rabbits with a bleeding gastric ulcer, the concentration of total protein was lower by 28.6% (P <0.001), albumin by 20.7% (P <0.001), and globulin by 8.6% (P> 0.05), and fibrinogen - by 32.9% (P <0.01) than in the intact group. Compared to rabbits who did not receive any treatment (group 2), these indicators were higher by 5.5% (P>0.05), 12.5% (P <0.01), 7.0%, respectively (P >0.05) and 2.4% (P>0.05). And relative to experimental animals that were administered only aminocaproic acid (group 3), they were 4.1% higher (P>0.05), 10.7% (P <0.01), 6.4% (P>0 05) and 3.2% (P>0.05).

Aminocaproic acid and a protein preparation, albumin, were introduced to individuals of the 6th group. Against the background of gastric ulcer, rabbit protein metabolism was 20.2% (P <0.001), 12.2% (P <0.001), 12.4% (P <0.05) and 19.1% (P> 0.05) below the intact group. But they turned out to be higher than the results of the 2nd group by 17.5% (P<0.01), 24.6% (P<0.001), 2.5% (P>0.05) and 23.5% (P< 0.05), while the results of the 3rd group were 16.4% (P<0.05), 22.6% (P<0.001), 2.0% (P>0.05) and 24.5% (P>0.05).

Rabbits in the 7th group, along with aminocaproic acid, were introduced glutathione and albumin. During biochemical analysis, the concentration of total protein was 10.3% (P <0.01), albumin - 3.9% (P> 0.05), fibrinogen - 13.5% (P> 0.05) lower similar indicators of the intact group, and globulin is even higher by 2.5% (P> 0.05). The concentration of total protein was higher by 31.9% (P <0.001), albumin by 36.3% (P <0.001), globulin by 19.9% (P <0.05), and fibrinogen by 32.1 % (P <0.05) compared with the 2nd group. Also, these results were higher by 30.7% (P <0.001), 34.1% (P <0.001), 19.3% (P <0.05) and 33.2% (P <0.05), respectively. relative to the 3rd group and 25.6% (P <0.01), 21.2% (P <0.001), 12.1% (P>0.05) and 29.0% (P <0, 05) above the indicators of the 5th group (**table 1).**

Conclusion

The worst indicators were obtained in animals with a bleeding gastric ulcer who did not receive any treatment (group 2), this is mainly due to blood loss, as well as reduced functional activity of the liver. Due to the hemostatic effect of aminocaproic acid, which was introduced starting from the 3rd in all subsequent groups, the animals showed a positive dynamics in the markers of protein metabolism of the blood. The following differences depended on the nature of the additionally administered drug. In the 4th group, the animals were additionally given an antioxidant

- glutathione. The purpose of its use was to suppress oxidative stress in the liver tissue and, as a result, restore its impaired function. For the same purpose and for comparison with glutathione, another antioxidant drug, mexidol, was used in the 5th group. In both groups, the results were better compared with hemostatic monotherapy. This confirms the literature on functional liver disorder with ulcerative bleeding and indicates the positive effect of antioxidant therapy. At the same time, glutathione was more effective than mexidol. Less than in the previous ones, protein metabolism markers differed from the norm in the 6th group where the albumin protein preparation was used. But the best results were obtained in the 7th group, where albumin and glutathione were simultaneously administered to rabbits with aminocaproic acid. We believe that along with standard therapy, the use of glutathione antioxidant for ulcerative bleeding is a pathogenetically substantiated and effective treatment and can especially improve the prognosis for relapse and mortality in patients with concomitant diseases.

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ECOLOGICAL AND FISHERIES MONITORING OF LAKE FISH FARMING IN THE FOREST-STEPPE TRANS-URALS

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Abstract. The article shows the role of the emergence of a tracking-monitoring method for environmental processes in the fishery lakes of Russia and gives examples of the ecological and fishery variability of the lakes in the south of the West Siberian Plain under the influence of the dynamics of climate change. For this reason, it is recommended to perform a real assessment of the quality of the ecosystem of lakes used for raising whitefish based on monitoring, as the main objects of pasture aquaculture of the Trans-Urals.

Keywords: monitoring of fishery lakes, increase of fish productivity, fishery bonitet, optimization of managerial decisions on fishery use of lakes of the castle type.

One hundred years ago, M.P. Somov [1] in his fundamental work laid the foundations of ecological and fisheries monitoring on the lakes of the North-West of Russia. He recommended determining the dynamics of the productivity of fishery reservoirs by the totality of animal and plant organisms entering the formation of fish products, which together depend entirely on the physical, climatic, floristic, and other parameters of a particular reservoir. Moreover, the factor of productivity (fish productivity) of the lakes, which changes in time, M.P.Somov considered to be the most important, and recommended to observe this process and the basis of the dynamics of changes in the natural components, which will help to correct the practical actions of the fishery owner of the reservoir. Thus, the economic and production component — fisheries taxation, or bonitet, which, with the intensification of production, can be increased quite significantly, depends on the dynamics of the biological and production aspects of the reservoir.

At the beginning of the 20th century, fisheries science [1], [2] considered ordinary - "average" catches of fish per calendar year in the range of 25–40 kg/ha, "high" - 50 kg/ha and more, and "bad" - annual catches of 20 kg/ha and below.

In these years, in the south of Western Siberia and the Trans-Urals, lake fisheries based on shallow lakes subject to periodic level fluctuations, and hence - changes in the salinity factor and oxygen concentration in water, required specific changes based on landscape reclamation methods [3], [4], [5], which stabilizes the ecological parameters of lakes, which are the basis of rational fisheries in the administrative territory. At the same time, zonal fisheries science intensified the introduction of new productive fish species that were absent in the south of the Urals and Western Siberia, which allowed acclimatization of bream, Ladoga ripus, Chudsky whitefish, carp (common carp), and then peled, pike perch in local lakes[6], [7]].

The expansion of the scale of fish-breeding and acclimatization works created real preconditions for increasing the yield of farmed fish from a unit of the lake's water area in comparison with previously existing fish catches of 20-40 kg/ha. On the example of the practice of fish farmers of the Chelyabinsk fish trust, who created a system of pond hatcheries and incubation workshops in the 50-60s, it was found that the systematic monitoring of the dynamics of environmental processes in fish farms by an integrated research and production laboratory, it is possible to control fish productivity of the exploited lakes. Multiple all-season analysis of the hydrochemical, hydrobiological characteristics of the lake ecosystem provides timely maneuver for production workers in reclamation and hatchery work on various types of lakes of the enterprise.

An analysis of the development trend of the fisheries of the Chelyabinsk oblast for 1949-1963 showed that fish-farming and acclimatization measures, with their large-scale implementation, allowed to increase the marketable fish productivity of the existing lake stock by three times - from 18-25 kg/ha to 55-70 kg/ha, maximum catches (170-180 kg/ha) per year [8]. It is ecological and fisheries monitoring of the bulk of fishery reservoirs and the operational use of the necessary land reclamation and specified planting of fish-breeding material in accordance with the real forage base and environmental conditions that increased the fish productivity of the lakes of the Chelyabinsk fish trust.

A new impulse of the effectiveness of ecological and fisheries monitoring as a basis for taxation of economic development and, then, the further development of commercial fish farming consequently, the long-term practice of the Kazan Lake Fishery, currently called the Kazan Fish CJSC,

presents us with an increase in the efficiency of each hectare of the "blue niva". The fish farm was created in 1968. It was preceded by a two-year comprehensive study of the lake fund of the Kazan region, with a total area of 10.0 thousand hectares. Out of a total of 90 small lakes, only 24 lakes with a total area of 6372 ha were included in the fishery. On 10 lakes, using the principles of landscape reclamation, low-pressure (1 m high) dams and water regulators were built to accumulate spring floods to release extreme floods.

Ichthyologists-hydrobiologists and fish farmers have proved that 490 tons of whitefish and carp can be raised on average in this area (on average) 490 tons. Prior to the organization of the fish farm, local consumer cooperation on the lakes of the Kazan region fished with aquatic fish with an average annual catch of crucian carp, roach, perch, pike of 50-60 tons, so the fishery taxation of the prospect of increasing the catch of salable fish was criticized. However, already in 1972, fish farmers of the fish farm provided non-aquatic brigades with the catch of valuable whitefish and carp in the amount of 540 tons, which is more than the ecological and fishery project [9]. For 40 years, the number of farmed fish per 6 thousand hectares of lakes ranged from 400 to 750 tons per year, and now (2015-2019), specialists of CJSC "Kazan" fish, having improved the technology for growing salable fish - whitefish and carp, produce 900-1000 tons of high-quality fish annually, or 150-170 kg/ha, which is 5-6 times more than in traditional fishing. This success is accompanied by constant cooperation with zonal fisheries science and monitoring of the level regime of lakes, water mineralization and the development of a self-renewing food supply for fish. Fish productivity and fisheries bonitet of the fenced lakes, as a rule, are always higher in comparison with none-fenced lakes.

At the same time, on the basis of monitoring, comprehensive ecological and fisheries studies of the lakes of the forest-steppe Trans-Urals took place within the Priishim plain and the degree (bonitet) of their suitability for the fish farming process in a specific period of time was determined. This work is necessary because of constant changes in the degree of water availability in the territory of the southern Trans-Urals with lakes experiencing significant fluctuations in their depth, and as a result, sharp changes in the chemical composition of water to extreme conditions (values) incompatible with the life of all freshwater fish. Consequently, for a number of reasons, not every lake can be used for annual, and even more so, long-term cultivation of marketable fish.

For example, a sharp shallowing of the Shtanovo lake of the Safakulevsky fish farm of the Kurgan oblast (Fig. 1) in 2018-2019 does not allow fish breeding to be carried out on it, because summer heating of water stimulates destructive bioecological processes and the occurrence of clogging phenomena based on oxygen deficiency in water. In winter, the process of ice formation on a shallow lake completely excludes the vital activity of fish and food invertebrates - zooplankton and zoobenthos.

**Figure 1. Actual depths of the Shtanovo lake
of the Safakulevsky district of the Kurgan oblast in June 2019**

Considering the frequency fluctuations of the level of lakes in the south of the West Siberian Plain [10], [11], and the arising natural conditions (factors) of the Trans-Urals, zonal fisheries science developed and recommended the lakes commodity fisheries of the region located in the forest-steppe part of the Priishim Plain lakes fisheries bonitet parameters. It provides a real assessment of the ecological and productive capabilities of each specific lake in the forest-steppe Trans-Urals, used to grow salable fish in points [12].

Studies have shown that all forest-steppe lakes of the Karach ichthyological type of Priishimsky Trans-Urals can be divided into five classes with their main features (Table 1).

Table 1. Class of fisheries of the lake used for the cultivation of marketable fish, and its main features

Class of lake and its characteristic features	Class point interval
1 class	
Seasonal lakes with average depths of 3.3-3.8 m, high development of zooplankton (more than 5 g / m3) and zoobenthos (more than 50 g/m^2) during the growing season. The sum of the main ions of water is 0.8-3.0 g/dm^3. Water Index Cl^{Na}, S^{Na}, C^{Ca}. Overgrowth by hard macrophytes is less than 5%. The total fish catches of farmed fish are more than 200 kg/ha per year. 2-3 year feeding of farmed fish possible	Over 85
2 class	
Zamornye lakes with foci (15-20% of the water area) of increased oxygen concentration in water in winter (more than 2 mg/dm^3). Average depths are 2.6-3.3 m. The biomass of zooplankton in the summer is 3.6-5.0 g/m^3, zoobenthos 36-50 g/m^2. Mineralization of water - the sum of total ions - 0.8-3.0 g/dm^3. Water Index Cl^{Na}, S^{Na}, C^{Na}. Overgrowth by hard macrophytes up to 10%. The total catches of farmed fish range from 130 to 200 kg/ha per year (annual feeding).	65-84
3 class	
Overland lakes. In winter, the oxygen content under ice is 1-1.2 mg/dm^3, at the bottom - 0.5-0.7 mg/dm^3. Macrophyte overgrowth up to 20% of the water area. Mineralization of water (the sum of the main ions) 0.3-5 g/dm^3. Water Index Cl^{Na}, S^{Na}. The average depth of the lake is 2-2.5 m. The biomass of zooplankton in the open water period is 2.6-3.5 g/m^3, zoobenthos is 15-35 g/m^2. The total catches of farmed fish are 80-130 kg/ha per year (annual feeding).	50-64
4 class	
Overland lakes with the development of macrophytes (hard x and soft) up to 40% of the water area. Mineralization from 1 to 6-7 g/dm^3. Oxygen deficiency under ice up to 100%. The average depth of the lake is 1.3-1.8 m. The biomass of zooplankton is 2-2.5 g/m^3, zoobenthos is from 6 to 14 g/m^2. Catches of farmed fish in the range of 35-50 kg/ha per year (annual feeding).	30-49
5 class	
Lakes with varying degrees of overgrowth of macrophytes (surface and submerged) with an average depth of 1.2-1.3 m. Mineralization of water - up to 7-12 g/dm^3. In winter, the lakes freeze to 50-60% of the water to the bottom. There is no oxygen. In winter, a layer of hydrogen sulfide is at the bottom, and in the summer there is an active emission of methane, carbon dioxide and a constant smell of hydrogen sulfide. In summer, the death of introduced whitefish and other fish species often occurs. The biomass of zooplankton in the open water period can reach 2 –«% G/m^3, and zoobenthos - up to 5-6 g/m^2. The total catches of farmed fish do not exceed 20-30 kg/ha per year (annual feeding).	up to 30

Using the characteristics of the table allows you to better assess the actual characteristics of any lake in the forest-steppe zone of the Trans-Urals, considered as the production base of the "fish farm" when deciding on the choice of technology for fish farming and reclamation process for a long period - as a result of competitive fixing of the reservoir. It is also important to take into account the dynamics of mineralization of water and its gas regime.

In the territory of Trans-Urals, in accordance with the ecological conditions of the geographical landscape, the main form of fish farming on the basis of lakes of the castle type may be the technology of annual feeding (rearing) of commercial peled (whitefish), therefore the continuous four-year regime for growing commercial fish indicated in the documents of the Ministry of Agriculture of the Russian Federation on most lakes of the trans-Ural type is unreal.

The Order of March 15, 2017 published by the Ministry of Agriculture of the Russian Federation. № 124 "On the Approval of the Methodology for Determining the Minimum Volume of Aquaculture Objects to be Diluted and (or) Maintained, Cultivated, and Released into the Water Object and Removed from the Water Object within the boundaries of the fish hatchery" provides for a differentiated regional approach to the implementation of aquaculture in local water bodies, indicating the average annual yield (catch) of cultivation objects within the Kurgan oblast in the amount of 25 kg/ha per year. And this is a completely objective value, taking into account real-life indicators of the development of the natural forage base of local reservoirs with a tense environmental situation (oxygen deficiency in water; increased and high salinity of water; shallow water). However, for the conditions of the Kurgan oblast, this Order does not provide for the cultivation of fish (conducting aquaculture) in hyperhaline lakes, as this is differentially taken into account for the conditions of the Astrakhan oblast and the Republic of Kalmykia. This procedure is also necessary for the lake fund in the south of the Trans-Urals and Western Siberia.

The current practice of commercial fish farming in 2010-2019 objectively showed that ignoring the natural climatic factors that are typical for about 40-45% of the lake fund of the Kurgan obalst, which have salt water and at a sharply changing depth (by 1 m or more), lasts only a few months, fraught with a number of negative consequences:

- the waste of expensive planting material (larvae, fry, and other juveniles) of introduced fish into shallow lakes of a castle type with highly mineralized water, leading to quick or slow death of fish;

- causing economic damage to users of extreme lakes, which are only periodically suitable for the fish breeding process due to the dynamics of climatic conditions that increase or decrease the level of lakes and the mineralization of their water, in which the juveniles of valuable fish were put for feeding;

- distrust among practitioners of the fish farming process in the activities of the State regulatory and supervisory bodies and services issues of fisheries in the Russian Federation;

- real departure from the objectively necessary reclamation measures by the method of hydraulic irrigation, contributing to the increase in fish productivity of local water bodies, potentially capable of "producing" food-grade, environmentally friendly "organic products", which will increase the balance of "food security" in the Trans-Urals region.

Ecological and fisheries monitoring of the practical use of the lake in the Trans-Urals region for raising whitefish (peled, muksun, chir, whitefish hybrids) made it possible to record the "invasion" of the cormorant cormorant, arriving from the south in large flocks in early August, emptying fish-breeding lakes from valuable food products cultivated by fishery farmers the population of the region. This problem should be solved at the State level of the Russian Federation.

Figure 2. Lake Crane, Kurgan oblast - September 28, 2018 (photo: I. Mukhachev)

Thousands of flocks of cormorants (like flocks of wolves attacking farm animals) act as active predators specializing in eating commodity yearlings of peled and other whitefish (many hundreds of tons annually), devastating fish breeding lakes of the Tyumen and Kurgan oblasts.

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PLANT EXTRACTS AS A METHOD
OF INHIBITING UNDESIRABLE MICROFLORA

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Abstract. The extracts of Chamomile, a traditional medicinal plant containing phytochemicals with diverse therapeutic properties were investigated. Four parts of the plant were extracted with 3 different solvents to analyze the total phenolics content (TPC) which were then tested for their antioxidant activity using 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging and total antioxidant capacity assays. The TPC were highest in the flowers. TPC in ethanol extract (150 ± 1 mg/g) were the highest. The antioxidant activity was highest in the flowers when compared with other parts like roots, barks, and leaves. Many phenolic compounds were quantified using UHPLC, the flavonols and hydroxybenzoic acids were dominant in the leaves, roots, barks, flowers. The antibacterial activity of methanol, ethanol flowers extracts showed larger zones of inhibition against Pseudomonas aeruginosa than Erwinia carotovora. Using minimum inhibitory concentration (MIC), the growth inhibition of P. aeruginosa and E. carotovora were found to be 71 ± 1% (methanolic extracts of roots) and 79 ± 0.3% (ethanolic extracts of leaves), respectively. These results suggested that ethanol, and methanol extracts might provide the highest amount of potentially beneficial compounds that may be helpful in treating some diseases.

Keywords: Chamomile, phenolic compounds, antibacterial activity, antioxidant activities, plant extract

Additives of natural origin based on medicinal-technical and aromatic raw materials can be successfully used as inhibitors of biochemical and microbiological processes that lead to food spoilage [1]. Aromatic plant products used in the food industry are classified as spices, aromatic seeds, and herbaceous plants.

The spices themselves include allspice, cassia, cinnamon, cloves, ginger, nutmeg, nutmeg, black and white pepper, turmeric and capsicum fruits; to aromatic seeds - anise, cardamom, caraway, celery, cumin, coriander, dill, fennel, mustard, fenugreek, poppy, sesame, star anise; to herbaceous plants (herbs) - bay leaves, marjoram, mint, oregano, parsley, rosemary, sage, savory, sweet basil, garlic and onions. Spicy raw materials are also classified by taste and smell. Caraway, cubeba, leaves and berries of a laurel tree, marjoram, anise, rosemary, sage, thyme are classified as intensely aromatic; fragrant - nutmeg and celery seeds; sweet - coriander and fennel [2].

Spicy aromatic extracts are a complex natural complex of biologically active substances, which include substances that exhibit antioxidant and antimicrobial properties that act on the body softer than supplements of artificial origin. The high specific surface area of plant fibers of natural spices is very favorable for the development of microflora, therefore dry ground spices obtained from tropical and subtropical raw materials are heavily contaminated with microflora vital products - mycotoxins (aflatoxins). To achieve sterility, spices must be kept at 150 ° C for 30 minutes. Preliminary heat treatment of dry spices is still not possible, since they all lose 15–20% of aromatic substances. Experiments on the sterilization of spices by UHF currents gave low efficiency, since their appearance changes significantly with increasing temperature. Phytoextracts are environmentally friendly products, since fiber and starches, which are a source of pollution, are completely separated. They are natural compositions of non-lipid (volatile hydrocarbons, carbonyl and phenolic compounds, higher alcohols) and lipid (fatty acids and sterols - provitamin D; possessing antioxidant activity of tocopherols - vitamin E; carotenoids - provitamin A; organophosphorus compounds) fractions. Spicy aromatic extracts are sources of vitamins C, K-phylloquinone and group B, as well as waxes, organic acids, polyunsaturated fatty acids and many other natural substances useful for the human body [3].

Essential oils isolated from plant materials are liquid volatile organic substances that cause their smell. The main components of essential oils - terpenoid compounds - terpenes $C_{10}H_{16}$ and their oxygen-containing derivatives. Essential oils are multicomponent mixtures with a predominance of one or more components. In the composition of natural essential oils today more than a thousand individual compounds are isolated [4].

By their nature, essential oils are not simple mixtures of individual substances, but complex stabilized systems. Such systems contain compounds that support a certain level of oxidizing agents and reducing agents, due to which the composition of essential oils can remain stable for a long time [7].

1. Preparation of extracts. The mature Chamomile plant parts (leaves, roots, flowers and barks) were collected from the mountains in the region of Uzbekistan in March 2019. The collected samples were identified and verified by the National Research University ITMO, Saint-Petersburg. All parts of the plant were washed in running tap water to remove soil and other adhering materials.

They were air dried and ground using a ceramic mortar and pestle to make a fine powder. The plant extracts were prepared in 3 different solvents following previously reported methods [5]. Samples weighing 10 g were added to a dark flask and mixed with various extraction solvents (200 mL, methanol, ethanol, water) at room temperature (25 °C) for 24 h. After 24 h, the infusions were filtered using Whatman No. 1 (11 µm nominal pore size) filter paper and re-extracted with an equal volume of the respective solvents for 48 h until the solvent became colorless. The supernatants were evaporated to dryness at 40 °C using a rotary evaporator. The final extract was kept in darkness at −20 °C in a sterile airtight container for few months while completing all analyses.

2. Antibacterial activity

Disc diffusion method. All extracts were tested for their antibacterial activity using reported methods [6]. Sterile nutrient agar plates were swabbed with bacterial suspension P. aeruginosa (Gram-negative) and Erwinia carotovora (Gram-negative), which were adjusted to a 0.5 McFarland standard (cell density was adjusted to 1.5×10^8 CFU/mL).

Extracts (25, 50, 75 and 100 mg/mL) in their respective solvents were diluted likewise a blank (solvent alone) and a positive control (thymol) were also prepared. Sterile discs (Sigma) (10mm diameter) were prepare to which test samples (100 µL, plant extract and positive control) were slowly impregnated and allowed to dry. The dried discs were then placed on the agar plates and incubated for 18–24 h at 37 °C to evaluate the zones of inhibition around the disc in comparison with control measured using a vernier caliper (with a minimum resolution of 0.01 mm, Sigma).

3. Results

Quantification of TPC. The highest TPC in Chamomile was found in the ethanol flowers extracts and ranged from 200 to 20 mg GAE/g powder as shown in Table 1. The TPC values were found significant between each solvents and concentrations ($P < 0.05$).

Table 1 - The TPC of Chamomile

Parts (mg/g)	MeOH	EtOH	M Water
L-E	65 ± 1	108 ± 1	83 ± 1
R-E	35 ± 1	101 ± 1	47 ± 1
F-E	68 ± 2	150 ± 1	89 ± 2
B-E	42 ± 1	78 ± 1	45 ± 1

MeOH – methanol extracts, EtOH – ethanol extracts, L-E – leaf extracts, R-E – root extracts, F-E – flower extracts, B-E – bark extracts. The values shown are the mean± SD. The superscript in each column represents significant P values ($P < 0.05$) that are different from each other.

Table 2 - Individual phenolic compounds identified in the Chamomile by UHPLC

Concentration (µg/g)				
Compounds	Leaf	Root	Flower	Bark
o-Coumaric acid	43 ± 2	15 ± 1	57 ± 1	29 ± 1
Myricetin	1420 ± 10	1100 ± 10	890 ± 10	1360 ± 5
Quercetin	742 ± 4	522 ± 3	884 ± 2	870 ± 3
Kaempferol	32 ± 1	24 ± 2	57 ± 2	23 ± 1
Resveratrol	23 ± 1	23 ± 2	25 ± 1	12 ± 1
Naringenin	15 ± 1	18 ± 1	12 ± 1	35 ± 2
Biochanin	20 ± 2	41 ± 2	34 ± 1	15 ± 1

The values shown are the mean ± SD. The superscript in each row represents significant P values ($P < 0.05$) that are different from each other.

The concentration of flavonols were found to be the highest, with myricetin, quercetin, and kaempferol contents ranging from 1420 to 550, 884–742, and 57–23 µg/g, respectively. In addition biochanin A, o-coumaric acid, naringin, naringenin, catechin, and resveratrol were also identified (Table 2). Since phenolic compounds are known to show antioxidant and antibacterial activities those phenols present in Chamomile were evaluated and the role of solvents in extracting bioactive compounds was also evaluated.

Disc diffusion method. The results showed an increase in the zones of inhibition with an increase in concentration (100 mg/mL). Of all the solvents, the methanol and ethanol extracts showed good inhibition against both strains at highest concentration (100 mg/mL) (Table 3). For P. aeruginosa the barks had the largest inhibition zone, followed by flowers, roots and leaves. For E. carotovora, the largest inhibition zone was observed with the flowers, and other parts decreased in the order of roots, leaves and barks at 100 mg/mL. In both strains, the methanol and aqueous extracts showed limited inhibition zones.

Table 3 - Antibacterial screening test of different extracts against bacterial strains

Micro organism (µL)	Zone of inhibition (mm) at 100 mg/disc			
	Positive control	MeOH	EtOH	Water
	P. aeruginosa			
L-E	32 ± 0.2	22 ± 0.4	30 ± 1	18 ± 1
R-E	28 ± 0.2	24 ± 0.4	22 ± 1	19 ± 1
F-E	35 ± 0.1	40 ± 0.2	37 ± 1	21 ± 1
B-E	15 ± 0.1	21 ± 0.2	22 ± 2	16 ± 1
	E. carotovora			
L-E	25 ± 0.1	26 ± 0.4	22 ± 1	19 ± 1
R-E	24 ± 0.4	23 ± 0.4	18 ± 3	21 ± 2
F-E	25 ± 0.2	32 ± 0.4	30 ± 2	20 ± 2
B-E	24 ± 0.1	24 ± 0.4	22 ± 1	17 ± 1

MeOH – methanol extracts, EtOH – ethanol extracts, L-E – leaf extracts, R-E – root extracts, F-E – flower extracts, B-E – bark extracts. The values shown are the mean ± SD. The superscript in each column represents significant P values ($P < 0.05$) that are different from each other.

Conclusion

The most prevalent phenolics of Chamomile were myricetin, quercetin, which have an important role in various biological activities. These compounds are reported to aid in the plant's antioxidant and antibacterial activities. Many other compounds may be involved in other therapeutic effects. All of the identified compounds require further research to determine their role in a variety of applications. The antibacterial activity suggests that the Chamomile may be a source of other antibacterial drugs that might replace some antibiotics.

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DIFFRACTION OF A PLANE WAVE AT AN INHOMOGENEOUS CYLINDRICAL SHELL

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Annotation. We consider the diffraction of a plane wave on a cylindrical shell with two inertial masses fixed symmetrically (at $\varphi = \pm\varphi_1$) on its surface. The results of calculations of the frequency characteristics of the scattered field of a shell with diametrically opposite masses ($\varphi_1 = \pi/2$) upon excitation of only symmetric (with respect to the plane $\varphi = 0$; $\varphi = \pi$) vibration modes are presented. It has been established that when moving from a model with one local mass (at $\varphi = \pi$) to a model with two local masses (at $\varphi = \pm\pi/2$) (i.e., separating the inhomogeneity), the level of the scattered field increases in the frequency range corresponding to symmetric vibration modes with even numbers. At frequencies of vibrational modes with odd numbers, the scattered field coincides with the field of a uniform shell. The radiation patterns of the scattered field of the shell with two local masses (at $\varphi = \pm\pi/2$) are determined.
Keywords: diffraction, scattered field, cylindrical shell, modes.

The study of diffraction of acoustic waves on homogeneous cylindrical shells (CS) is the focus of a number of works (for example, [1-3]). In [4–6], the features of scattering of a sound wave by CS with an inhomogeneity represented as a single inertial mass concentrated in azimuth were studied.

In the present work, we study the diffraction of a plane sound wave normally incident on the surface of a shell with an inhomogeneity in the form of two identical inertial masses. We consider a model of a thin-walled CS of unlimited length of radius $r = a$ with inhomogeneities rigidly fixed on the surface, azimuthally localized, characterized by linear density m and installed symmetrically (relative to the $\varphi=0$; $\varphi=\pm\varphi_1$ plane;) along the generatrix of the shell. In carrying out this analysis, limited to the simplest case corresponding to low-frequency azimuthal oscillations, the well-known

[1,2] representation for the field outside the shell is used: $P = P_i + P_S^{(0)} - P_r$, where $P_S^{(0)}$ and P_r – are the sound pressure in the wave reflected by the rigid cylinder and the pressure in the emitted wave, respectively.

The inhomogeneities established on the CS surface will lead to a change in its diffraction field (P)), compared with a homogeneous shell, as a result of exposure to the component associated with the radiation (P_r) [4-6]. The radiation field can be determined if a solution is found to the problem of forced oscillations of an inhomogeneous shell under the influence of an incident wave. For this purpose, we use the corresponding equations of the self-consistent problem of forced oscillations of the CS model under study, written with respect to the normal component of the vibrational velocity $v(\varphi)$, obtained in the approximation of the technical theory of shells without taking into account the tangential inertia forces [7]. When compiling these equations [6], it is assumed that the inertial masses are rigidly fixed ($v(\varphi_1 - 0) = v(\varphi_1 + 0) = V$, where V - is the velocity of the center of inertia of the corresponding mass) and have one degree of freedom: they can only move along the normal to the shell surface. Therefore, at the points of mass fixation, the function $v(\varphi)$ remaining continuous in the first and second derivatives, has a gap only in the third derivative, the value of which is proportional to the inertia of the inhomogeneity.

The solution to the problem of forced oscillations will be sought in the form of a series expansion in eigenmodes of vibration of an inhomogeneous system in vacuum [2]. Therefore, we preliminarily analyze the orthonormalized system of eigenfunctions, the main characteristics of which can be obtained in some extreme cases in an analytical form, which allows us to give a clear physical interpretation of the influence of inertial masses on the character of the field of the scattered CS.

Note that the analysis of the system of natural modes of vibration of a shell model with one inertial mass was carried out earlier in works [8–10].

Since the model of inhomogeneous CS under consideration has a symmetry plane ($\varphi = 0$; $\varphi = \pi$), for it, according to [8], we can distinguish symmetric ($i = 1$) and antisymmetric ($i = 2$) eigenfunctions v_q^i. The corresponding eigenvalues of $\gamma_q^{(i)}$ and frequency $\xi_q^{(i)} = (\gamma_q^{(i)}/\pi)^2$ are determined from the characteristic equations of the task,

$$
\begin{cases}
i=1, \quad \sin\gamma_q^{(1)} + \dfrac{\alpha_0\gamma_q^{(1)}}{2}[\cos(\gamma_q^{(1)}\eta)\cos(\gamma_q^{(1)}\chi) + \mu\cdot ch(\gamma_q^{(1)}\eta)ch(\gamma_q^{(1)}\chi)] = 0; \\
i=2, \quad \sin\gamma_q^{(2)} + \dfrac{\alpha_0\gamma_q^{(2)}}{2}[-\sin(\gamma_q^{(2)}\eta)\cos(\gamma_q^{(2)}\chi) + \mu\cdot ch(\gamma_q^{(2)}\eta)ch(\gamma_q^{(2)}\chi)] = 0,
\end{cases}
\tag{1}
$$

where $\chi = \overline{\varphi}/\pi$, ($\overline{\varphi} = \pi - \varphi_1$), $\eta = \varphi_1/\pi$, $\mu = \sin\gamma_q^{(i)}/sh\gamma_q^{(i)}$;

$\alpha_0 = 2\alpha$, ($\alpha = m/(2\pi m_s a)$)–heterogeneity parameter;

$m_S = \rho_S h$ – mass of a unit of shell surface thickness h); $q = 2,3,4,... -$ root numbers.

The functions $v_q^{(i)}$ are orthogonal (orthogonality with a weight depending on the parameter a). In the future, orthonormal eigenfunctions will be used: $\psi_q^{(i)}(\varphi) = v_q^{(i)} / \sqrt{D_q^{(i)}}$, where $D_q^{(i)}$ – are the norms of the corresponding vibration forms.

Two inertial masses mounted on the surface of the shell at $\varphi = \pm\varphi_1$, have a disturbing effect on those forms of vibration for which $\psi^{(i)}(\varphi = \pm\varphi_1) \neq 0$. The consequence of this effect is the deformation of the intrinsic forms (the nodes in the distribution of $\psi(\varphi)$ approach each other and the amplitudes of the maxima at the points of mass attachment decrease) in comparison with a homogeneous shell ($\alpha = 0$).

In the practically important case of the diametrically opposite mass fixing ($\varphi_1 = \pi/2$)the symmetric forms with even and antisymmetric ones with odd numbers turn out to be deformed [11]. Moreover, each equation of system (1) (respectively, for vibration modes with even and odd numbers) splits into two equations

$$
\begin{cases}
i=1: & \begin{cases} 1 + \dfrac{\alpha_0 \gamma_q^{(1)}}{4}\left[ctg\,\dfrac{\gamma_q^{(1)}}{2} - cth\,\dfrac{\gamma_q^{(1)}}{2}\right] = 0 \\[3mm] \cos\dfrac{\gamma_q^{(1)}}{2} = 0, \end{cases} \\[12mm]
i=2: & \begin{cases} 1 + \dfrac{\alpha_0 \gamma_q^{(2)}}{4}\left[-tg\,\dfrac{\gamma_q^{(2)}}{2} + th\,\dfrac{\gamma_q^{(2)}}{2}\right] = 0 \\[3mm] \sin\dfrac{\gamma_q^{(2)}}{2} = 0 \end{cases}
\end{cases}
\tag{2}
$$

From relations (2), it is possible to obtain a solution in the asymptotic approximation, which, for example, for symmetric forms with even numbers, looks as follows: $\gamma_q^{(1)} = 2\pi(q - 1/4)[1 + 1/\alpha_0 \pi^2 (q - 1/4)^2]$. As calculations show, this expression gives root values with an error of less than 10% for $q = 2$ n the region of variation of the parameter $a_0 > 0,7$ and less than 5% for $a_0 > 0,3$ for $q \geq 4$.

The distribution of the vibrational velocity for various vibration modes of the $\psi_q^{(i)}$ shell with two diametrically opposed heterogeneities for the region $-\pi/2 \le \varphi \le \pi/2$ and $-\pi/2 \le \widetilde{\varphi} \le \pi/2$ (where $\widetilde{\varphi} = \varphi - \pi$) are as follows:

$$
\begin{cases}
v_q^{(1)}(\varphi) = \cos\dfrac{\gamma_q^{(1)}}{\pi}\varphi + \dfrac{\sin\dfrac{\gamma^{(1)}}{2}}{sh\dfrac{\gamma^{(1)}}{2}}\,ch\dfrac{\gamma_q^{(1)}}{\pi}\varphi, \\[4em]
v_q^{(1)}(\varphi) = \cos\dfrac{\gamma_q^{(1)}}{\pi}\widetilde{\varphi} + \dfrac{\sin\dfrac{\gamma^{(1)}}{2}}{sh\dfrac{\gamma^{(1)}}{2}}\,ch\dfrac{\gamma_q^{(1)}}{\pi}\widetilde{\varphi}
\end{cases}
\tag{3}
$$

$$
\begin{cases}
v_q^{(2)}(\varphi) = \sin\dfrac{\gamma_q^{(2)}}{\pi}\varphi + \dfrac{\cos\dfrac{\gamma^{(1)}}{2}}{ch\dfrac{\gamma^{(2)}}{2}}\,sh\dfrac{\gamma_q^{(2)}}{\pi}\varphi, \\[4em]
v_q^{(2)}(\varphi) = -\sin\dfrac{\gamma_q^{(2)}}{\pi}\widetilde{\varphi} + \dfrac{\cos\dfrac{\gamma^{(2)}}{2}}{ch\dfrac{\gamma^{(2)}}{2}}\,ch\dfrac{\gamma_q^{(2)}}{\pi}\widetilde{\varphi}
\end{cases}
\tag{4}
$$

A measure of the deformation of these distributions under the influence of inertial masses, which increases with the growth of the inhomogeneity parameter (a)and the sequence numbers of the vibration modes, can be the expansion coefficients a_{qn}, b_{qn} of the corresponding eigenfunctions of $\psi_q^{(i)}$ in Fourier series [9]

$$
\psi_q^{(2)}(\varphi) = \sum_{m=0}^{\infty} a_{qn}\cos n\varphi,
$$

$$
\psi_q^{(2)}(\varphi) = \sum_{m=0}^{\infty} a_{qn}\sin n\varphi
\tag{5}
$$

(n=0,1.2.3,……).

For a shell with diametrically opposed masses, these coefficients can be represented as follows:

$$
\begin{cases}
a_{qn} = \dfrac{2\left(\cos\dfrac{\pi n}{2}\right)\sin\dfrac{\gamma}{2}}{\sqrt{D_q^{(1)}}}\left[\dfrac{4\left(\gamma\cos\dfrac{\pi n}{2}\right)^2}{\gamma^4-(\pi n)^4} - \dfrac{\pi n(\sin\pi n)ctg\dfrac{\gamma}{2}}{\gamma^2-(\pi n)^2} + \dfrac{\pi n(\sin\pi n)cth\dfrac{\gamma}{2}}{\gamma^2-(\pi n)^2} \right] \\[4ex]
b_{qn} = \dfrac{2\left(\sin\dfrac{\pi n}{2}\right)\cos\dfrac{\gamma}{2}}{\sqrt{D_q^{(2)}}}\left[\dfrac{\pi n(\sin\pi n)th\dfrac{\gamma}{2}}{\gamma^2+(\pi n)^2} + \dfrac{\pi n(\sin\pi n)tg\dfrac{\gamma}{2}}{\gamma^2-(\pi n)^2} + \dfrac{4\gamma^3\sin\dfrac{\pi n}{2}}{\gamma^4-(\pi n)^4} \right]
\end{cases}
\tag{6}
$$

The values of the coefficients a_{q0} (6), according to the calculation results, turn out to be approximately 2 times larger than the corresponding coefficients for CS with one mass (at $\varphi=\pi$).

On the other hand, the separation of heterogeneity under consideration leads to a change in the spectral composition of the deformed CS vibration modes (5). Indeed, symmetric with even numbers (3) turn out to be symmetric with respect to the horizontal plane ($\varphi=-\pi/2, \varphi=\pi/2$). Therefore, their expansion (1) will contain only those coefficients a_{qn}, for which the corresponding vibration modes of the homogeneous shell ($\cos n\mathbf{j}$)are also symmetric with respect to this plane (i.e., with even n). Therefore, each deformed vibration mode of such a CS model represents a spectrum of spatial harmonics with even numbers corresponding to monopole ($n=0$), quadrupole ($n=2$) and other higher-order homogeneous CS modes of vibration having even numbers ($n=4,6,8,....$).Note that for a shell with one inertial mass (at $\varphi=\pi$) [9] (having one degree of freedom and moving only normal to the shell surface), each form for which $\psi(\varphi=\pi)\neq 0$ (ie, symmetric) represents the full spectrum of spatial harmonics (in the expansion (5) of (5) $a_{qn}\neq 0$ for $n=0,1,2,3,...$).

Note that for deformable antisymmetric vibrational modes (4) (with odd numbers), expansion (5) contains terms corresponding to the uniform CS ($\sin n\mathbf{j}$),forms having odd numbers (i.e. $b_{qn}=0$ at $n=1,3,5,...$).

After studying the properties of the natural vibrations of an inhomogeneous shell, an analysis of its forced oscillations is carried out, assuming for definiteness that the wave is incident along the plane of symmetry and only symmetric vibrations are excited. To this end, the well-known method [2] is used, representing the solution in the form of series expansion in eigenmodes of $\psi_{\tilde{u}}(\varphi)$. When analyzing the radiation field of such a shell, a ready-made solution to the CS radiation problem is used [2]. As a result, the following ap-

proximate expression is obtained (without taking into account the relationship between the vibration forms) for the radiation field of a cylinder of small wave sizes ($ka << 1$) in the far zone ($kr >> 1$) normalized to the amplitude of pressure in the wave $P_s^{(0)}$ (in the far field) arising from reflection on a rigid cylinder [6]:

$$P_H = -\frac{2i}{ka}C_0 - 2iC^{(1)} + \left\{ -C_2^{(1)}\left[\frac{2i}{ka}a_{20} + \frac{ka}{2}a_{22}\cos 2\varphi + ... \right] - \right.$$

$$\left. -C_3^{(1)}\left[\frac{2i}{ka}a_{30} + \frac{ka}{2}a_{32}\cos 2\varphi + ... \right] + ... \right\},$$

(7)

where $ka = \pi\xi N$; a parameter that determines the dimensions of CS at a characteristic frequency w_1 (for the considered low-frequency oscillations $N << 1$); C_0, C_1 – respectively, dimensionless amplitudes of forced pulsating and oscillating fluctuations CS: $C_0 = \beta(-i\xi)$, $\beta = h/(a\sqrt{12})$; $C_1 = \cos\varphi'/(2\pi^2(1+\alpha_0)(-i\xi))$; $\varphi = \varphi'$ – is the angle of incidence of the wave with respect to the plane ($\varphi = 0$; $\varphi = \pi$); $C_q^{(1)}$ – are the dimensionless amplitudes of the forced vibrations of natural forms with numbers q.

We use the obtained relation (7) to analyze the effect of the separation of the inertial mass (established at $\varphi = \pi$) on the frequency response of the field scattered by the shell.

The inertial mass established at $\varphi = \pi$ [6], firstly, leads to a significant increase in the level of radiated pressure compared to homogeneous CS as a result of deformation of $\psi_q^{(1)}(\varphi)$ [9], when monopole and dipole radiation prevails in the radiation field of each deformed shape. Secondly, the diagrams $P_H(\varphi)$ differ significantly from the corresponding diagrams of a homogeneous shell.

The division of the inhomogeneity (at $\varphi = \pi$) into two identical parts (set at $\varphi = \pm\pi/2$) should increase the level of the wave field of the emitted CS at the resonant frequencies of the vibrational modes with even numbers. The radiation patterns of these forms will obviously be determined mainly by radiation from monopole and quadrupole types. The forms with odd numbers of inhomogeneity (at $\varphi = \pm\pi/2$) will not be affected (since $\psi^{(1)}(\varphi = \pm\pi/2) \neq 0$), and at the corresponding resonant frequencies the shell will radiate as homogeneous.

The radiation pattern of the scattered field CS with two masses (at $\varphi = \pm\pi/2$), when the monopole and quadrupole character of radiation prevails at the resonant frequencies of vibrational modes with even numbers, according to (7), is determined by the expression

$$\Phi = \left[1 - \frac{a_{22}}{a_{20}} \left(\frac{ka}{2} \right)^2 i \cos 2\varphi \right], \tag{8}$$

The coefficients a_{20}, a_{22} (at $\alpha = 1$, for $q = 2$) will be equal to: $a_{20} = 0{,}41$; $a_{22} = 0{,}398$. The diagram (8) is determined by the expression $(1 - 3.7 \times 10^{-3} i \cos 2\varphi)$ and practically coincides with the monopole type radiation diagram.

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THE CLEANING SEED COTTON OF SMALL WEED IMPURITIES AND THEORETICAL RESEARCH TO IMPROVE ITS EFFICIENCY

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Annotation. In the article, it is noted that in the technology of cleaning raw cotton from weed impurities, research has been conducted on the creation of cleaners and the production cleaning line, but the issues of the vertical layout of the cleaning sections have not been sufficiently addressed so far. Based on the analysis of previously conducted practical and theoretical studies, the authors obtained theoretical regularities describing the process of efficient extraction of small weed impurities from raw cotton. The results obtained allow us to establish the speed of the drum and the angle of its circumference by the mesh surface, at which the required degree of loosening of the raw cotton is ensured, at which small weed impurities are effectively released.

As a result of complex research, an innovative version of the cleaner with the arrangement of spike-slatted drums according to the "Z" scheme has been developed, which allows the cotton to carry out an unstressed movement, excluding the counter impact effects. The unidirectional rotational speed of the spike drums allows to eliminate bottomhole situations in the machine. In this case, the circumference angle of the spike drum with the mesh surface is more than 180 ° and unstressed trajectory of the movement of raw cotton is carried out during its cleaning.

During the processing of raw cotton in the new vertical cleaner, the natural quality indicators of the processed raw cotton are preserved to the maximum. After the development of a new vertical cotton cleaner, the authors proposed a new classification of raw cotton cleaners from small weed impurities.

Keywords: raw cleaning, small weed impurities, small weed impurities cleaner, spike drum, mesh surface.

Introduction. The adopted Strategy of Action on five priority areas of development of the Republic of Uzbekistan for 2017-2021 sets the task of improving the quality of products by improving high-tech industries based on the deep processing of raw cotton, the widespread introduction of energy-saving technologies, modernization and reconstruction of the ginning industry.

In this direction, research on the cleaning of raw cotton, taking into account the main influencing factors, occupies a special place in the world. Technological processes for the cleaning of raw cotton from impurities were studied in the works of E.F. Budin, B.V. Loginov, G.I. Miroshnichenko, G.I. Boldinsky, P.N. Tyutin, A.E. Lugachev, A. Juraev, F.I.Saadi, R.Z. Burnashev, B.Ya. Yakubov, Yu.S. Sosnovsky, Kh. Sidikov, M. Agzamov, V.N. Arkadaksky and P.N. Borodin [1].

From an analysis of studies in the United States of America [2-12]. it can be seen that foreign researchers studied the issues of improving the design of cleaners, their working bodies, cleaning ratio, rotation speed of working bodies and so on.

In addition, in the technology for cleaning raw cotton from impurities, studies have been carried out to create cleaners and a production line for cleaning, however, the vertical layout of the cleaning sections has not been sufficiently addressed to date.

Research results. Let us study separately the movement of the flow in each section of the drum. The first section is determined by the value of the angle α in the interval $\alpha_{0-i} < \alpha < 2\alpha_i$ (Fig. 1.a). We consider the medium to be compressible, select from this section an element from the flow of raw cotton ds (Fig. 1.b) and compose the equation of motion according to the Euler formula. We consider the flow motion to be stationary. Then the Euler equations for this element are written in the form (1):

а)

б)
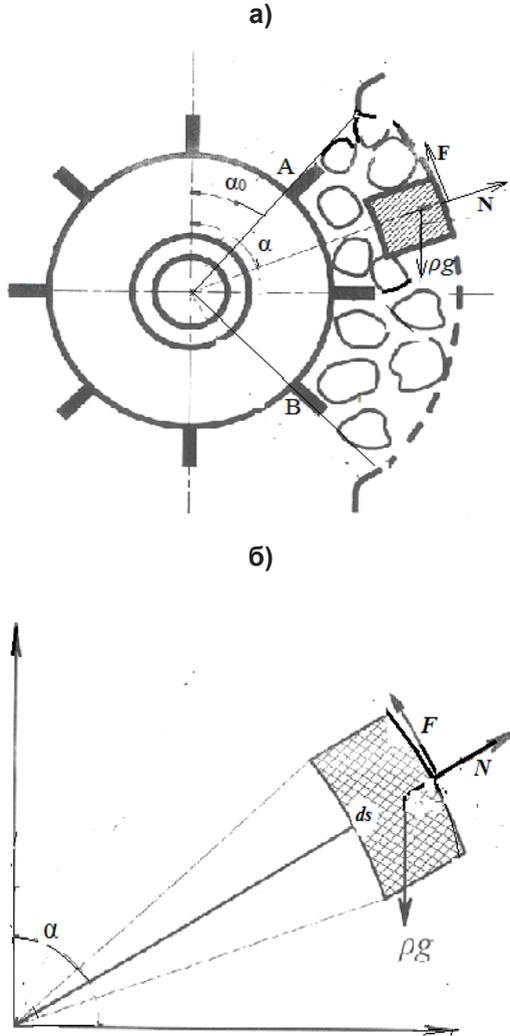
Fig. 1. The movement pattern of the flow of raw cotton along the drum under the action of three pegs

$$v\rho\frac{dv}{ds} = -\frac{dp}{ds} + \rho g \sin\alpha - Nf \qquad N = \rho\frac{v^2}{R} - \rho g \cos\alpha \qquad (1)$$

where s - the length of the contact arc of the raw cotton with the mesh, counted from point A, v – current particle speed of raw cotton, p, r - pressure and density, R - drum radius, N - normal specific gravity, f - coefficient of friction between mesh surface and raw cotton

After the exclusion of power N from (1) we get the equation for pressure $p(s)$, $\rho(s)$ and speed $v(s)$:

$$v\rho\frac{dv}{ds} = -\frac{dp}{ds} + \rho g(\sin\alpha + f\cos\alpha) - \rho\frac{v^2}{R}f \qquad (2)$$

Equation (2) contains three unknowns: p, r и v. To close it, we use the equation of state of a compressible medium, establishing a relationship between pressure p and density r :

$$\rho = \rho_c[1 + A(p - p_c)] \qquad (3)$$

and mass conservation condition for stationary flow motion

$$\rho v S_0 = Q_0 \qquad (4)$$

here $S_0 = k_0 Lh$ – cross sectional area of the flow layer, h- layer thickness, L- drum length, r_c- coefficient characterizing the decrease in the contact area of raw materials with the surfaces of the spikes. Q_0 cleaner performance, r_c p_c - density and pressure upon receipt of raw materials on the surface of its contact with the stick, A- raw compressibility constant. If $A << 1$ (4) we determine the speed

$$v = v_c[1 - A(p - p_c)] \qquad (5)$$

Upon impact of the spikes on the raw materials upon contact, the particles of the flow acquire speed $v_c = \beta v_k$, где v_k - linear speed of spike, $\beta < 1$- speed reduction coefficient, determined experimentally, in [1] the average flow rate in the cleaning zone is taken $v_{cp} = 0.5 v_k$.

Putting in the formula (5) $v = v_c$, we find the density of raw materials on the contact surface with the spike $\rho_c = \dfrac{Q_0}{S_0 v_c}$.

To determine the pressure p_c, we believe that pressure is known p_0 raw material density $p = p_0$ in the feed zone. Then we believe, that $p = p_0$ и $\rho = \rho_0$ formula (3), we find

$$p_c = p_0 - (\rho_0 / \rho_c - 1) / A \qquad (6)$$

From the requirement of the absence of separation of raw materials from the surface of the spike follows $p_c > 0$, that determine $\dfrac{\rho_0}{\rho_c} < 1 + p_0 A$.

On the other hand, the condition for the discharge of raw materials in the treatment zone must be fulfilled. $p_c < p_0$, that gives $\dfrac{\rho_0}{\rho_c} > 1$. To implement the process of rarefaction of raw materials without breaking contact with the spike, it is necessary that the density ratio $\dfrac{\rho_0}{\rho_c}$ satisfy inequality $1 < \dfrac{\rho_0}{\rho_c} < 1 + p_0 A$

Pressure limit p_0 (or speed of peg) from the condition that there is no damage to the seeds during the impact interaction of the spike with the raw material. If denoted by P_k ultimate impact force, at which seed damage occurs, then assuming in formula (7) $p_c < P_k / S_0$, we get $p_0 < P_k / S_0 + (\rho_0 / \rho_c - 1) / A$.

We introduce a new variable by the formula (6) $\alpha = s / R$ (a - central angle, R - drum radius). In view of (4) and (6), we write equation (2) with respect to pressure p.

$$a \frac{dp}{d\alpha} = R\rho g (\sin\alpha + f\cos\alpha)[1 + A(p - p_c)] - \overline{Q_0} f [1 - A(p - p_c)]$$

where $a = 1 - \overline{Q_0} v_c \cdot A$, $\overline{Q_0} = \dfrac{Q_0}{S_0}$.

We reduce the last equation to the form:

$$\frac{dp}{d\alpha} = F_1(\alpha) p + F_2(\alpha) \tag{7}$$

where
$$F_1(\alpha) = \frac{A[R\rho_0 g F_0(\alpha) + \overline{Q_0} f v_0]}{a},$$

$$F_2(\alpha) = \frac{(1 - Ap_c) F_0(\alpha) R\rho_0 g - \overline{Q_0} v_0 f (1 + p_c A)}{a}$$

$$F_0(\alpha) = \sin\alpha + f\cos\alpha$$

Solution of equation (7) satisfying the condition $p(\alpha_0) = p_c$ represented in quadratures

$$p = F(\alpha)[\frac{p_c}{F(\alpha_0)} + \int_{\alpha_0}^{\alpha} \frac{F_2(\alpha)}{F(\alpha)} d\alpha] \tag{8}$$

where $F(\alpha) = \exp[\int F_1(\alpha) d\alpha]$

The density and flow rate are calculated by formulas (5) and (6).
We use formula (8) to determine the pressure p in each section.

The contact of the flow of raw cotton with the mesh surface occurs in areas $\alpha_{i-1} < \alpha < \alpha_i$ (i=1..6).

Next, density and velocity plots are plotted in the cleaning zone.

In continuation of the previously conducted practical and based on the theoretical studies presented, we developed a scheme for a vertical cleaner of raw cotton from fine litter, which allows us to eliminate the above disadvantages by successive movement of spike drums, where it becomes possible to increase the angle of coverage of the mesh surface of the drum.

Unidirectional rotational speed of the annular drums eliminates down-hole situations in the machine. In this case, the angle of girth of the annular drum with a mesh surface is more than 180 °. and an unstressed trajectory of the movement of raw cotton during its cleaning.

The presented layout scheme of the cleaning sections (Fig. 3) allows to significantly increase the cleaning effect, as well as preserving the natural quality indicators of raw cotton and its components, which is the basis for the development of technology for vertical cleaning of raw cotton at gin-neries.

a)
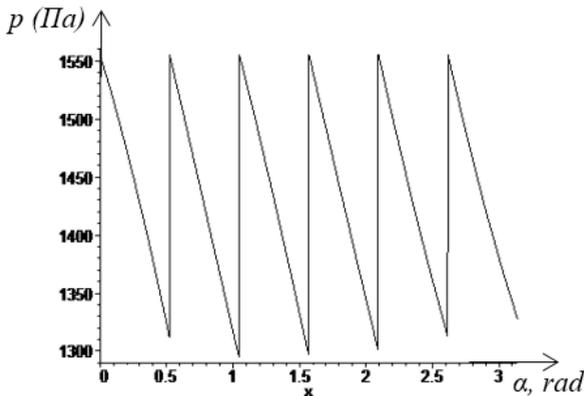
б)
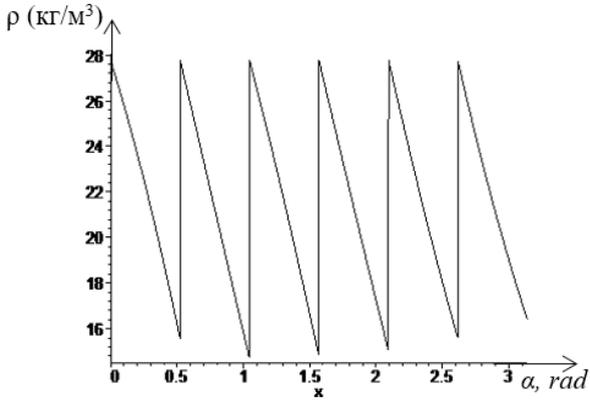
**Fig. 2. Change in pressure (a) and density (b)
along the arc of the cleaning zone**

The following data were used for the calculation: Q0:=3000/3600;
A:=0.001; v0:=2; p0:=2000; g:=10; r0:=40; f0:=0.3; k:=0.6; S0:=0.01008*2*k;
α1:=2* α0; vc:=9; Q01:=Q0/S0; R:=0.4; a:=1-v0*Q01*A.
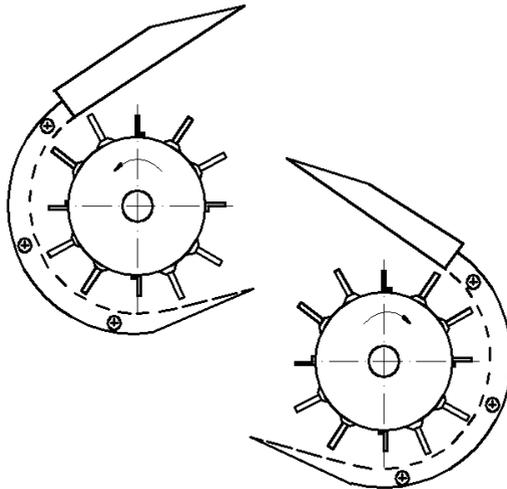
**Fig. 3. Schematic section of the vertical cleaner
raw cotton from fine litter**

1. **Findings.** Based on the results of the analysis of work to improve the cleaning process of raw cotton from small weed impurities and theoretical studies in this direction, the following conclusions can be drawn: It is necessary to develop theoretical and practical research to increase the net surface area to 1800C or more by creating the optimal arrangement of units for cleaning raw cotton from fine litter. Studies of American scientists Carlos B. Armijo, Kevin D. Baker, Sidney E. Hughs, Edward M. Barnes, Marvis N. Gillum [14], who concluded that with a steadily increasing weediness of harvested cotton, led to this conclusion. raw need to move on to more efficient schemes and technologies for cleaning it from small weed impurities.

2. In order to eliminate hazardous areas and transitions between ring drums, a model should be developed for the shockless movement of raw cotton when it is cleaned of fine litter due to the transition to a vertical scheme for cleaning cotton of fine litter. It has been revealed that the pressure of the velocity after the striking changes abruptly, while after the impact the density decreases, that is, loosening occurs, and the speed of the raw cotton particle increases. This pattern allows you to set the speed of the annular drum at which you can select the desired degree of loosening, when weed impurities are effectively released.

3. The developed scheme of a vertical cleaner of raw cotton from fine litter allows to reduce the metal consumption of the structure, the energy intensity of the unit, while ensuring high reliability in operation, as well as the ability to maximize the preservation of the natural quality indicators of the processed raw cotton. This development [15] is the winner of the 2018 National Competition of Innovative Ideas organized by the Strategic Development Center, the Ministry of Innovative Development of the Republic of Uzbekistan, and the UN Office in Uzbekistan as part of the INNOWEEK International Week in Tashkent.

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FRACTURE OF THE MULTILAYER COMPOSITION "ZRO$_2$ CERAMIC COATING - NIAL BONDING LAYER - TI-6AL-4V SUBSTRATE" DURING THERMAL TEST

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Abstract. Using the methods of scanning electron microscopy and X-ray diffraction analysis, the influence of the substrate temperature on the structure and phase composition of the intermediate NiAl layer and the ZrO$_2$ ceramic coating was studied. It was shown that the deposition of intermediate layers of NiAl suppresses cracking and chipping of ZrO$_2$ ceramic coatings during thermal loading. Based on the results obtained, the optimal Al and Ni contents in the NiAl binder layer and its thickness were selected, which ensure the maximum number of cycles until the destruction of ZrO$_2$ ceramic coatings during their thermal cycling. The effect of the roughness of a substrate of a 3D-printed titanium alloy Ti-6Al-4V on the cracking and warping nature of ZrO$_2$ coatings deposited on an intermediate NiAl layer during thermal cycling was studied. The results obtained will make it possible to make practical recommendations on the creation of heat-protective coatings characterized by maximum thermal resistance.

Keywords: additive technologies, titanium alloy Ti-6Al-4V, ceramic coating, thermal stability, surface curvature, interface, fracture.

During thermal loading of the ceramic-metal-substrate composition, due to the difference in the thermal expansion coefficients of the coating materials and the substrate, biaxial tensile stresses develop in the coating, deforming it so that it matches the size of the substrate. In turn, compressive stresses develop in the surface layers of the substrate, the relaxation of which at elevated temperature can lead to grain growth in the metal sub-

strate, changes in the elemental and phase composition, etc. Therefore, even with the appropriate choice of the material of the binder layer, which has a low coefficient of thermal expansion and high corrosion resistance, the destruction of ceramic coatings takes place in the process of thermal cycling. Moreover, the nature of the destruction, as well as its intensity, is determined by the curvature of the interface between the ceramic coating and the bonding layer, as well as the bonding layer and the metal substrate. For example, it is known that in inhomogeneous stress fields, an impurity ion acts on a force proportional to the difference between the volumes of the impurity atom and the lattice atom. Therefore, atoms with a larger ionic radius move in the extension region, and atoms with a smaller radius move in the compression region. The result of this process may be a redistribution of Al and V atoms in the surface layer of a Ti-6Al-4V titanium alloy substrate. In the presence of a NiAl binder layer, gradients of the chemical potential along its free surface and along grain boundaries will lead to different growth rates of the oxide film on the surface of the binder layer, as well as to a change in the phase composition of the coating.

In turn, the formation of an oxide film on the surface of the binder layer is accompanied by the development of compressive stresses caused by several factors. In addition, at an elevated temperature, recrystallization can occur in the binder layer, at which grain boundaries migrate and partially annihilate. In this case, grain-boundary atoms are embedded in the crystal lattice of growing grains, causing an increase in the concentration of vacancies at their boundaries. Redistribution of the excess free volume possessed by grain boundaries leads to compaction and compression of the metal binder layer. However, the latter is tightly bound to the growing oxide film, which prevents compression of the binder layer. In turn, the transformation of metal into oxide, on the contrary, is accompanied by an increase in the volume of the formed layer. Finally, in the process of oxidation, an increase in the density of the oxide film occurs due to its so-called "lateral" growth. This effect is caused by the continued growth of Al_2O_3 inside the already existing oxide layer. However, due to limitations on the substrate side, the film cannot expand, and its compaction becomes excessive. These factors lead to the development of compressive stresses in the oxide film and, accordingly, its warping, causing the destruction of heat-protective coatings.

In this regard, the aim of this work is to find the possibility of increasing the thermal stability and crack resistance of ZrO_2 ceramic coatings deposited on Ti – 6Al – 4V titanium alloy substrates by selecting the optimal percentage of NiAl binder layer components.

Experiment details. The investigated materials were the as-received titanium Ti–6Al–4V alloy produced by casting and Ti–6Al–4V parts built by EBM of commercially available welding wire.

EBM was performed using an electron beam welding machine 6E400 (Teta, Russia) operating in a vacuum below 1.3×10-3 Pa at an acceleration voltage of 30 kV. The movement of the 150 mm x 150 mm base plate along X, Y and Z axes was provided by a 3-axis computer-controlled positioning system. The distance between the electron beam gun and the base plate (working distance) was 630 mm. At the beginning of a build process the titanium base plate was heated up to 900°C. Ti-6Al-4V welding wire 1.6 mm in diameter was melted with a plasma power source onto the plate surface to build up a part. Beam currents were ranged from 24 to 17(25-18) mA. The speed of platform movement along the XY and Z-directions was equal to 5 and 1 mm/s correspondingly.

The electron beam welding machine was also used for the continuous scanning electron beam treatment of Ti-6Al-4V cast alloy and Ti-6Al-4V parts manufactured by the EBM process. A sawtooth signal with a frequency of 100 Hz was used to turn the electron beam into a line of 27 mm length. The accelerating voltage and beam current were 30 kV and 60 mA, respectively. The both types of specimens were processed, being moved with a speed of 20 mm/s with respect to the deflected electron beam. The focused electron beam with a spot of 0.5 mm in diameter treated the specimen surface line by line. The electron gun power and the specimen's movement speed were chosen to provide an energy density of 450 J/cm².

As a result of the research, a technology was developed for the deposition of intermediate layers of NiAl with different Al contents. ZrO_2 ceramic coatings and a NiAl binder layer were deposited by electron beam evaporation of the corresponding powders. The aluminum content in the binder layer was 5 to 35%. Before evaporation of the coating and the binder layer, the Ti-6Al-4V alloy substrates were heated by scanning their surface with a defocused electron beam. The heat resistance of coatings deposited on an initial Ti-6Al-4V substrate and on intermediate NiAl layers was studied by thermal cycling tests. Thermal cycling of coated samples was carried out by heating them in a muffle furnace to 1000°C, holding at this temperature for 1 min, and cooling in air.

A Carl Zeiss Axiovert 40 MAT optical microscope, and a LEO EVO 50 scanning electron microscope (SEM) equipped with EBSD and EDS detectors were employed for microstructural characterization of the specimens in the plan-view and cross-section geometries. Specimens for metallographic study were cut both along and perpendicular to the build direction using electrical discharge machining.

Discussion of the results. It was shown that the roughness of the titanium substrate (the elemental composition of which is listed in Table 1) does not significantly affect the structure of YSZ heat-protective coatings, however, it affects the nature of their destruction under thermal loading.

Table 1. The concentration of elements in the titanium substrate, at.%

Al	Ti	V
6.4±0.1	87.3±0.1	4.3±0.1

The thickness of the ZrO_2 coatings of the studied samples deposited on the NiAl transition layer is 100 μm. Upon thermal loading of the composition "ZrO_2 ceramic coating - NiAl bonding layer - Ti-6Al-4V substrate", the alloying elements are redistributed from the sublayer to the coating. The elemental composition for all samples after the destruction of the coating due to thermal loading is presented in tables 2-3. The paper presents several types of samples: I- coating is applied to the original surface of the printed sample; II- coatings on a surface pretreated with an electron beam. The thickness of the ZrO_2 coating remained unchanged. The thickness of the transition layer varied and amounted to 35 and 70 μm (samples marked *). In tables 1,2, the index shows the percentage of Al in Ni.

Table 2. Thickness and elemental composition of the ZrO2 coating deposited on the NiAl transition layer

Sample №	Coating thickness, μm	Element. at.%	
		Zr	O
I_{25}	100	80	20
I^*_{25}	100	75	25
II_{25}	100	72	28
II^*_{25}	100	76	24
II_{35}	100	83	17
II^*_{35}	100	75	25

**Table 3. The thickness and elemental composition
of the NiAl sublayer deposited on a titanium substrate**

Sample №	Sublayer thickness, μm	Element. at.%			
		Zr	O	Al	Ni
I_{25}	35	3	29	61	6
I^*_{25}	70	12	21	23	30
II_{25}	35	12	15	12	45
II^*_{25}	70	6	36	43	53
II_{35}	35	13	17	12	22
II^*_{35}	70	3	23	37	35

As can be seen from fig. 1, the YSZ coating deposited on a 3D-printed substrate, characterized by high roughness, periodically cracks and chips. It was found that during thermal cycling (heating to a temperature of 1000°C and subsequent cooling to room temperature) in the ZrO_2 coatings deposited on a pre-polished substrate, individual cone-shaped fragments of the coating are extruded (Figure 1). As a result, round defects with a diameter of 30-50 μm are formed on the surface of the coating, which makes it substantially coarser. In addition, from the very beginning of loading, cracks originating on the free surface of the YSZ coating propagate rapidly to its interface with the intermediate NiAl layer, pass through it to the next interface with the titanium substrate. At the moment when the crack reaches the titanium substrate, tensile stresses relax in the adjacent coating region. Moreover, near each crack, a concentration of shear stresses occurs at the coating-substrate interface, and internal bending moment and stresses normal to the interface occur.

The latter tend to peel off the coating, i.e., cause deviation of cracks along the interface. The latter is also contributed to by the high fracture toughness of the titanium substrate, which prevents the penetration of cracks propagating through the coating. Moreover, the radius of local curvature of the hills and depressions on the surface of 3D-printed samples is large enough, and, therefore, the existing wave-like interface does not affect the rapid propagation of cracks along the interface and subsequent cleavage of coating fragments. Finally, intense dislocation glide in a loaded titanium substrate also contributes to the unhindered propagation of the crack along the interface, since the exit of dislocations to the coating – substrate interface leads to local irregularities that weaken the bonds between them. As a result, the composition and thickness of the intermediate layer does not affect the thermal stability of the coating and it is destroyed after 20 loading cycles.
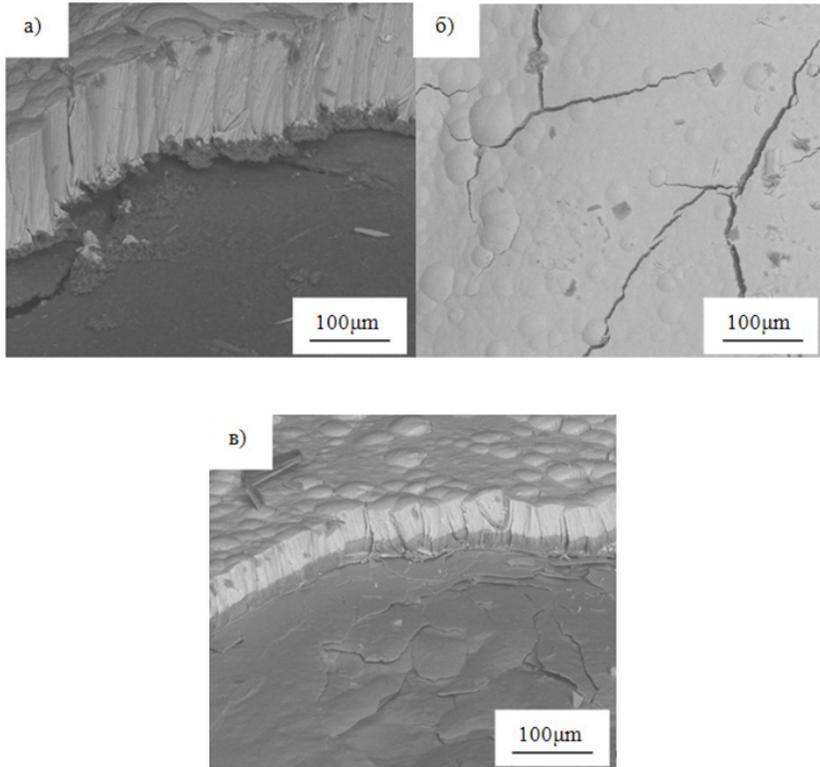
Figure 1. SEM-images of coating on the original surface after 20 cycles. The thickness of the transition layer is 35 (a) and 70 (b, c) μm. Al content in Ni is 25%

The grooved relief formed by the electron beam on the surface of 3D-printed Ti-6Al-4V samples causes the formation of small protrusions and depressions not only at the coating-substrate interface, but also on the coating surface. The depressions, characterized by a small radius of curvature of the coating surface, are the nuclei of cracks developing in the coatings under thermal loading.
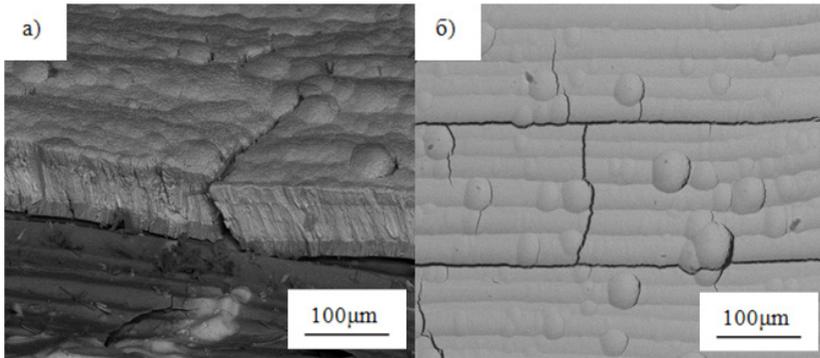
Figure 2. SEM-images of coatings on a surface pre-treated with an electron beam after 126 and 150 cycles, respectively. The thickness of the transition layer is 35 (a) and 70 (b) μm. Al content in Ni is 25%

Shallow cracking effectively relaxes tensile stresses in ceramic coatings and, accordingly, reduces the concentration of shear stresses at the coating-intermediate layer interface. In turn, the fine roughness of the interface prevents the crack from deflecting along the interface, and, therefore, does not lead to cleavage of the coatings. During thermal cycling of coatings deposited on an intermediate layer of NiAl, redistribution of alloying elements from the sublayer to the coating occurs and a layer enriched with Ni is formed (See Table 2). It should be noted that cracks do not propagate through the entire thickness of the coating.

With an increase in the percentage of Al in the intermediate layer to 35% and the layer thickness to 70 μm, a significant increase in the thermocyclic resistance of the composition occurs. Thermocyclic tests of coatings of these samples showed that even after 150 heating – cooling cycles, no changes in the microstructure of ZrO_2 coatings, their cracking, or chipping, were observed.
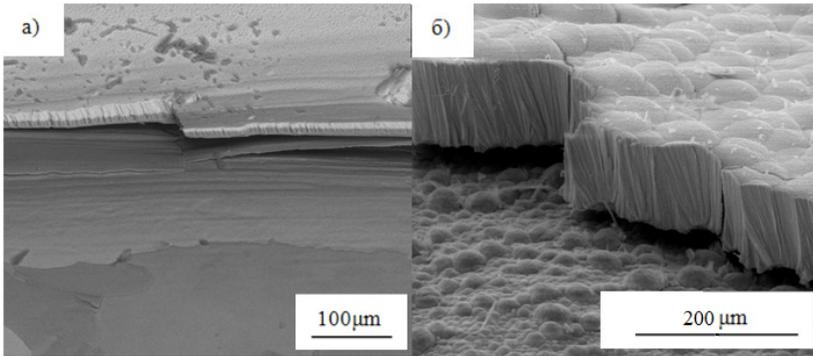
**Figure 3. SEM-images of coatings on a surface pretreated
with an electron beam after 180 (a) and 230 (b) cycles.
The thickness of the transition layer is 35 (a) and 70 (b) µm.
Al content in Ni is 35%**

The main reason for the increase in the thermal stability of ZrO_2 coatings deposited on the NiAl binder sublayer is the formation of a dense film of thermally grown alumina on the surface of the sublayer, which prevents the diffusion of oxygen to the underlying titanium substrate. The latter prevents the oxidation of the substrate and, therefore, promotes high adhesion. As a result, the destruction of the coating occurs after more than 230 loading cycles.

Conclusion. The heat resistance of coatings deposited on an initial Ti-6Al-4V substrate and on NiAl intermediate layers was investigated by thermal cycling tests and also by long-term thermal annealing. Thermal cycling of coated samples was carried out by heating them in a muffle furnace to 1000°C, holding at this temperature for 1 min, and cooling in air. Using the methods of scanning electron microscopy and X-ray diffraction analysis, the influence of the substrate temperature on the structure and phase composition of the intermediate NiAl layer and the ZrO_2 ceramic coating was studied. It was shown that the deposition of intermediate layers of NiAl suppresses cracking and chipping of ZrO_2 ceramic coatings during thermal loading. Based on the results obtained, the optimal Al and Ni contents in the NiAl binder layer and its thickness were selected, which ensure the maximum number of cycles until the destruction of ZrO_2 ceramic coatings during their thermal cycling. The effect of the roughness of a substrate of a 3D-printed titanium alloy Ti-6Al-4V on the cracking and warping behavior of ZrO_2 coatings deposited on an intermediate NiAl layer during thermal cycling was studied. The results obtained will make it possible to make practical recommendations on the creation of heat-protective coatings characterized by maximum thermal resistance.

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METAL PROTECTION

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Abstract. The problem of corrosion and metal protection has become especially acute and urgent in the last three quarters of a century due to the development of industry and construction, the intensification of technological processes and a sharp increase in the amount of molten metal in circulation. It was then that the doctrine of metal corrosion began to take shape in independent science. The great merit in this belongs to the leading Russian scientists V. A. Kistyakovsky, N. A. Izgaryshev, G. V. Akimov, A. N. Frumkin, N. D. Tomoshov, I. J. Rosenfeld, Y. M. Kolotyrkin and others. As the volume of metal smelting increased, its working conditions became more stringent: working temperatures, speeds and pressures increased, and working conditions became more and more diverse. All this negatively affected the safety of metals increased the requirements for their protection. It is estimated that as a result of corrosion, 1 to 1.5% of the metal in circulation is lost annually. The main place in the fight against metal corrosion belongs to paint and varnish coatings, and for its successful application it is necessary to have a complete and clear understanding of the processes and methods of corrosion protection that are under development.

Keywords: metal corrosion, oxidation, passivity, chemisorption, corrosive environment.

Basics of corrosion and protection of metal.
Basic concepts. Definition and classification of corrosion.
Corrosion is the process of the destruction of metals under the chemical or electrochemical effects of the environment. This is a process associ-

ated with the transition of the metal-medium system to a more thermody-namically stable state, so that its flow can be controlled by a change in the Gibbs surface energy. A characteristic feature of corrosion is its heteroge-neous nature. This is caused by the action of liquid or gaseous products on the metal. Ferrous metals are the most common and vulnerable to cor-rosion, but much attention should be paid to the protection of non-ferrous and even rare metals.
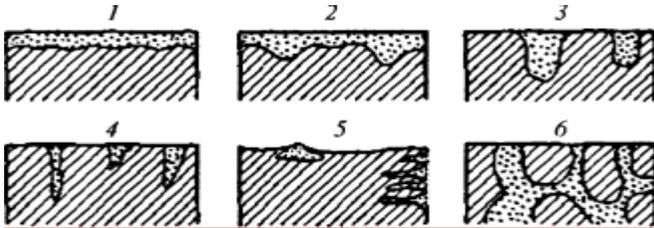
Fig. 1. Types of corrosion (by type of destruction): 1 - uniform; 2 - uneven; 3 - ulcerative; 4 - point; 5 - subsurface; 6 - intergranular

Corrosion is classified according to various criteria: type, flow condi-tions, type of corrosion damage. Depending on the type of ongoing pro-cesses, chemical and electrochemical corrosion are distinguished. The first type of corrosion occurs in non-electrolytes and dry gases and obeys the laws of chemical kinetics of heterogeneous processes. This is not ac-companied by the formation of an electric current. Electrochemical corro-sion occurs in electrolyte solutions and in moist gases and is characterized by the presence of two parallel processes: oxidation and reduction. This type of corrosion is accompanied by the directed movement of electrons in the metal and ions in the electrolyte, that is, the appearance of an electric current [2].

According to the process conditions, which are very diverse, biological, gas, atmospheric, liquid, and soil corrosion are distinguished.

The most harmful is atmospheric corrosion. It proceeds under the influ-ence of oxygen and atmospheric moisture with chemicals dissolved in it.

By to the type of corrosion damage, corrosion is divided into homoge-neous and uneven, ulcerative, pitting (crack), crack, subsurface, intergran-ular (Fig. 1). The first two types of destruction are associated with general or continuous corrosion, the rest with local. With simultaneous exposure to the environment and mechanical stress, corrosion cracking is possible; cracks of transcrystalline nature appear in the metal, which upon germina-tion often lead to complete destruction of the products.

Passivity of metals.

In the normal state, most metals contain oxide films on the surface, which arise as a result of adsorption of oxygen from air:

$$Me + O_2 \longrightarrow Me / 120_{ads}.$$

Adsorbed oxygen can enter into chemical interaction with the metal with the formation of an inactive surface layer, which gives it adsorption passivity. Passivity of metals is a relatively high state of corrosion resistance caused by inhibition of the process of anodic electrochemical corrosion. This condition is characterized by: 1) a sharp decrease in the corrosion rate, which is usually constant in time, and 2) a significant change in the metal potential in the positive direction, for example, for iron from -0.2 to + 1.0 V, for chromium from -0, 4 to +0.9 V

There are a number of theories that explain the passive state of metals: film, adsorption, kinetics, electronic configurations.

The theory of the film explains the passive state of metals by the formation of the thinnest film of the protective phase (approximately 10-10-10-8 μm). This is a continuous film of a colorless glassy oxide, characterized by good electronic ionic conductivity, but poor(характеризующаяся хорошей электронной ионной проводимостью, но плохой.).

According to the theory of adsorption, a passive state is achieved due to the formation on the metal surface of a layer of adsorbed oxygen with a thickness of 5-10 nm. Adsorbed oxygen saturates the valencies of the most active surface metal atoms and reduces their surface energy. The change in surface energy when the adsorbed monolayer is completely coated is 3.8 • 10-12 erg per electron, which corresponds to 2.37 eV.

Kinetic theory associates the phenomenon of passivity with the difficulties of the process of dissolution of the anode metal due to the formation of a stable solid metal-oxygen solution in the surface layer.

According to the theory of electronic configurations, the appearance of a passive state is the result of a shortage of electrons in the inner layers of metals with unfilled d-levels. The deficit arises due to the chemical adsorption of oxygen or another oxidizing agent, which is accompanied by the absorption of electrons, a decrease in its density in the surface layers of the metal. It was established that the ability of the oxide layer to passivate metals depends on its semiconductor properties.

These passivity theories are applicable to crystalline metals. At present, metals have been obtained, including iron, which has an amorphous structure, the passivity of which is much higher than that of crystalline lenses.

A passive layer is created on ferrous metals mainly due to Fe2O3, Fe3O4 and FeO • OH oxides. Only solid oxide layers can have protective

properties. The condition for continuity is an excess volume of oxide. Consider the volume of metallic Me from which it is obtained. Most polyvalent metals are passivated if the following condition is satisfied for them:

$$2,5 > V_{ox}/V_{Me} > 1.$$

For alkali and alkaline earth metals, with the exception of beryllium, this condition is not fulfilled and passivation does not occur. Metals can enter the passive state not only as a result of interaction with atmospheric oxygen, but also with activated adsorption (chemisorption) of ions, mainly anions, such as NO_3^-, NO_2^-, CrO_4^{2-}, WO_4^{2-}, as well as when electric current is supplied to the metal in an electrolytic medium.

Passivity has a decisive influence on the corrosive behavior of metals. It is enough to indicate that the high corrosion resistance of some metals, such as titanium, is due solely to their passivity. Most metals capable of self-passivation are well preserved in an atmosphere with low humidity (sometimes up to 40-70%). Corrosion occurs only when the balance is disturbed and the phase or chemical composition of the passive layer changes.

Chemical corrosion of metals

Chemical corrosion is a spontaneous interaction of a metal with an aggressive environment, during which the metal is oxidized and the oxidative component of the aggressive environment is restored. Like any chemical reaction, this type of corrosion is temporary. Dry gases (O_2, CO_2, SO_2, HCl, nitrogen oxides, etc.), Superheated steam, liquids that are not electrolytes, as well as products from organic and inorganic substances, including metals, can be corrosive oxidants (agents). [2].

Of the varieties of chemical corrosion, gas corrosion has been widely studied. Its mechanism is reduced to the growth of oxide films on the surface of a metal. There are several stages that occur sequentially and in parallel. For example, in the case of divalent metal, the lubrication steps are:

1) ionization of a metal and the transition of its ions and electrons from the metal phase to oxide:

$$Me \longrightarrow Me^{2+} + 2e;$$

2) movement of Me^{2+} ions and electrons in the oxide layer;
3) oxygen adsorption on the surface of a passive oxide layer:

$$MeO + O_2 \ MeO \ 120_{zdl};$$

4) ionization of adsorbed oxygen and the movement of formed ions in the oxide layer:

$$O + 2e \rightarrow O^{2-} ;$$
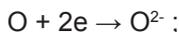
5) oxide layer growth:

$$Me^{2+} + O^{2-} \rightarrow MeO.$$
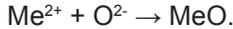
The oxide growth rate is limited by the diffusion rate of the components that react in the layer, and the process is automatic braking. The latter is explained by an increase in the thickness of the diffusion layer and a lower permeability of the upper oxides formed during oxidation, compared with the lower ones.

If a metal forms several stable compounds with an oxidizing component of the medium, multilayer oxide films with a blurred boundary between the layers are obtained. A lower degree of oxidation naturally occurs in layers directly adjacent to the metal. In general, the oxide layer can be considered as a set of layers of metal compounds arranged in series.

For instance:

for iron Fe I FeO I Fe304 I Fe203 I 02

for manganese Mn I MnO I Mn304 I Mn203 I 02

Different metals have different resistance to chemical corrosion; The composition of the medium also has a great influence (Fig. 2).

Chromium is very resistant to many environments, including oxidation; on the contrary, the chemical resistance of iron at high temperatures (800°C and more) is low. The corrosion rate constant, like any reaction, is determined by the Arrhenius equation:

$$K = Ae^{-E/RT}$$

where E - the activation energy (heat) of the chemical reaction.

Chemical corrosion products (inlays and other compounds) are very fragile and prone to cracking due to internal stresses (mainly thermal). In the process of metal destruction during chemical corrosion, the formation of gas bubbles in the oxidized layer and near the metal layer is also observed [1].
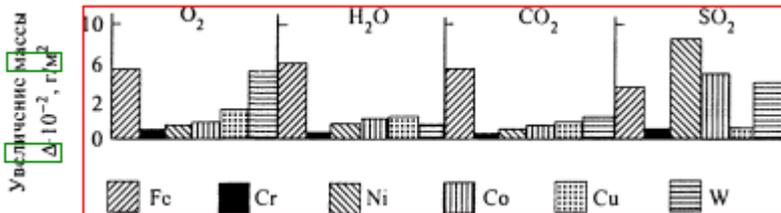

Fig. 2. The composition of the medium and the increase in mass

The protection of metals from chemical corrosion consists mainly of their alloy with the addition of elements that are more resistant to oxidation. Doping protection is based on the formation of compounds:

a) with a small defect in the crystal network, which has low diffusion coefficients with respect to the corrosive agent;

b) with a crystalline network of spinels (in the form of double oxides) with improved chemical resistance.

The most effective alloying additives that provide iron with heat resistance are chromium, titanium, molybdenum, tungsten, aluminum, tantalum, niobium. Thanks to its use, corrosion-resistant steels were created for jet aircraft, missiles, nuclear equipment and others.

Chemical corrosion in metals can be observed not only in dry gases. Studies show that chemical corrosion of metals also occurs in liquid media (for example, in non-electrolytes and liquid metals). The process of chemical corrosion of metals in non-electrolytes is also divided into several stages, and each stage determines the speed of the process:

1) diffusion of the oxidizing agent to the metal surface

2) chemisorption of reacting particles on a metal

3) chemical reaction of an oxidizing agent with a metal

4) the process of desorption of reaction products with a metal surface

5) diffusion of reaction products from metal into the volume of non-electrolyte.

$$k = Ae^{-Q/RT}$$

where k – chemical reaction rate constant, A – constant, Q – chemical activation energy, T – absolute temperature.

According to this formula, we can see that temperature always affects the speed of the process, but this is not always the case. Complications arise (a change in the solubility of the oxidizing agent and the film of metal corrosion products in non-electrolyte) with a change in temperature [2].

Based on the foregoing, we will carry out laboratory work on the oxidation of steel.

The aim of this work will be to apply a preliminary anti-corrosion coating of dense oxide Fe_3O_4 films and to apply the last layer of alkyd varnish. The oxide film betrays not only the anticorrosive properties for metal but also a decorative look.

Protective by oxidation, phosphating, metal coating can be done by anodizing, electrochemical staining (contact deposition of metal), galvanic method, etc. Chemical oxidation of ferrous metals can be carried out in alkaline and acidic solutions. The most widespread are alkaline solutions in which the oxidation process proceeds stably and a uniform film with good adhesion is formed. The color of the coating depends on the composition of the metal. On carbon and low-alloy steels of dark gray, black coatings

are formed, on alloy steels on brown cast iron. The main component of alkaline oxidation solutions is sodium hydroxide, oxidizing agents nitrates and nitrites. The process is carried out at a boiling point of 135-145 □. Different grades of steel, oxidize at different temperatures.

We take a metal plate of 0.8 kp steel, clean our metal with an emery cloth. Then degrease it. For our case, we take acetone and white spirit for degreasing. Next, carefully brush it with a brush, clean it with a soap (alkaline) solution for final processing, cleaning. Then we wash the metal with hot water.

For metal oxidation we take:

1) Sulfuric acid H_2SO_4
2) Urea
3) Citric acid

Since we have a small metal plate, we take our solution in such quantity so to completely cover the metal:

1) 1000ml – 50ml $\quad\quad\quad$ x=7,5ml $\quad\quad\quad$ (Sulfuric acid H_2SO_4)
$\quad\quad$ 150 – x
2) 1000ml – 2gr $\quad\quad\quad$ x=0,3gr $\quad\quad\quad$ (Urea CH_4N_2S)
150 – x
3) 1000ml – 100gr $\quad\quad\quad$ x=15gr $\quad\quad\quad\quad\quad$ (Citric acid)

If the metal is too polluted (greasy, dirty, there are upper light layers of rust), then before oxidizing we clean the metal with:

1) caustic soda or potassium hydroxide - 10-20 g., soda ash-50 g. liquid glass - 5-15 g. distilled water - 1000 ml, solution temperature - 70-80°C3 or

2) caustic soda or caustic potassium 50 g. soda ash -30g. sodium phosphate 30 g. liquid glass or soap (only for chemical degreasing) 5 g. distilled water 1000 ml. solution temperature - 70-80°C.

Simple anticorrosion coatings of metals include oxidation of steel and aluminum, steel burnishing and phosphating, electrochemical coloring of steel and copper, chemical coloring of copper and brass, and anodizing of aluminum.

After oxidation, the metal is washed with hot water and immersed in another solution for oxidation in black color:

1) $NaNO_2$ $\quad\quad$ (Sodium nitrite)
2) $NaNO_3$ $\quad\quad$ (Sodium nitrate)
3) NaOH $\quad\quad\quad\quad$ (Sodium hydroxide)

The second stage of oxidation is carried out for 90 minutes at T° = 140. After the process is carried out, the filter paper is dried.

For the final stage, alkyd varnish to the metal using a spiral blade is applied.

Fig. 3. Stripped steel after mechanical cleaning and degreasing

Fig. 4. The oxidation solution

Thus, we proposed a scheme of anticorrosive coating of metal in laboratory conditions.

Conclusion

Corrosion of metals is spontaneous destruction of metal materials under the influence of an electrochemical, chemical process with the environment. In conclusion, I want to say that the study of the properties of paint and varnish coatings and methods of protection against corrosion is still the main problem for the national economy, enterprises, construction and construction of machines and ships, etc. Currently, many methods have been developed to combat corrosion.

When oxidizing steel, it is necessary to take into account which metal is used and how we will oxidize and at what temperature. Oxide films, as mentioned above, betray not only anticorrosion properties but also a decorative look. In the course of work, in the end, we got a metal with a "shiny black color" and with anti-corrosion properties.

In the course of laboratory studies, confirmation was obtained that oxidation helps to significantly slow down the corrosion of metals. With the first solution, we clean the metal surface from oxides and dirt, with the second solution we form a protective film, which not only creates barrier properties, but also gives a decorative look.

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TECHNOLOGY FOR PRODUCING CORROSION-RESISTANT FILLER FOR HIGH-STRENGTH CONCRETE

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Abstract. The article presents the technology for producing a corrosion-resistant filler (CRF) from stone crushing waste (granite screening). The analysis of the qualitative indicators of granite screening, its strength, degree of radioactivity, frost resistance, resistance to aggressive environments is carried out.

Keywords: mortar, concrete, corrosion resistance, frost resistance, filler, stone crushing waste, granite, silicon dioxide, crushed stone.

Kazakhstan has significant raw material resources to saturate the construction market with modern highly effective materials of a wide range of applications. One of the radical directions of increasing the efficiency and quality of the main building material - mortar and concrete - is the wide and scientifically substantiated use of highly effective individual and multicomponent complex chemical additives - modifiers. An analysis of the state of the raw material base of Kazakhstan and industry science shows that the whole range of modern effective modifiers for obtaining building materials of desired properties can be produced directly in the republic from secondary raw materials and industrial wastes. This contributes to the implementation of the state policy of import substitution [1,2].

One of the possible solutions to this urgent problem is the creation of materials based on corrosion-resistant fillers.

When developing a technology for producing a corrosion-resistant filler from waste from the granite screening industry, an analysis of the experience highlighted in the works of V.G. Batrakova, Shintemirov K.S., Yu.M. Bazhenova, G.I. Gorchakova, Sharipova S.M. [3,4,5,6]. In the work of Sharipov S.M. acid-resistant fillers from stone crushing screenings were considered [7].

We have conducted studies on the corrosion-resistant properties of stone crushing waste granite screenings.

Granite screenings - material that is obtained by crushing and sorting granite crushed stone. Crushed stone is processed by the screening method - divided into fractions. Granite screenings are usually gray in color, red and pink material is less common. The size of the fractions varies from 0.1 to 5 mm, but not more. Strength - M1200. The degree of radioactivity in granite screenings is 158 Bq/kg. This material contains no more than 0.3% clay and dust particles. The number of grains of irregular shape is not more than 14.5%. Frost resistance - F400. That is, screenings can withstand up to 300 cycles of complete freezing and thawing. The bulk density of this material is in the range from 1.32 to 1.34 t/m³. To obtain a corrosion-resistant filler, it is necessary to grind to a fraction of 0.5 mm.

In our work, corrosion-resistant fillers from granite stone crushing waste were considered. To obtain finished CRF products, it is necessary to determine the qualitative indicators of screening, the content of clay, dust-like inclusions in its composition. For further study of the qualitative indicators of screening, it is necessary to study the deposit and the quality of granite, since screening has similar characteristics. To obtain a corrosion-resistant filler, a technological scheme was developed, shown in Figure 1.
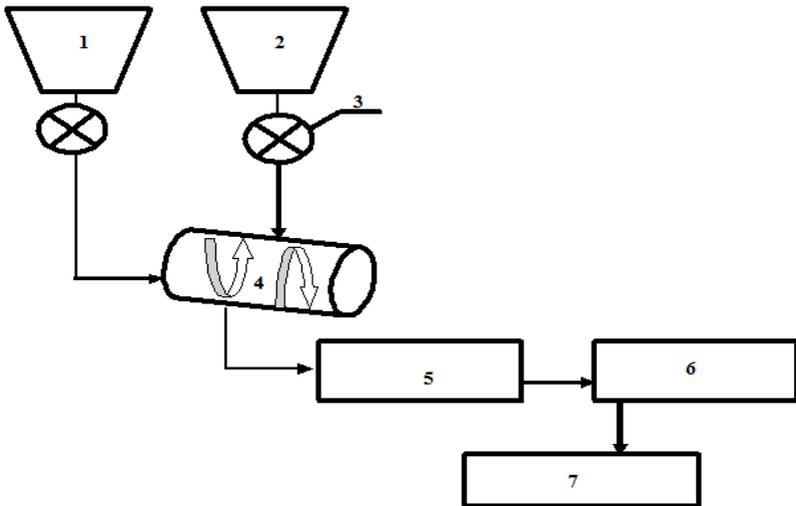
1 - screening of granite; 2 - capacity with water; 3 - dispenser;
4 - inclined rotating sieve for washing screenings from clay;
5 - a drying chamber; 6 - ball mill;
7 - warehouse of finished products.
**Figure 2 - Technological scheme
for obtaining corrosion-resistant filler**

For the production of corrosion-resistant filler, it is necessary to take into account the clay and dust-like content of particles in the granite screenings. This is necessary to determine the amount of water needed for washing it. When preparing CRF, the screening is placed in the hopper (1) and, through the dispenser (3), is sent to an inclined rotating sieve (4), after which water (2) enters the sieve (4) through the dispenser (3), which performs the primary washing. After the initial flush, a final flush is performed. After washing, the water settles for secondary use, then the washed screenings are sent to the drying chamber (5), in the summer, granite can be dried in natural conditions under a cover. After drying, the raw materials are sent to the grinding, where with the help of a ball mill (6) it is ground to a size of 0.8 mm.

The resulting CRF is placed in a finished product warehouse (7), or packed in 50 kg bags, the filler can be in a humid environment without loss of quality indicators.

Qualitative indicators of corrosion-resistant filler are presented in table 1.

Table 1 - Properties of the corrosion-resistant filler of the Balkhash granite deposit after preparation

№	Qualitative indicators, %	Indicator values
1	Corrosion resistance	97,4
2	Mass fraction of silicon dioxide	78
3	Mass fraction of carbonates and free oxides of calcium and magnesium	1
4	Mass fraction of iron	0,5
5	Mass fraction of moisture	2

Table 1 presents the indicator of the corrosion resistance of the mineral 97%, which is a very high indicator, as well as a high content of silicon dioxide - 78% in the structure of the filler. In this connection, CRF has high resistance to aggressive environments, and the structure of the filler from 0.8 mm will allow the filler to be distributed as evenly as possible over the structure of concrete.

In the work, we also studied the properties of high-strength concrete with plasticizing additives and fillers.

In the process of studies on the stability of aggressive media, there is an intensive development of neoplasms in the sample without additives, according to table 2 [8]. The dynamism of the destruction of the concrete structure occurs as a result of the formation of salt compounds, due to which neoplasms are formed.

Table 2– Concrete Properties

Composition	Compressive strength limit, MPa	Brand on water resistance	Water absorption, %
Without additives	45	W9	5
With additives and corrosion resistant filler	89	W16	3,9

Table 3 - Test results of high-strength concrete for resistance to aggressive media

Composition	Compressive strength, MPa				
	28 days	90 days	180 days	270 days	360
Without additives	45	42	38	32	25
With additives and corrosion resistant filler	89	89	88	85	81

According to studies, the test results of the samples showed the effectiveness of using high-strength concrete based on a complex of additives of modifiers and fillers.

Samples without additives, subject to constant exposure to natural aggressive environments, significantly lose strength by 270 days, by 360 days the dynamics of loss of strength continues to grow, which confirms the need for new technologies for products operating in water-saturated and aggressive environments.

We also conducted studies of the depth of corrosion of high-strength concrete in a solution of sulfuric acid, presented in table 4.

Table 4 - Corrosion Depth of High-Strength Concrete in Sulfuric Acid

Composition	The depth of destruction of concrete in solutions of sulfuric acid		
	Brand on water resistance	pH	Depth of destruction (cm), in 60 days
With additives and corrosion resistant filler	W16	2,0	0,44

Thus, in the production of high-strength concrete, the main source of negative impact is an aggressive environment. High-strength concrete with the use of corrosion-resistant filler can reduce the undesirable effects of aggressive environments and increase the life of the structure.

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THE EFFECT OF DISPERSION ON THE PROPERTIES OF CEMENT STONE UNDER VARIOUS HARDENING CONDITIONS

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Abstract. The article considers the quality indicators of cement stone, physico-mechanical and strength characteristics with the use of dispersion during heat-moisture treatment (HMT) and without it. The article also presents a microstructural analysis of different compositions under different hardening conditions.

Keywords: heat and moisture treatment, cement, dispersion, high-strength concrete, polymer component, S-3 superplasticizer.

Prospects for the development of the construction industry of Kazakhstan determine the feasibility of producing highly effective mortar and concrete. The use of high-strength concrete products is gaining tremendous growth. The use of high-strength concrete, of course, is a priority, since it covers the most important construction and technical characteristics [1].

To obtain high-quality concrete, the main indicator is the active components. We considered the qualitative indicators of the dispersion of the polymer components of PVC, plasticizer S-3 and silica fume MK.

In order to determine the effectiveness of the dispersion, studies were conducted on compressive strength and bending, frost resistance - alternate freezing and thawing, as well as wetting and drying [2,3]. The tests were carried out on samples from a dispersion of PVC, C-3 and MK with HMT and samples after 28 days of normal hardening (table 1).

Table 1 - Physico-mechanical characteristics and dispersion under normal hardening conditions and with HMT

Hardening conditions	C/M	Bending Strength, MPa	Compressive strength, MPa
HMT	0,23	14.6	110
Regular hardening conditions	0,23	9,7	61

According to the results of the studies presented in table 1, we can conclude that the use of dispersion has high quality indicators only with HMT, since the process of accelerated hardening of cement binder can significantly increase the quality characteristics of the material.

The effectiveness of the integrated use of dispersion modifiers with a cement binder in HMT is justified, since the strength characteristics of the dispersion are higher than the usual combination of components. The results of the study are presented in table 2.

Table 2 - Strength of cement stone in various hardening conditions

Tests	Composition and conditions of hardening			
	Dispersion in HMT 2% C-3 + 1% PVC + 10% MK	Dispersion in vivo 2% C-3 + 1% PVC + 10% MK	2% C-3 + 1% PVC + 10% MK for HMT	2% C-3 + 1% PVC + 10% MK in vivo
1 C/M	0,23	0,23	0,3	0,3
2 Humidification and drying	88/80%	44/72%	79/74%	85/76%
3 Freezing and thawing	99/90%	50/82%	85,8/80%	89/80%

According to the results shown in table 2, the highest quality indicator is represented by the composition of the dispersion after application of HMT. The loss of strength during freezing and thawing was 10%, and during wetting and drying was 20%. In this study, the results are highest. High strength indicators of control measurement are presented in samples C-3, PVC and MK, gaining strength of 28 days under natural hardening conditions, and manufactured by the classical method. The strength was 112 MPa. However, in the process of exposure to freezing and thawing, the loss of strength was 20%, and when moistened and dried, 24%. The smallest result of the control measurement showed the dispersion composition, hardened in vivo, which amounted to 61 MPa, which is 44% lower than the sample dispersion composition at HMT.

Thus, based on the results of the research, the most optimal for high-strength concrete and products made in the factory with HMT is the technology of dispersing cement binder, S-3, PVC and MK. However, the application of binder dispersion technology and modifiers is not effective for concrete hardening under normal conditions.

In the work, a quantitative analysis of cement stone with the modifiers C-3, PVC, MK, presented in table 3 was carried out.

**Table 3 - The results of the quantitative analysis
of cement stone with modifiers S-3, PVC, MK.**

Element	Atoms, %	Compound	Weight, %	Error, (±)	Norm, %
Mg	0.79	MgO	1.27	0.11	1.27
Al	2.20	Al_2O_3	2.69	0.19	2.69
Si	10.42	SiO_2	40.01	0.45	40.01
S	0.66	SO	1.26	0.16	1.26
K	0.36	K_2O	0.67	0.19	0.67
Ca	28.85	CaO	51.41	1.07	51.41
Fe	0.84	Fe_2O_3	2.69	0.52	2.69

From the results of quantitative analysis, an increase in the percentage of SiO_2, which entered into the MK reaction, providing an increase in concrete strength, was established [4,5].

Also, microstructural analysis was carried out in which the following were presented:

- microstructure dispersion of cement binder C-3 + PVC + MK high-strength concrete at HMT;

- microstructure dispersion of cement binder C-3 + PVC + MK high-strength concrete in natural hardening conditions;

- microstructure of cement stone with additives C-3, PVC, MK high-strength concrete in natural hardening conditions;

- microstructure of cement stone with additives C-3, PVC, MK high-strength concrete at HMT.

The results are presented in figures 1,2,3,4, in the form of micrographs.
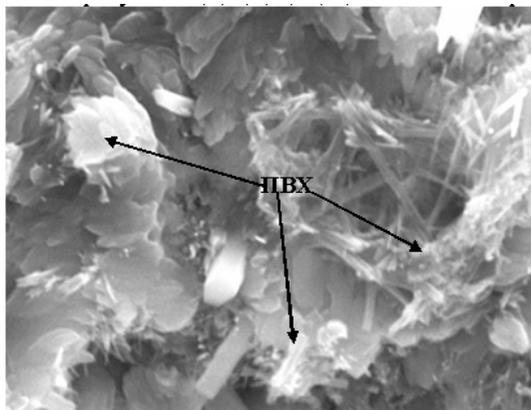
S-3 + PVC + MK high-strength concrete at HMT, magnification × 5000
Figure 1 - Microstructure 1 dispersion of cement binder

In Figure 1, we see a uniform distribution of the polymer component in the structure of cement stone, which confirms the results of studies on the dispersion efficiency in HMT.
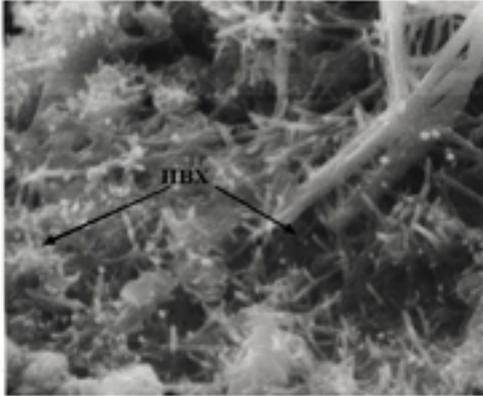
S-3 + PVC + MK high-strength concrete in vivo hardening,
magnification × 5000
Figure 2 - Microstructure 2 dispersion of cement binder

The microstructure of the dispersion of cement binder S-3, PVC, MK high-strength concrete under natural hardening conditions at the age of 28 days is shown in Figure 2. The indicated microstructure shows a change in the uniform distribution of the polymer component.
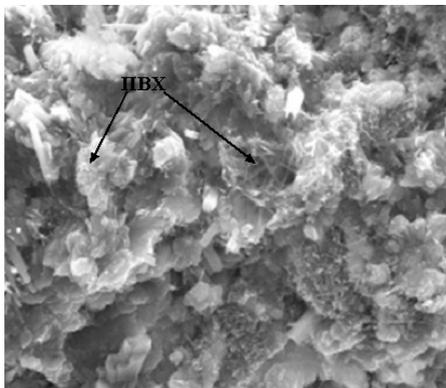
Figure 3 - The microstructure of cement stone with additives C-3, PVC, MK high-strength concrete in natural hardening conditions, magnification × 5000

The microstructure shown in Figure 3 reflects the distribution of the polymer component over the entire structure of the cement stone.
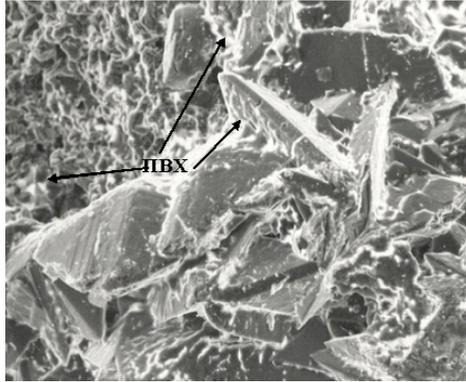
Figure 4 - The microstructure of cement stone with the addition of C-3, PVC, MK high-strength concrete with HMT, magnification × 5000

In Figure 4, the microstructure of the cement stone reflects the mono-lithic nature of the cement stone and the polymer component.

Thus, the studies of the properties of cement stone by dispersing the cement binder S-3, PVC, MK under HMT and under normal conditions of hardening showed that obtaining high-strength concrete by dispersion is possible only with HMT.

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PROTECTIVE CLOTHING TEXTILE MATERIALS AND WORKWEAR DATABASE STRUCTURE DEVELOPMENT

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Abstract. A large amount of information is processed during the work wear and protective clothing manufacturing. The digital database creating and application will improve efficiency of the pre- production processes. The article describe structure of database of the textile materials for work wear and protective clothing, based on classification by purpose

Keywords: special and protective clothing, material, database, data model, structure, table.

Personal protective equipment is currently in steady demand. With an increase in the consumption of special and protective clothing, the range of materials used is expanding. New properties materials are being created with various types of coatings and production methods [1-3].

A large amount of numerical and informational data is collected, accumulated, measured, processed, and transmitted during the process of protective and special clothing's designing, developing and manufacturing [4-7]. Important design tasks are: the study of materials' properties, configuring and selecting materials, taking into account the range of materials available, and a description of their characteristics. Creating an information database (DB) will reduce the complexity of new models preparation for launch into production, increase the efficiency of access to information, and provide users with the opportunity to work with well-organized and structured data [8-9]. The authors developed a data structure for special and protective clothing materials.

Data organization is a key aspect when dealing with large amounts of information. The data should be organized in such a way to make it possible to find the necessary information quickly and easily. A large role in the organization of databases is played by the generalized presentation of data at a conceptual level [10]. Using the conceptual model, it is described what data is stored in the database, and links between them are established.

Models for describing the data and the relationships between them can be: semantic, relational, network, hierarchical. Currently, most databases are relational, i.e. presented as a set of relational tables. Such tables must meet the following requirements: each table element represents a single value; all columns of the table are homogeneous (i.e. all elements of the column represent the data of the same type); columns are uniquely named; there are no duplicate lines; lines and columns can be viewed in any desired order [10-12].

Based on the analysis of materials for special and protective clothing standards and the range of materials offered by Russian and foreign manufacturers, several materials groups were selected according to their purpose. Table 1 presents the groups of materials of the clothing's upper layer.

Table 1 – Groups of materials of the clothing's upper layer according to their purpose

№	Purpose Groups
1	From mechanical stress
2	From high temperatures
3	From low temperatures
4	From radioactive contamination and x-rays
5	From electric current, electrostatic charges and fields, electric and electromagnetic fields
6	From non-toxic dust
7	From toxic substances
8	From water and solutions of non-toxic substances
9	From acid solutions
10	From alkalis
11	From organic solvents, including varnishes and paints based on them
12	From oil, oil products, oils and fats
13	From total industrial pollution
14	From harmful biological factors

Subgroups of materials are identified in each destination group, each of them is given a symbol (in accordance with the purpose), the name (article) of the material, information about the manufacturer, fiber composition, surface density, type of protective coating (if any), the characteristics of materials in accordance with the standards' requirements. Figure 1 shows a fragment of a table with data on materials.

7	Destination groups	Subgroup name	Designation for special clothes	Name of material	Manufacturer	Composition	Surface density, g/m²	Cover	Characteristics and additional information
8	1	2	3	4	5	6	7	8	9
	From mechanical stress	cuts and abrasions	Mn	ФАС	Russia	100% cotton	350	-	For protection against general industrial pollution and mechanical influences

**Figure 1 - fragment of a table with data on materials
for special and protective clothes**

На рисунке 2 представлен фрагмент схемы данных, демонстрирующей связи между таблицами. Связь между таблицами осуществляется через ключевое поле – «Код материала». В БД по материалам выделяется четыре таблицы данных: группы назначения, вид материала, условное обозначение материалов в соответствие с назначением, информация о производителях.

To organize the database, use the Microsoft Access database management system (DBMS) is suggested. It supports the relational model of data presentation and has the ability to import and export data in various formats, including Excel tables and text files [13].

Figure 2 shows a fragment of a data schema demonstrating relationships between tables. The relationship between the tables is carried out through the key field - "Material Code". Four data tables are distinguished in the database: destination groups, type of material, symbol of materials in accordance with the purpose, information on manufacturers.
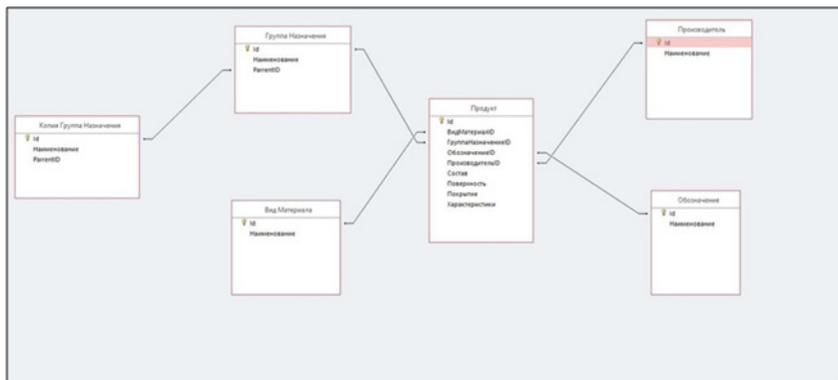
Figure 2 – The screen form of the relationships between tables structure

Thus, based on the analysis of information on the materials of each destination group, a structure of information on the materials used for the manufacture of protective and special clothing was developed. Creating a database will help to reduce the time it takes to search, process information about materials in the production of special and protective clothing. With the advent of new materials, it is possible to add information about them to the database. In the future, it is possible to add new tables related to material accounting.

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SPELT PASTA WITH VEGETABLE POWDERS

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Abstract. The results of research on the development of recipes and technology for pasta from whole-wheat flour with the addition of whole-grain buckwheat flour and vegetable powders of low-temperature drying are presented. The purpose of the work is to create an enriched product for dietary prophylactic and dietary therapeutic nutrition of individuals with excess weight. Prototypes of pasta were developed on the laboratory pasta press Sandore (model Sandorina) (Italy). According to organoleptic, physico-chemical quality indicators, cooking properties, the obtained pasta meets the requirements of the current regulatory documentation. Unconventional recipe components did not adversely affect the quality indicators of finished pasta and their condition after cooking. The use of non-traditional raw materials in the pasta dough recipe enriches the product with protein, dietary fiber, vitamins, minerals, reduces calorie content, does not require changes in the process parameters or equipment replacement. The production of pasta from spelt flour with the addition of buckwheat flour, vegetable powders expands the range of dietary therapeutic and preventive nutritional products.

Keywords: pasta, calorie content, spelt, vegetable powders, quality indicators.

Introduction

Pasta is in great demand among the population of many countries, therefore it is promising as an object for making enriching additives and using non-traditional raw materials. Research in this direction is being conducted both in Russia [1-6] and in many other countries [7-10]. The expansion of the raw material base for pasta production contributes to an increase in nutritional value, a decrease in calorie content, and an expansion of the assortment of dietary therapeutic and preventive nutritional foods for various population groups [1-6].

Russian pasta enterprises use mainly baking flour in production due to the insufficient amount of special pasta flour, which is obtained from durum wheat varieties. Pasta made from baking flour has a high calorie content and low nutritional value. Therefore, bakery flour for pasta production is enriched with all kinds of additives [2-6]. Optimization of the quantitative and qualitative composition of pasta test recipes for the content of proteins, fats, carbohydrates, vitamins, minerals, as well as a reasonable reduction in calorie content is one of the ways to normalize weight [5, 6].

In our work, when compiling pasta recipes, we solved the problem of reducing calorie content and increasing the content of dietary fiber, vitamins and minerals. Previously published works present the results of studies on the development of pasta recipes using spelt flour and vegetable components [2-5]. Spelt is a low-calorie cereal superior to wheat in terms of protein, unsaturated fatty acids, dietary fiber, B vitamins, and iron [4, 5]. Spelt is recommended in diets for overweight and obesity - a fairly common problem today, as it contains substances that normalize fat metabolism [4, 5]. Buckwheat flour is characterized by a high degree of protein balance, a high content of vitamins, fiber [6, 8]. The inclusion of buckwheat flour in the recipe will enrich the product with vegetable protein, vitamins, essential amino acids, and minerals [6, 8]. Broccoli and celery, like all vegetables, are rich in fiber, pectins, vitamins, minerals, organic acids, natural dyes, and various biologically active substances [2, 3, 5]. Adding vegetable components to pasta dough strengthens its structure, reduces adhesion, improves technological characteristics, facilitates the process of pasta production, improves quality indicators of finished products: appearance, surface condition, color [2, 3, 5]. And, importantly, it gives the finished pasta functional properties.

The use of non-traditional raw materials in pasta production changes the properties of dough and finished pasta. Therefore, when developing new formulations, a complex of studies is carried out.

Research purpose

Development of recipes and technology for pasta from whole grain spelt flour with quality indicators that meet the requirements of current regulatory documents.

Research objectives

Determination of the optimal pasta recipe in accordance with the requirements of organoleptic and physico-chemical quality indicators. The study of cooking properties.

Materials and methods

The objects of research were: whole grain spelt flour, whole grain buckwheat flour, vegetable powders (broccoli, celery), soy fiber, egg powder, semi-finished pasta dough, boiled pasta.

Results and discussion

The studies were carried out in the laboratories of the Research Institute of Food Concentrate Industry and Special Food Technology - Branch of the "Scientific Research Institute of Nutrition" and Biotechnology and the Center for Food Rheology of the Research Institute of the Baking Industry. For research, laboratory samples were made with different percentages of the recipe components of pasta dough on a Sandore laboratory pasta press (Sandorina model) (Italy). Traditional pasta recipe was taken as a base for new ones. Based on the results of laboratory tests, four spelt pasta recipes were developed (Table 1).

Table 1
Composition of pasta from spelt

Product	Composition
Sample 1	Whole grain spelt flour, soy fiber, egg powder
Sample 2	Whole-grain spelt flour, whole-grain buckwheat flour, soy fiber, egg powder
Sample 3	Whole grain spelt flour, soy fiber, egg powder, broccoli powder
Sample 4	Whole grain spelt flour, soy fiber, egg powder, celery powder

When passing through the matrix, the semi-finished product did not stick to the tool and equipment, had a uniform color, retained its shape, did not crumble. During cutting and layout, it was plastic, which is associated with the total amount of protein, pectin, and fiber in the formulation components, which have a high water absorption capacity, which was also noted in [2, 3, 5, 6, 9]. Plasticity is important when choosing drying modes [2, 3, 5-10].

During cooking, pasta partially discolored, which was more noticeable in samples 3 and 4, which had a more pronounced greenish tint in dry form. Samples 1 and 2 after cooking slightly changed the intensity of a light brown hue. The appearance of boiled pasta is presented in the figure.

Figure. Appearance of boiled pasta

All samples did not stick together after cooking; the shape preservation for all samples was 100%. Loss of solids was in the range of 2.1-3.3%, which meets the requirements of regulatory documentation of no more than 6%. The coefficients of the increase in volume after cooking had the following values: sample 1 - 1.97; sample 2 - 1.98; sample 3 - 1.99; Sample 4 - 2.07. Pasta should have a coefficient value in the range of 1.5-2.5 [4, 6]. The obtained values of the coefficient of increase in volume correspond to the specified range of values.

The results of studies of organoleptic, physico-chemical indicators and cooking properties of the samples are presented in table 2.

Table 2

Organoleptic and physico-chemical quality indicators of developed pasta

Indicators	Researched Samples			
	Sample 1	Sample 3	Sample 3	Sample 4
Colour	shadeless with a cream tint, no traces of heterogeneity		shadeless with a greenish tint, no traces of heterogeneity	
Surface condition	smooth, without roughness			
Break	mealy			
Shape	appropriate to the type of product			
Taste	characteristic of this product, with a peculiar pleasant aftertaste of the components used			
Smell	characteristic of this product, with a light peculiar smell that does not spoil the products			
Condition of products after cooking	do not stick together			
Shape preservation,%	100			
Dry matter transferred to cooking water,%	2,1	2,5	3,2	3,3

All the studied samples had a powdery break, which can be explained by the absence of a vacuum operation in a laboratory pasta press. Under production conditions, using a pasta press with vacuum, this drawback is eliminated.

The complex of physico-chemical studies showed that the developed pasta meets the requirements of the current regulatory documentation.

Conclusion

The studies proved the possibility of producing in accordance to the proposed formulations with the required quality, corresponding to the regulatory documentation. The use of non-traditional raw materials did not adversely affect the quality indicators of finished products and the state after cooking. The use of non-traditional raw materials in pasta production enriches pasta with protein, nutrients, vitamins, minerals, and expands the range of dietary prophylactic and dietary therapeutic nutrition products.

Acknowledgments

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A STUDY OF THE ALUMINA DISTRIBUTION
IN THE LAB-SCALE CELL DURING ALUMINUM ELECTROLYSIS

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Abstract. The aluminum electrolysis process in the conventional cryolite-alumina electrolyte with cryolite ratio of 2.7 was carried out at an initial temperature of 970 °C and the anode current density of 0.5 A/cm^2 in a 15A lab-scale cell in order to study the formation of the side ledge during electrolysis and the alumina distribution between electrolyte and side ledge. The alumina contained 35.97% α-phase and 64.03% γ-phase with the particles size in the range of 10-120 μm. The cryolite ratio and the alumina concentration were determined in molten electrolyte during electrolysis and in frozen bath after electrolysis. The side ledge in the electrolysis cell was formed only by the 13th hour of electrolysis. With a slight temperature decrease a significant increase in the side ledge thickness was observed. The basic components of the side ledge obtained by the XRD phase analysis were Na_3AlF_6, $Na_5Al_3F_{14}$, Al_2O_3, and $NaF\cdot5CaF_2\cdot AlF_3$. As in the industrial cell, the increased alumina concentration in the side ledge formed on the cell walls and at the ledge-electrolyte-aluminum three-phase boundary during aluminum electrolysis in the lab cell was found.

Key words: aluminum electrolyzer, cryolite-alumina electrolyte, alumina, alumina distribution, side ledge, cryolite ratio

Introduction

Global trends in development of the aluminum industry in the direction of creating powerful high-ampere electrolytic cells, the advantages of which are undeniable, require novel solutions for organizing more energy-efficient and resource-saving technology [1]. It is possible to improve the aluminum production technology by means of organizing the fastest possible implementation of the electrolysis cell with minimal loss of resources, reducing the anode-cathode distance, decreasing the ohmic resistance in the current-carrying parts of the electrolyzer as well as the resistance of the electrolyte [2].

An increase in the power of the electrolyzer and, as a consequence, the anode area leads to a decrease in the interpolar space, reduction in the electrolyte volume in the electrolyzers, and creates the problem of an uneven distribution of alumina in the working space [3-5]. The uneven distribution of alumina in the electrolyte leads to a violation of technological process: fluctuations in current density and temperature, an increase in the frequency of anode effects.

The anode effect in aluminum electrolyzers occurs when the space near the anode is the alumina depleted; it is accompanied by a sharp increase in voltage from 4 to 40 V, an increase in the anode current density, and an additional increase in overvoltage. Thus, the anode effect leads to significant energy costs, to the electrolyte overheating, to the loss of aluminum and a decrease in the current efficiency. Moreover, the perfluorocarbons, which are greenhouse gases, form and release into the atmosphere during the anode effect. The main strategy of the modern aluminum smelters is to conduct the electrolysis process without technological failure, which reduce the technical and economic indicators of production.

In order to eliminate the negative influence of the anode effect, it is necessary to study the processes of distribution and more complete dissolution of alumina in the working space of electrolyzers. Industrial alumina contains several crystalline modifications of α-Al_2O_3, β-Al_2O_3 and γ-Al_2O_3, of which only γ-Al_2O_3 is actively soluble in the cryolite melt. The alumina obtained by the Bayer method can contain as high as15-60% α-Al_2O_3, which settles on the cathode and on the sides of telectrolyzer, changing the composition of the side and bottom ledge and forming crusts, which disrupts the technological process.

The precipitation formation brings the destruction of the cell bottom, the local electrolyte overheating and the change in resistance, which causes significant fluctuations in the voltage and significantly complicates the control of automatic alumina feed of the bath.

It is impossible to directly investigate the distribution of undissolved alumina over the space of an industrial electrolyzer. In order to do this, it is necessary to use conditions simulating real electrolyzer (density and viscosity of the medium, location of electrodes, bath feeders, ratio of geometric proportions, etc) [6, 7].

The purpose of this work was to determine the alumina distribution in the electrolyte and side ledge formed during electrolysis in the conventional cryolite-alumina electrolyte in the lab-scale cell.

Experimental

Chemicals

The electrolysis was carried out in the cryolite electrolyte of the conventional composition, consisting of NaF (57 wt%), AlF_3 (49 wt%) and CaF_2 (5 wt%) with cryolite ratio (CR) 2.7. The electrolyte was prepared from the individual components NaF, AlF_3 (reagent-grade, Vekton).

The alumina (98.2% Al_2O_3) was supplied by LLC Granchim. The alumina was added in an amount ensuring its concentration in the electrolyte of 4 wt%, based on the assumption that the current efficiency in the lab cell was 70%.

The phase and granulometric composition of the alumina used was studied.

The XRD pattern of the alumina was obtained using a Diffractometer Mini Flex 600 (Rigaku). It was determined that the amount of the α phase q_α = 35.97%, and the amount of the γ phase q_γ = 64.03%.

The Al_2O_3 particle size was determined in the range of 0.02–2000 μm using a Mastersizer 2000 (Hydro 2000S) instrument. Water was used as a dispersant. The particles distribution is given in Fig. 1. The Al_2O_3 particles size distribution is in the range from 10 to 120 μm.
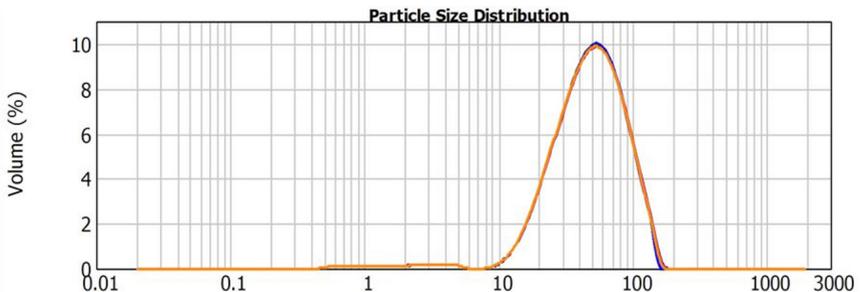
**Fig.1. Alumina particles size distribution**

Procedure

The electrolysis was carried out in a lab setup, schematically depicted in Fig. 2.

Each experiment was carried out with a new graphite anode, which, if necessary, was replaced directly during the experiment. The anode cross section was 40x40 mm and the height was 140 mm. A hole with a diameter of 10 mm was drilled in the anodes for a copper current lead. Before testing, the anodes were dried at a temperature of 120 ° C for 1 hour.

A graphite crucible filled with electrolite and aluminum metal at the bottom was placed in a protective steel cup. The cell was installed using the lifting mechanism in the furnace. The furnace shaft was closed with a lid with a heat insulator.

The operating parameters of aluminum electrolysis:
- current – 15 A;
- electrolyte temperature – 970 °C
- the anode current density – $0.5/cm^2$
- aluminum level – about 12 см;
- electrolyte level - 15 см;
- interpolar distance - 50 мм,
- elapsed time – about 70 h.
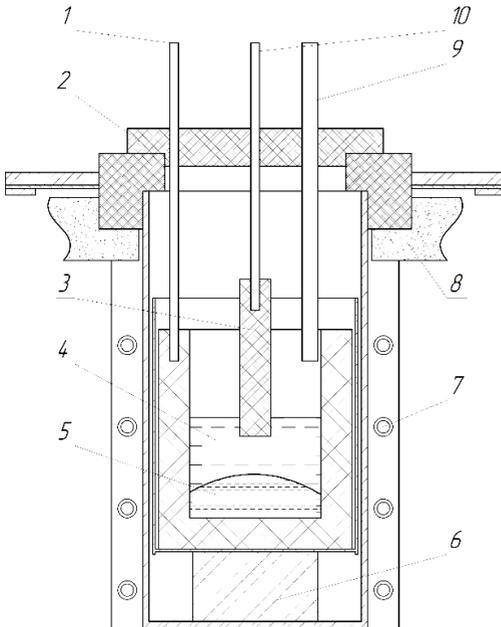
Fig.2. Electrolysis cell schematic
1 - current lead to a graphite crucible-cathode,
2 - cover with mounted holes for current leads to electrodes and tube for additions and sampling,
3 – graphite anode, 4 – electrolyte,
5 – liquid aluminum,
6 – fire-clay brick,
7 – furnace, 8 – lining

During electrolysis, the electrolyte samples were withdrawn to determine the alumina content and CR.

Measurements of the thickness of the side ledge, formed during the solidification of the electrolyte for the period and after electrolysis, were conducted by the measuring mechanism. After the experiment, dry sampling was carried out at various points of the frozen bath. The Al_2O_3 content was determined in the area of the electrolyte, the side and bottom ledge formation. The oxygen analysis was performed using an ONH836 Oxygen Analyzer instrument manufactured by LECO (USA).

Results and discussion

The experimental parameters are summarized in Table 1. The elapsed time was 70.25 h. The initial test temperature was 980 °C. The electrolyte liquidus temperature was 962°C; apparently, it decreased with alumina addions. The alumina concentration in the electrolyte remained at about 4 wt% for the first 30 hours. However, subsequently it decreased to about 3 wt%.

Table 1. Experiment parameters

Time, h	Current, A	Voltage, V	$T_{electrolite}$, °C	Al_2O_3, mas.%	CR
2:40	15.0	1.7	980		2.68
8:30	14.8	1.57	973	4.62	
13:20	16.0	2.0	969	4.16	
20:35	16.2	2.05	967		2.45
23:00	16.1	2.17	965	4.16	2.45
37:00	16.1	2.23	965		2.37
47:00	16.1	2.28	964	3.48	
57:00	16.1	2.29	965	3.5	2.32
70:25	16.0	2.38	965	2.71	2.36

The dynamics of the solid layer's formation on the cell walls was obtained by measuring the profiles over time. The profile of the solid layers at the boundary of the electrolyte-cell wall, electrolyte-aluminum-cell wall, aluminum-cell wall is presented in Fig.3. As can be seen, the side ledge in the electrolysis cell was formed only by the 13th hour of electrolysis.
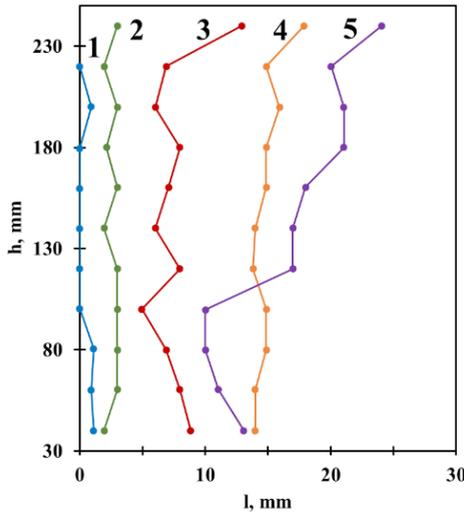
Fig.3. Profile of the ledge formed on the cell walls by time (h):
1 – 8:30, 2 – 13:20, 3 – 23:00, 4 – 37:00, 5 – 70

The chemical analysis of the electrolyte samples (table 1) revealed that the CR value is close to the planned one and was 2.68 at the electrolysis beginning. Nevertheless, the CR decreased over the time, this is likely due to the formation of the solid side and bottom ledge. So, after 20 hours of electrolysis, the CR decreased to 2.45 and remained near this value until the end of the experiment. As follows from Fig. 3, the first signs of the ledge formation (thickness of about 2 mm) appear by about 13th hour, and by 23d hour the ledge thickness reaches already 8-10 mm.

With a slight decrease in the electrolyte temperature, a significant increase in solid precipitation occurs over the entire profile of the ledge (curve 3 in Fig.3). However, the profile shape changes by the end of the experiment: the ledge thickness in the region of the three-phase boundary has decreased, possibly because the concentration of alumina in the electrolyte has fallen. However, a crust formed in the upper part of the cell. The electrolysis cell after cooling is shown in Fig.4.
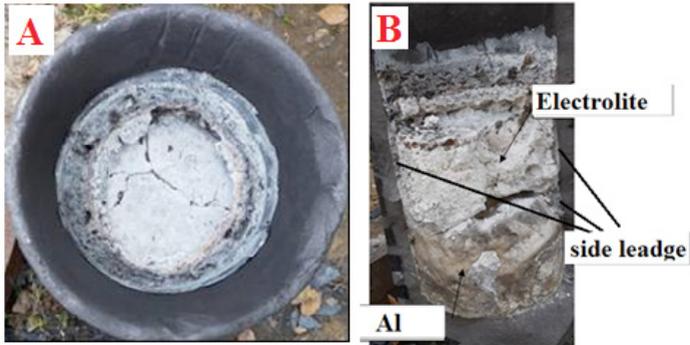
Fig. 4. Cell after cooling: A is a top view; B - cross section

The electrolyte and side ledge samples were taken in order to determine CR and alumina content. Sampling points are shown in the Fig.5. Description of the samples are given in Table 2.

Table 2. Description of withdrawn samples

| Sampling point (Fig.5)	Description	CR	Al_2O_3, wt%
1	Electrolyte, top	2.38	2.04
2	Electrolyte, middle	2.41	2.88
3	Electrolyte, over aluminum	2.50	3.75
4	Left wall, ledge-electrolyte, top	2.46	3.73
5	Left wall, ledge-electrolyte, middle	2.34	3.52
6	Left wall, ledge-electrolyte, over aluminum	2.38	3.79
7	Left wall, ledge-electrolyte-aluminum	2.51	3.75
8	Right wall, ledge-electrolyte, top	2.18	3.48
9	Right wall, ledge-electrolyte, middle	2.32	3.98
10	Right wall, ledge-electrolyte, over aluminum	2.39	4.35
11	Right wall, ledge-electrolyte-aluminum	2.43	3.96
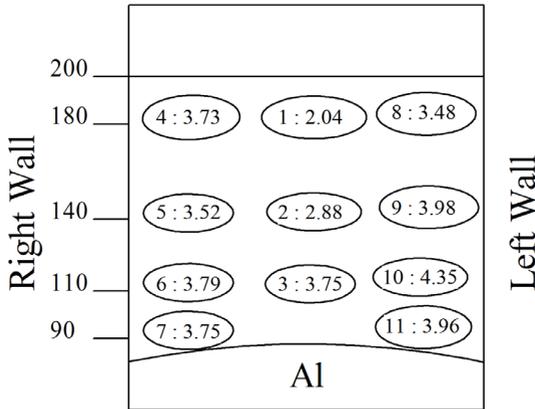
Fig.5. Sampling points with indication of alumina content

The XRD phase analysis of samples No. 4-11 revealed that the basic components were cryolite Na_3AlF_6 and $Na_5Al_3F_{14}$, Al_2O_3, a component containing calcium fluoride $NaF \cdot 5CaF_2 \cdot AlF_3$.

An increase in the alumina concentration in the frozen electrolyte from the top to the bottom is observed. The average concentration of alumina is 2.89 wt%, which satisfactorily correlates with the result of the chemical analysis of the electrolyte sample taken by the 70th hour of electrolysis (Table 1).

The elevated alumina concentration in the solids formed on the cell walls and at the three-phase boundary of the ledge-electrolyte-aluminum, in comparison with the molten electrolyte, was found during aluminum electrolysis in the lab cell, that is similar to the alumina distribution in the industrial cell. An increase in the alumina content was observed along the line from the cell center to the walls and top down along the cell wall.

A regular change in the CR at various points of the bath can be noted: it is higher in the electrolyte region directly above the aluminum and lower in the ledge-electrolyte-aluminum zone.

Conclusion

The formation of the side ledge occurred by the 13th hour of electrolysis under given conditions: the anode current density of 0.5 A/cm^2, initial temperature 970 °C, the alumina contained 35.97% α-Al$_2$O$_3$ and 64.03% γ-Al$_2$O$_3$ with the particles size in the range of 10-120 µm. According to the experimental results it can be concluded that the chemical composition of the side ledge is different from the electrolyte composition, including the elevated alumina content.

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