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BIOTECHNOLOGICAL ASPECTS OF CAGE GROWING OF AFRICAN CATFISH IN THE CONDITIONS OF UZBEKISTAN

Mullabaev N.R.,
Tashkent State Agrarian University,
Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan
Ayazov X.G.,
Tashkent State Agrarian University
Isroilov S.U.,
Tashkent State Agrarian University
Sobirov J.J.
Tashkent State Agrarian University,
Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan
DOI: 10.5281/zenodo.7142802

Abstract

On May 15, 1260 kg of fish stock (70 g) were planted in fish cages installed in the Tuyabuguz reservoir (Uzbekistan) African catfish, Clarias gariepinus, I grew until mid-October. They fed minced meat made from the insides of broiler chickens. By mid-October, the average individual body weight reached 1300 g, the total biomass - 23400 kg. The total increase in fish biomass for 5 months amounted to 21740 kg. Kormovoy's coefficient in the experiment turned out to be 3.2. The fish productivity of cages was about 25 kg/m ^{3}.

Keywords: Aquaculture, fish cages, African catfish, *Clarias gariepinus*, fish feeding, Uzbekistan.

Introduction

With a very limited list of warm-water species - objects of fish farming for temperate climate conditions, further expansion of the list of cultivated species can be largely due to tropical fish. No, such fish cannot overwinter in our geographical conditions. IX cultivation in open conditions is of interest when the growing season is fully used when the water temperature of surface water bodies warms up sufficiently (above 18 ^{o}C). This period lasts from April to mid-October (more than 5 months) [2, 412]. Under the conditions of intense use of water resources in the republic with the current level of technological effectiveness of the agricultural sector, another aspect of increasing fish production is the adaptive system of keeping fish to the existing diverse types of water bodies, primarily lentic ones. Prospect cultivation of tropical fish in cages installed in reservoirs, is. the development of real technologies for integrated water use. Floating fish cages of the valley to be resistant to local conditions, incl. to strong waves even with single strong wind events per year. During the rainy season, only African nutmeg catfish (*Clarias gariepinus*), grown until now mainly in closed conditions with heated water, which increases its cost [4, 52]. The purpose of this work was to conduct and monitor the experimental and demonstration cultivation of commercial African catfish in the conditions of the Tuyabuguz reservoir in the Tashkent region (the Angren river basin).

Material and Method

2019 in the garden institution of the fish farm LLC “Fish Berg” in the western part of the Tuyabuguz water intake (Fig. 1.). In the process of growing, the main hydrochemical indicators of the fishery quality of water in cages in the surface layer (0.5-1 m on a club) were determined.

Fig. 1. Cage farm of LLC "Fish Berg" in the western part of the Tuyabuguz reservoir.

Material and construction of the basket. The design of octagonal floating cages was developed independently in 2018, the frame is made of a 4 * 4 mm square profile with a thickness of 1.7 mm. The volume of one stand is 300 m ^{3} (diameter 13 m). Buoyancy is maintained by plastic barrels with a volume of 200 liters. The cages were installed near the dam at a gap 500 meters from the shore, at the place where the water depth was set to 30 m; a boat was used to service the cages.

Fish stock. The cages were stocked with African catfish stock (30-100 g) with an average individual weight of 70 grams. The fish seed material was purchased in the hatcheries of the Tashkent region, where the larvae are obtained under conditions of controlled temperature on an industrial scale in January, the juveniles are grown in the pools by May to the indicated sizes, which makes the development of cage culture of this object promising.

In the middle of May, we stocked 3 cages, each with a density of 22 fish/m ^{3}. During the growing season, two fish were sorted by size, sorting all the fish into two groups (small, and large).

Feeding. Catfish are fed with a mixture of minced meat from the insides of broiler chickens. At the same time, in the first 15 days, fishmeal (60: 40, respectively) and premix were added to the entrails of the chickens (daily 1 kg in the total amount of the feed mixture. Then only minced meat was prepared from the entrails of the chickens with the addition of 1 kg of the premix part. Taking into account that it was soft and fried, the fish freely tore off and swallowed.

Upon reaching 500 grams of fish, the sample is cut with unprocessed special giblets, and after reaching 1000 grams with chicken feet, heads and beetles are saturated.

The entrails of broiler chickens (offal, heads, legs, minced meat, and bones) were purchased daily at the slaughterhouse of poultry farms in the Pskent district of the Tashkent region.

The diet (wet food by weight) for juvenile catfish with an average weight of 70 grams was 13% of the fish biomass, with the growth of the fish, the diet was reduced to 2% for commercial fish weighing 1 kg or more. Diet corrector according to control hives and water temperature. For this reason, a 10-day control is carried out and a general method is used to calculate the average individual body weight of an African.

Fishing of cages was carried out in mid-October.

Results

As our experience in the operation of fish-breeding floating cages in the conditions of a sharply continental climate of the republic has shown, the storm resistance of feeding lavish cages increases when several cages are connected and a single system is used for such a system, a permanent cable of 20 mm is used. It should be noted that we installed the cage system in a place with a depth of up to 30 m. To withstand waves in strong winds, anchors weighing over 400 kg were tired. For construction, the anchor is a plastic 200-liter barrel with a hole and a 3-4-meter pipe with a metal pipe, and a concrete barrel with filling. The anchors were attached to the cage system with the power of a nylon

rope. The length of the rope depends on the depth of the reservoir.

Temperature regime. During the entire period of growing marketable fish, the temperature of the water in the cage itself and the fumigation space was the same. On the experimental side of water intake from May 1 to June 1, the average water temperature rises from 17° C to 24° C. During June and until the end of August, the average daily water temperature in the reservoir warmed up to a maximum of 29° C. In September, the water temperature is from 25° C to 15° C, and the water temperature is 15° C.

Thus, the water temperature in the garden, established in the Tuyabuguz reservoir during the period from May to October, is warm enough for the life and growth of the African catfish.

The pH values varied from 7.0-8.3, which is acceptable from a fishery point of view. It should be noted that the hydrochemical indicators of fish of commercial water quality were also favorable for the African catfish.

Biotechnology of growing marketable fish. The fish stock was delivered on 15 May in 25-liter plastic drums, and each drum contained 15 kg of fish biomass. Before releasing the fish, the temperature of the water in the tank (24° C.) and the garden (20 ° C.) was balanced.

The total biomass of fish stock was 1260 kg, and the average weight of an individual was 70 g.

Feeding began the next day after stocking. The ratio was 13%. In the evening and at night, a 150-watt light bulb was hung over the cage to attract plankton organisms, followed by small weedy fish that freely entered the cage. At night, we visually constantly noted the catfish hunting for these small fish.

The average water temperature in June was 25° C. According to the data of the control bed, the average individual body weight reaches 160 g, and the total fish biomass in the nursery is 3000 kg. The ration was set at the level of 13% of the horse's biomass, the amount of compound feed and compound feed was about 400 kg per day.

The average daily water temperature in July increased to 29°C. The catfish grew and reached an average of 380 g. The total fish biomass in the cage line increased to 7000 kg. Due to the growth of catfish, the diet was reduced to 8.5% of the biomass. The average daily amount of feed brought in this month reached 600 kg per day.

The average water temperature in August was 27° C. The average individual weight of fish reaches 820 g, and the total biomass – is 14500 kg. Diet size 4.1%, average feed intake 600 kg per day.

The average daily water temperature in August was 27°C. The average individual body weight of fish reached 820 g, the total biomass - 14500 kg. The ration was reduced to 4.1%, the average daily feed intake was 600 kg per day during this period.

The average water temperature in October is up to 22 °C. Long-term growth of fish, the average individual body weight reaches 1300 g, and the total biomass increases to 23400 kg. And the cost of products is affordable and affordable.

During the entire cultivation of commercial African catfish, 71,000 kg of feed were introduced into all cages. The total increase in fish biomass for 5 months amounted to 21740 kg. The feed coefficient in the experiment was 3.2. The fish productivity of cages was about 25 kg/m^3.

Conclusion

The Tuyabuguz reservoir is located in the flat part of the Akhangaran river basin in the Tashkent region. It can be assumed that the temperature regime of water corresponds to the rest of the lentic reservoirs of the flat part of the rivers of Uzbekistan. In the reservoir, the water temperature regime is favorable for growing tropical (and warm-water) fish for about 5 months. With regard to such fast-growing fish as the African catfish, it can be considered that the period is sufficient for the production of marketable fish, provided that the feeding cages are stocked with high-quality fish stock. In our case, when stocking the cages in May with an average sample size of 70 g, the African catfish grew to 1.5 kg in mid-October.

Cultivation of African catfish in fish-breeding floating cages in reservoirs and lakes of the flat part of Uzbekistan is promising and will allow to produce significant additional fish products [3, 214; 1, 270]. The functioning of the cages does not require any correction in the mode of operation of the reservoirs. Fish live in water, but they themselves do not spend it, and do not change its quality, i.e., fish cages do not interfere with the functioning of the water bodies of the country's irrigation system.

However, growing fish in fish cages should be classified as aquaculture in open conditions, i.e., subject to seasonality. The practice of recent years shows that in the second half of autumn, all producers of African catfish in open conditions carry out total fishing and bring products for sale. As a result, there is a glut of the market in a short period of the year, the price of African catfish falls. The rest of the year, the African catfish is not present on the market. Considering the above, it is possible to recommend the development of catfish fish processing technologies, for which it would be advisable to produce a one-time large number of high-quality products. This will drastically increase the prospects for replication of cage rearing of African catfish in cages.

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CHEMICAL SCIENCES

PYROLISYS OF CALCIUM ADIPATE IN THE PRESENCE OF CATALYSTS BASED ON CHROMIUM ALUMINATES

Golovanov A.A.,
Doctor of Sciences in Chemistry
Tsvetkova I.V.,
Candidate of Sciences in Chemistry
Kondrateva A.A.,
Master Student
Orlova D.D.
Bachelor Student
Togliatti State University, 445020, Togliatti, Russia
DOI: 10.5281/zenodo.7142821

PYROLYSE VON CALCIUMADIPAT IN GEGENWART VON KATALYSATOREN AUF BASIS VON CHROMALUMINATEN

Golovanov A.A.,
Doktor der Chemiewissenschaften
Tsvetkova I.V.,
Kandidatin der Chemiewissenschaften
Kondrateva A.A.,
Masterstudentin
Orlova D.D.
Bachelorstudentin
Staatliche Universität Togliatti, 445020, Togliatti, Russland

Abstract
The possibility of obtaining cyclopentanone by pyrolysis of calcium adipate in the presence of catalysts based on chromium aluminates is considered. Pyrolysis proceeded with the formation of cyclopentanone, cyclopentenone and cyclopentene. Their structure was proved using IR spectrometry, GC-MS and NMR spectrometry. The use of catalysts based on chromium aluminates makes it possible to increase the yields of the target products.

Kurzfassung
Es wird die Möglichkeit erwogen, Cyclopentanon durch Pyrolyse von Calciumadipat in Gegenwart von Katalysatoren auf Basis von Chromaluminaten zu gewinnen. Die Pyrolyse verlief mit der Bildung von Cyclopentanon, Cyclopentenon und Cyclopenten. Ihre Struktur wurde mittels IR-Spektrometrie, GC-MS und NMR-Spektrometrie bewiesen. Durch den Einsatz von Katalysatoren auf Basis von Chromaluminaten können die Ausbeuten an den Zielprodukten gesteigert werden.

Keywords: adipic acid, pyrolysis, cyclopentanone, cyclopentene, cyclopentanone, catalysts, chromium aluminates, fractional composition.
Schlagwörter: Adipinsäure, Pyrolyse, Cyclopentanon, Cyclopenten, Cyclopentanon, Katalysatoren, Chromaluminate, Partikelgrößenverteilung.

Zuvor wurde die Möglichkeit aufgezeigt, Cyclopentanon aus Nebenprodukten der Caprolactamherstellung durch Pyrolyse von Calciumsalzen der Adipinsäure zu gewinnen. Es wurde eine Untersuchung der thermischen Stabilität von Calciumadipat unter Verwendung eines Shimadzu DTG-60/60H-Derivatographen durchgeführt. Seine Zersetzungstemperatur betrug 400 °C (Abb. 1) [1].

Die Pyrolyse von Calciumadipat wurde in Gegenwart von Katalysatoren auf Basis von Metalloxiden und -salzen durchgeführt. Die höchste Produktausbeute wird mit einem industriellen Dehydrierungskatalysator des Typs „K-16u“ (51,6 %) erzielt [2].

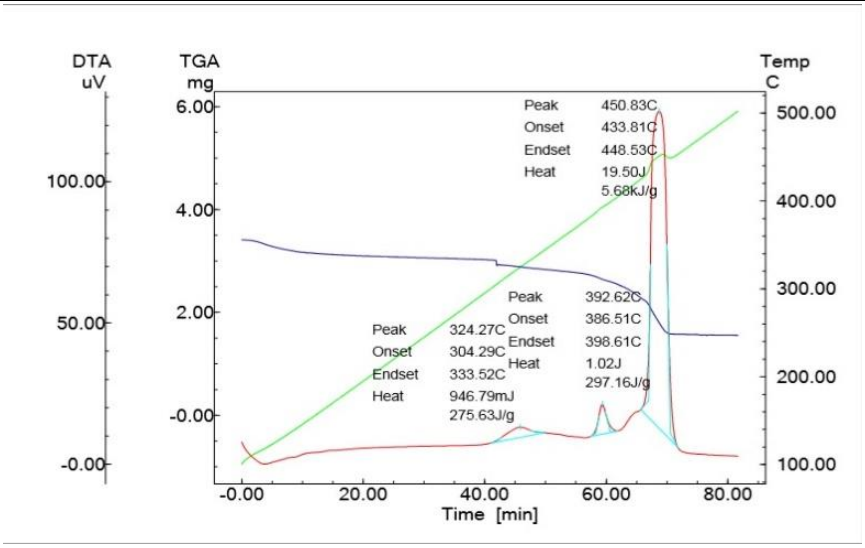


Abb. 1. Derivatogramm von Calciumadipat

Die Pyrolyse wurde in einem Elektroofen unter Verwendung eines Quarzreaktors bei verschiedenen Temperaturen (500, 600 °C) und einer Kontaktzeit von 2 Stunden durchgeführt. Die Beladung mit Calciumadipat betrug 3,0 g, Katalysatorproben – 0,03 g. Im Laufe der Zeit bildete sich im Kolben ein flüssiges Produkt mit einem charakteristischen Geruch; die Farbe der Flüssigkeit änderte sich nach Pyrolysetemperatur von hellgelb nach hellbraun. Die Analyse der Zusammensetzung der erhaltenen Flüssigkeiten wurde unter Verwendung eines Chromatographens Kristallux 4000M mit Flammenionisationsdetektor (Kapillarsäule, Heliumträgergas, Quarz, DB-WAX (PEG), 30 m/ 0,32 mm/ 0,5 μm) durchgeführt.

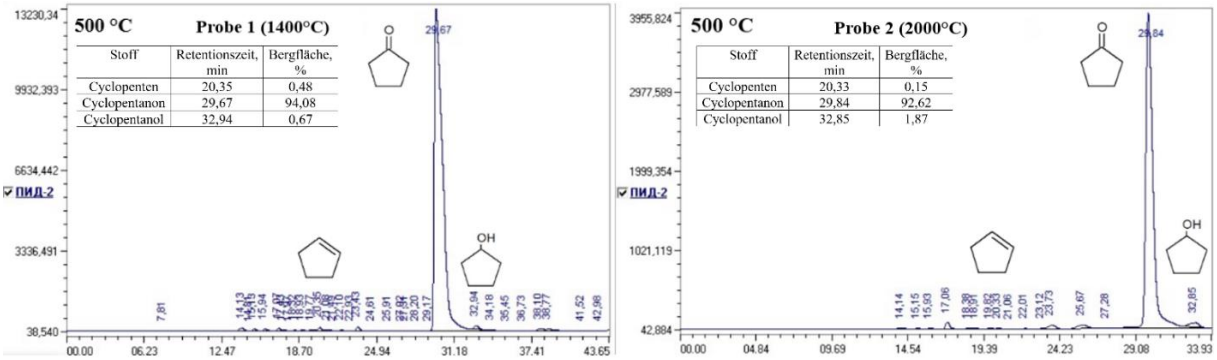


Abb. 2. Chromatogramme eines flüssigen Produkts, erhalten bei 500 °C (Proben 1,2)

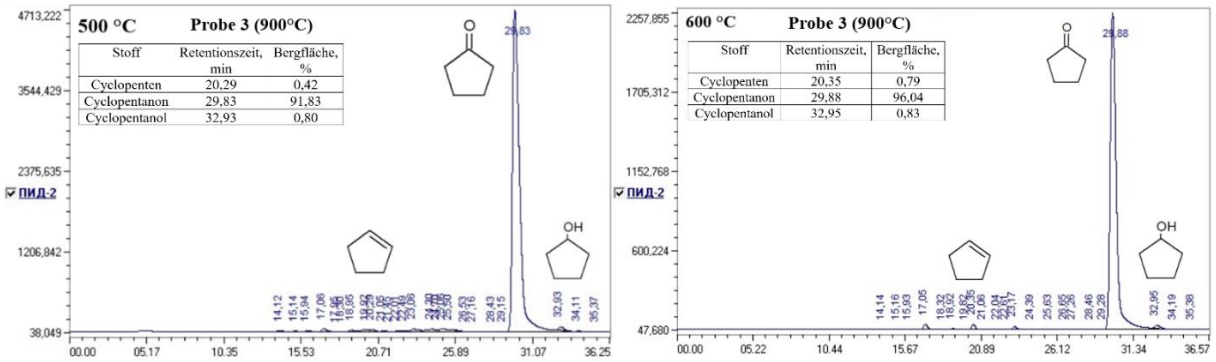


Abb. 3. Chromatogramme eines flüssigen Produkts, erhalten bei 500 und 600 °C (Proben 3)

Tabelle 1

Ergebnisse der Pyrolyse

Katalysator	Prozesstemperatur, °C	Cyclopentanon-Ausbeute, %
«K-16u» (Fe_2O_3×Cr_2O_3×ZnO)	500	34,14
	600	51,61
1/1400°C (Induktionsofen)	500	31,60
2/2000°C (Lichtbogenofen)	500	37,87
3/900°C (Muffelofen)	500	41,57
	600	46,33
ohne Katalysator	600	10,18

Die Partikelgrößenverteilung des «K-16u» Oxidkatalysators und der Katalysatoren auf der Basis von Chromaluminat wurden gemessen (Proben 1 und 3). Probe 2 wurde aufgrund ihrer dichten Struktur nicht analysiert. Die Analyse wurde auf einem SALD-2000-Laser-Partikelgrößenanalysator (Shimadzu, Japan) durchgeführt.

Tabelle 2

Vergleich der Wirksamkeit von Katalysatoren und ihrer Partikelgrößenverteilung

Katalysator	Teilchendurchmesser, µm				Prozesstemperatur, °C	Cyclopentanon-Ausbeute, %
	d_{10}	d_{50}	d_{90}	d_{cp}		
1/1400°C (Induktionsofen)	23,233	55,115	110,772	50,932	500	31,60
2/2000°C (Lichtbogenofen)	nicht gemessen				500	37,87
3/900°C (Muffelofen)	**1,2058**	**23,8196**	**161,130**	17,252	500	**41,57**
					600	**46,33**
«K-16u» (Fe_2O_3×Cr_2O_3×ZnO)	**2,979**	**44,586**	**203,152**	31,945	500	**34,14**
					600	**51,61**

Die höchste Ausbeute an Cyclopentanon wird erzielt, wenn die Proben von Katalysator 3 und Katalysator "K-16u" verwendet werden. Diese Katalysatoren haben die breiteste Partikelgrößenverteilung.

Die Analyse der bei der Pyrolyse entstehenden Produkte erfolgte mit den Methoden der IR-Spektrometrie, GC-MS und NMR-Spektrometrie. Durch IR-Spektrometrie wurde nachgewiesen, dass das bei der Pyrolyse erhaltene flüssige Produkt Cyclopentanon enthält (Abb. 4,5).

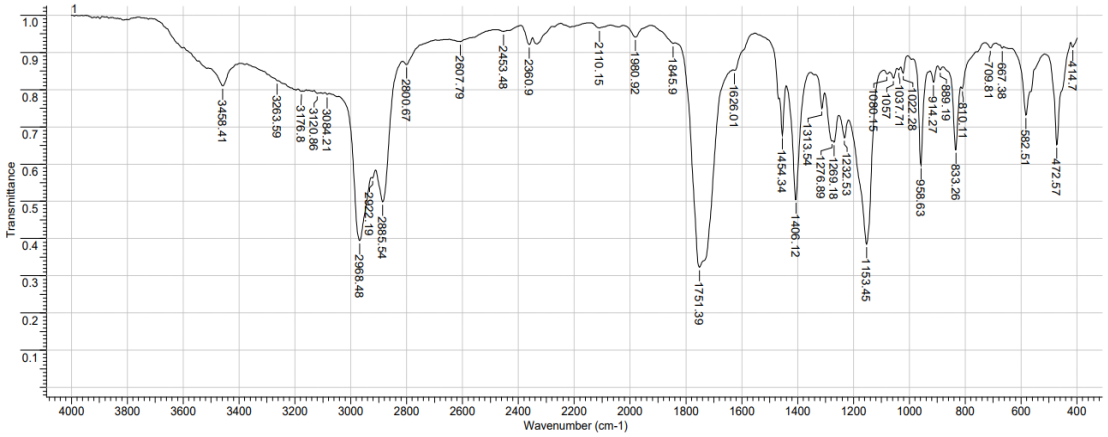


Abb.4. IR-Spektrum von reinem Cyclopentanon

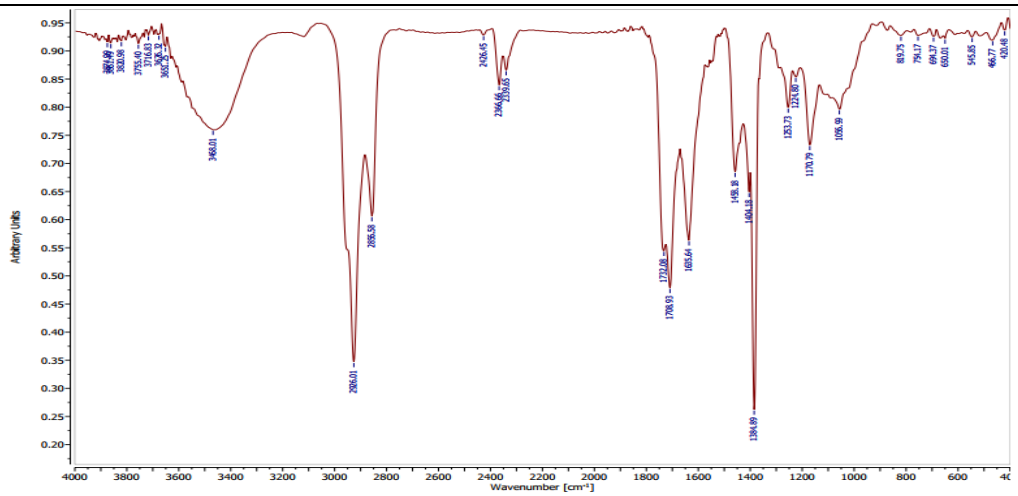
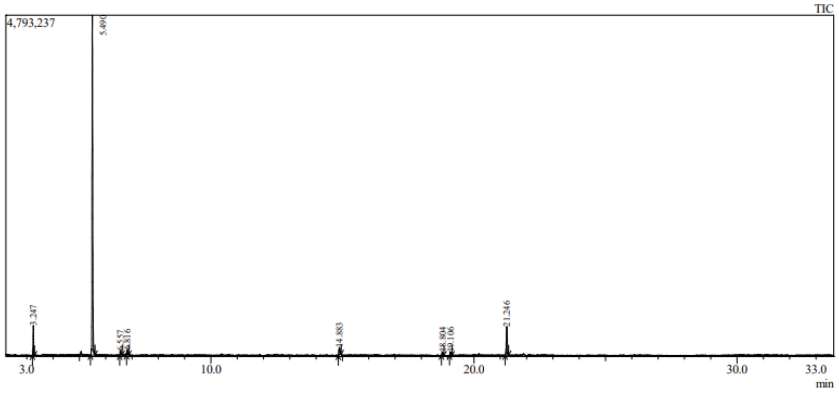


Abb.5. IR-Spektrum des in Gegenwart des Katalysators "K-16u" erhaltenen Produkts

Gemäß den Ergebnissen der GC-MS-Analyse wurde festgestellt, dass neben Cyclopentanon und Cyclopenten die Bildung von Cyclopentenon auftritt (Abb. 6). Cyclopentenon ist ein Zwischenprodukt der Pyrolyse.

Eine NMR-Spektrometrie-Untersuchung bestätigte das Vorhandensein der folgenden Verbindungen im erhaltenen Produkt: Cyclopentanon, Cyclopenten und Cyclopentenon (Abb. 7).



Peak Report TIC

Peak#	R.Time	I.Time	F.Time	Area	Area%	Height	Height%	A/H	Mark	Name
1	3.247	3.215	3.292	569000	5.04	413687	7.06	1.38		Benzene
2	5.490	5.422	5.595	8863769	78.54	4728083	80.64	1.87		Cyclopentanone
3	6.557	6.528	6.628	141645	1.26	61195	1.04	2.31		2-Cyclopenten-1-one
4	6.816	6.792	6.882	151364	1.34	69742	1.19	2.17		2-Pentanone, 4-hydroxy-4-methyl-
5	14.883	14.835	14.952	281304	2.49	104320	1.78	2.70		2-Oxepanone
6	18.804	18.762	18.852	106588	0.94	45134	0.77	2.36		[1,1'-Bicyclopentyl]-2-one
7	19.106	19.068	19.162	99705	0.88	41076	0.70	2.43		6-Butyl-1,4-cycloheptadiene
8	21.246	21.182	21.315	1072406	9.50	399642	6.82	2.68		Cyclopentanone, 2-cyclopentylidene-
				11285781	100.00	5862879	100.00			

Abb. 6. Chromatogramm des in Gegenwart des Katalysators "K-16u" erhaltenen Produkts

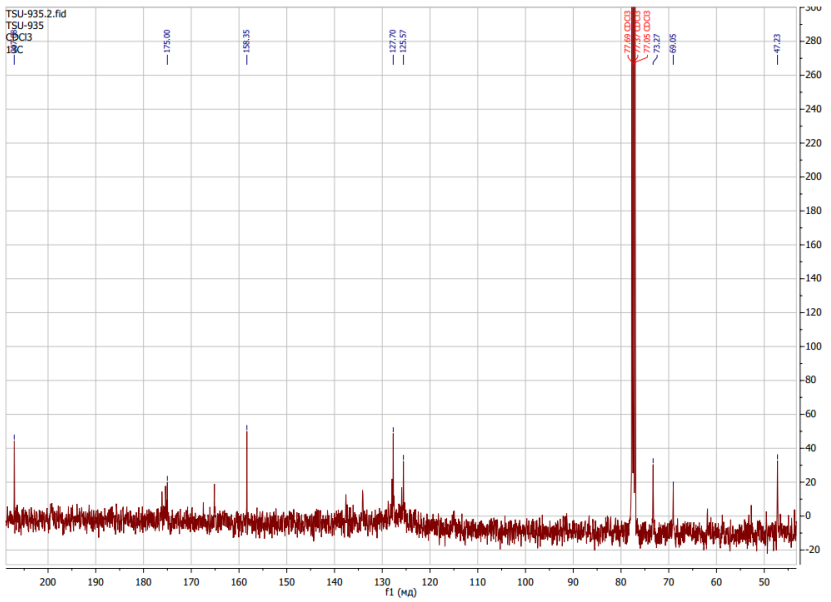


Abb. 7. NMR-Spektrum des in Gegenwart des Katalysators "K-16u" erhaltenen Produkts

In diesem Artikel wurde gezeigt, dass die Anwesenheit von Aluminium-Chrom-Katalysatoren im Pyrolyseprozess die Ausbeute an dem Zielprodukt Cyclopentanon deutlich erhöht.

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MEDICAL SCIENCES

STRUCTURAL SPECIFITY OF AXODENDRITIC PROJECTIONS OF PSEUDOUNIPOLAR NEURONS AND ITS INTERACTION WITH SURROUNDING SATELLITE GLIAL CELLS.

Aliyarbayova A.A.,
Doctor of philosophy (PhD) in Medicine,
Senior teacher of department Cytology, embryology and histology
Sultanova T.A.,
Doctor of philosophy (PhD) in Medicine,
Assistant professor of department Cytology, embryology and histology
Mehraliyeva G.A.,
Doctor of philosophy (PhD) in Biology,
Senior teacher of department Cytology, embryology and histology
Sadiqova G.H.,
Doctor of philosophy (PhD) in Medicine,
Senior teacher of department Cytology, embryology and histology
Ibrahimova T.A.,
Assistant of department Cytology, embryology and histology
Qurbanova S.Q.
Assistant of department Cytology, embryology and histology
Azerbaijan Medical University, Baku
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Abstract

We present structural properties of projections of pseudounipolar neurons of the spinal ganglia (sensory dorsal root ganglia). Taken into account neurons composing these ganglia have only one processes by name axodendritic, and then latter branched into central and peripheral parts. The long peripheral processes receive different afferent stimuli from outer and inner environment, whereas the short central processes project into the dorsal horn of the spinal cord. This work was to learn the morphological (histological and ultrastructural) properties of axodendritic processes and its interaction with surrounding satellite glial cells. The research performed on male rat's dorsal root ganglia containing blocks that prepared according to general methods accepted in microscopy. The current study demonstrates that the axodendritic processes - the place, involving in reception and transmission of nerve impulses; also, the neuron and its branches - axoplasmic protrusion (axodendritic processes) completely surrounded by a satellite glial cells; in the axoplasm of this projection the number of cytoskeletal elements (microtubules, neurofilaments) is too high, in spite of the absence of chromatophilic substance.

Keywords: pseudounipolar neuron, axodendritic projection, satellite glial cell, electron microscope

Introduction. The dorsal root ganglion (also named spinal ganglia, sensory root ganglia) has a major clinical application, principally in its association with neuropathic pain. The pseudounipolar neurons composing mentioned ganglia with their processes aid in dorsal and ventral roots of the spinal nerves, carrying sensory messages from many receptors, including those for pain and temperature towards the central nervous system for a reply [1]. A properly study structural peculiarities of that neurons and its processes help to improve the diagnosis and treatment of neuropathic pain syndromes. An important feature of the pseudounipolar neurons composing the spinal ganglia is that they surrounded by satellite glial cells from all sides. Satellite glial cells in peripheral nervous system covered not only neurons also their processes. One of the areas that not studied in detail in the literature is the incomplete clarification of connections satellite glial cells and pseudounipolar neurons at the level of axodendritic projections.

Aim of study was to carefully investigation the morphological structural properties of axodendritic projections of neurons of spinal ganglia and its interaction with the surrounding satellite glial cells.

Material and methods. The object of study was dorsal root ganglia purchased from 20 white male rats with a weight of 200 - 230 grams that fed a standard laboratory in specific pathogen-free facilities. All procedures complied with the Principles of Laboratory and Animal Care established by the Azerbaijan Medical University. The experimental animals divided into two groups. After of the intravenous injection (into the tail vein 0.5 ml physiological salt solution) the first groups of research animals decapitated under ketamine/xylazine (100/10 mg/kg) anaesthesia; the abdominal and thoracic cavity of the rats opened by parasternal incision, and then was taken out the internal organs and the vertebral bodies were cut. Later by the help of special lancet, a spinal canal opened and spinal ganglions removed from the soft tissue at intervertebral foramen level. The specimen had been fixated in solution that contains 2% paraformaldehyde, 2% glutaraldehyde and 0.1% picrin acid prepared in phosphate buffer (pH 7.4). The second groups of research animals were deeply anaesthetized with ketamine (Nembutal) and perfused transcardially with a solution containing 2% formaldehyde, 2% glutaraldehyde and 0.1% picrin acid prepared in phosphate buffer (pH 7.4). 2 hour later

after intravascular fixation, a spinal canal had opened and dorsal root ganglions removed from the soft tissue. The specimen taken from both groups animals after the postfixation in 1% osmium acid solution in phosphate buffer, prepared into Spurr and Araldit-Epon blocks according to general methods accepted in microscopy [2]. Obtained from blocks on ultratomes LKB-III, Leica EM UC7 semithin sections (thickness 1-2μm) stained with methylene blue, azure II and basic fuchsine or with toluidine blue [3]. Then carefully inspected images of each section recorded by using Pixera (USA) digital camera connected to Latimet (Leitz) microscope and saved in computer. Silver and gold ultrathin sections from same blocks first painted with 2% uranyl acetate solution, then in 0.6% lead citrate made in NaOH 0.1N solution. Then ultrathin sections examined under the Transmission Electron Microscope (JEM-1400, Japan) at an accelerating voltage of 80-100 kV and received the electronograms. This procedure continued until the block had been used. The morphometric data of the image taken in TIF format (microphotographs and electronograms) analyzed using the "Olympus Soft Imaging Solutions" computer program (The TEM imaging platform) by German company.

Results. We should note that the majority of more than studied 10,000 nerve cells composing the spinal ganglia have a free covering satellite glial cells [4].

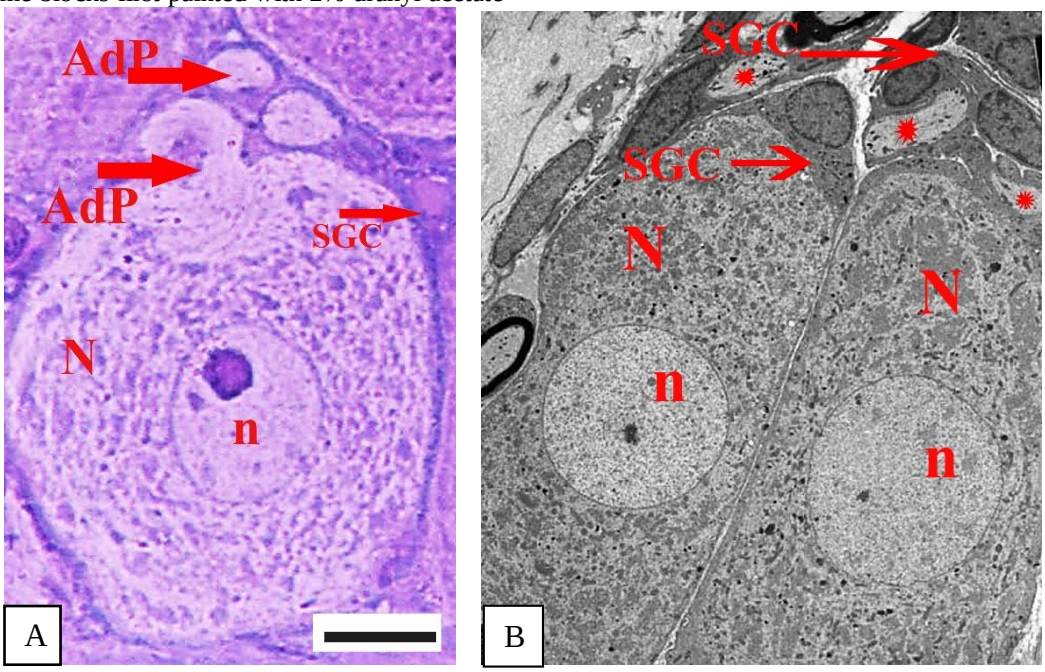

Figure 1. Microscopic (A) and ultrastructural (B) slide.
A - Semithin section of pseudounipolar neuron (by red arrow shown axodendritic processes); B - electronogramma of two neighbor pseudounipolar neurons (by red star shown axodendritic processes). Explanation given in text. Stain: A - methylen blue, azur II and basic fuscin; B – uranil acetat and lead citrate. Abbrevation: N-neuron, SGC satellite glial cell, n-nucleus, AdP- axodendritic processes. Magnification: A 20μm, B 2400 time.

As can be seen from the picture (figure 1A) the neuron with a diameter of 55 μm (that is large light neuron) has nucleus, nucleolus and large cytoplasm. On slide in the middle upper part of the neuron arising one axodendritic projection (marked by red arrow), which coiled in left side as arch, as well as, on the right side from it visible the two its segments located separately. All 3 part of processes of pseudounipolar neurons whole covered by satellite glial cells and isolated from surrounding connective tissue elements. It should be noted that such protrusions are rarely found in the semithin section of studied neurons. Other interesting peculiarities on the picture 1A the fact that the protrusion itself has light staining cytoplasm and stand out from the body of nerve cells by its intensity. On figure 1B shown two neighbor pseudounipolar neurons that possess their whole covering individual glial cells, like "cap" on top. Also on the upper part of both neurons, visible axodendritic processes (marked by red star), that intensity is differ from cell body of neuron. Neuronal cell body contain nucleus with prominent nucleolus, organelles, cytoskeletal elements, but in its projection only visible some organelles, such as mitochondrion and dense cytoskeletal elements. Both neuron and projection isolated from external connective tissue structural elements by satellite glial cells (on figure 1B shown by red arrow).

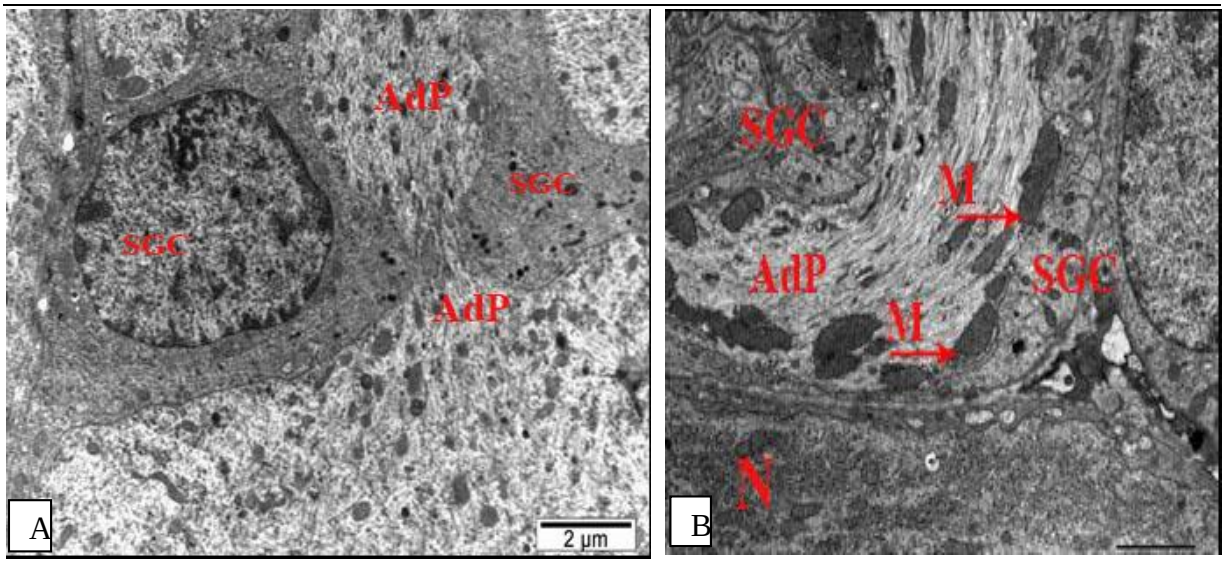

Figure 2. Electronogramma (ultrastructural slide, both A and B) of axodendritic processes of pseudounipolar neuron. Explanation given in text. Stain: (both A and B) uranil acetat and lead citrate. Abbrevation: N- neuron, SGC- satellite glial cell, AdP- axodendritic processes, M - mitochondrion (shown by red arrow). Magnification of both 2µm.

Ultrastructural examination of the axodendritic protrusions of pseudo unipolar neurons (figure 2A) under more magnification shows that the number of cytoskeletal elements (microtubules, neurofilaments) is too high, despite the absence of chromatophilic substance with synthetic function. The conducted morphometric study shows that cytoskeletal elements dominate in the cytoplasm of the initial part of axodendritic protrusions. Despite the sharp densification of cytoskeletal elements, the number of mitochondria appears to be significantly lower (figure 2A). However, another noteworthy point is that mitochondria are located mainly near glial cell-covered parts of the axolemma (figure 2B). The location of mitochondria at the level of the neuroglial border suggests that there is a high physiological activity accompanied by energy expenditure in the places where the axodendritic projections of the pseudounipolar nerve cell begin. A similar structure - few numbers round shaped lightly staining (transparent), looks like separately isolated structure on the right side of neuron with a diameter of 65 µm on figure 3A, that indicated by red arrow and named axodendritic processes. The analysis of the obtained histological slides shows that this transparency of the axodendritic processes is due to the absence of chromatophilic substance (Nissl substance, that makes up the synthetic apparatus of the nerve cell). As a confirmation of the above, the cytoplasm of the projection part staining in light color separated from the surrounding connective tissue elements by satellite glial cells. In the electronogram, satellite glial cells covering these processes are very prominent (figure 3B).

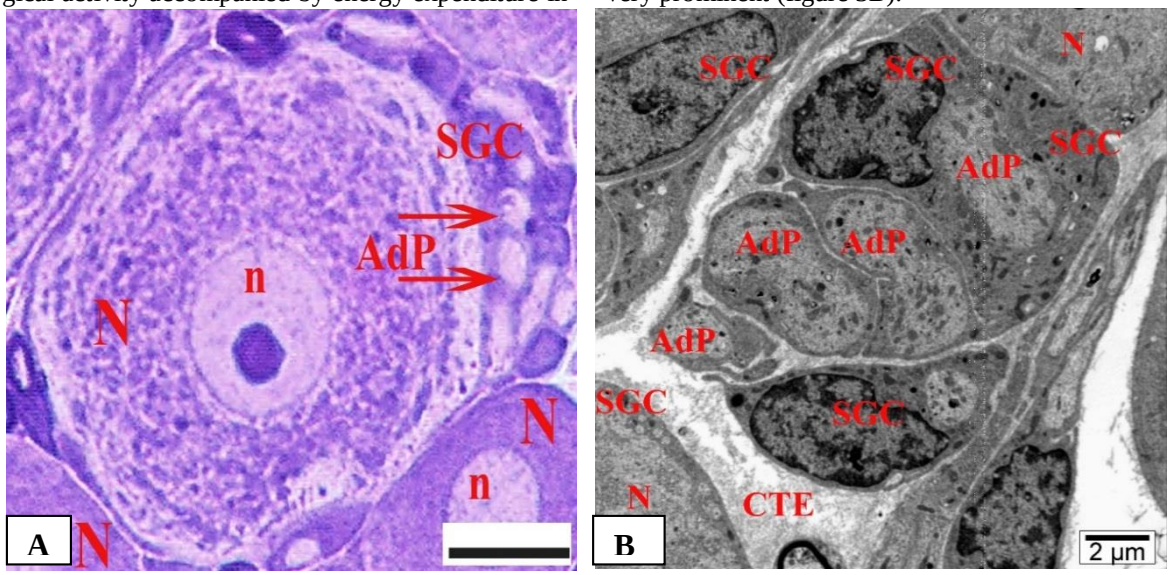

Figure 3. Microscopic (A) and ultrastructural (B) slide. A - Semithin section of pseudounipolar neuron with its branching axodendritic processes (shown by red arrows). B - electronogramma of bundle of the branching axodendritic processes of pseudounipolar neurons. Explanation given in text. Stain: A - methylen blue, azur II and basic fuscin; B – uranil acetat and lead citrate. Abbrevation: N –neuron, n-nucleus, SGC-satellite glial cell, AdP- axodendritic processes, CTE- connective tissue elements.
Magnification: A 20µm, B 2µm.

Apparently, the neuron and the branches of its axoplasmic protrusion (axodendritic processes) completely surrounded by a satellite glial cell. Interestingly, the nucleus of the satellite glial cell is located between the axoplasmic protrusion and not around the neuron. Electronograms obtained from serial ultrathin sections of the same region (figure 3B) show that each of the above-described neuron and its surrounding axodendritic projections has a distinct satellite glial coating.

At the level where the glial sheath covers either the part of neuron or its various projections, the mesaxon and similar structure characteristic for myelinated and unmyelinated nerve fibers are not detected (fig. 1B; fig. 2B, 3A, 3B). This once again shows that satellite glial cells cover not only the bodies of pseudounipolar neurons, but also their axodendritic projections and the initial parts of the its branches (fig. 1B, 2B) arised from neuron.

In the literature, some authors suggested that satellite glial cells belong to the cells with a lot of number processes, like astrocytes (surrounding nerve cells in the CNS) [5]. But based on the materials we have studied, we can come to the following results:

1. While the feet of astrocytes form the glial border resting on the inner surface of the pia mater, the corresponding structure is generally not found in the spinal ganglia;

2. While the projections of astrocytes cover only parts of nerve cells where no synaptic connections, but satellite glial cells surround pseudounipolar cells body and their projections from all sides;

3. Although astrocytes also form a glial sheath (blood-nerve barrier) around cerebral vessels, but spinal ganglia satellite glial cells generally do not have projection that are in close contact with vessels. Thus, although the satellite glial cells of the spinal ganglia aid to the cells with processes, but there is no homology between them and astrocytes.

Conclusion. Summarizing the obtained materials, it should be noted that the axodendritic processes arised from pseudounipolar neuron have coiled around latter. Despite of cytoplasm of neuron, the axoplasm devoid of Nissle substance. Axodendritic processes contain a lot of number cytoskeletal elements (microtubules, neurofilaments) and the mitochondria (which are the synthesis center of macroergic molecules) are located in the axoplasmic protrusions in close to the plasmalemma of satellite glial cells shows that they are actively involved in the reception and transmission of nerve impulses.

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CORRECTION OF HEMOSTASIS AND HEMOREOLOGY USING INTRAVENOUS LASER IRRADIATION OF BLOOD IN THE PERIOPERATIVE PERIOD WITH INDIRECT REVASCULARIZATION IN PATIENTS WITH THROMBOANGIITIS OBLITERATING IN THE STAGE OF CRITICAL ISCHEMIA

Kosayev J.V.,
Candidate of Medical Sciences, Chief Researcher, Department of Vascular Surgery .
Scientific Center of Surgery named after Acad. M.A.Topchubasheva, Baku, Azerbaijan
ORCID ID: https // orcid.org / 0000-0001-6625-2698
Hasanov I.A.,
Doctor of Medical Sciences, Associate Professor,
Head of the Department , Department of Sport Medicine and Rehabilitation;
Azerbaijan State Academy of Physical Education and Sports, Baku, Azerbaijan
ORCID ID: https // orcid.org / 0000-0002-2040-6580
Abushov N.S.,
Doctor of Medical Sciences, Professor,
Head of the Department of Vascular Surgery.
Scientific Center of Surgery named after Acad. M.A.Topchubasheva, Baku, Azerbaijan
ORCID ID: https // orcid.org / 0000-0002-5978-7800;
Taghi-zade G.T.,
Candidate of Medical Sciences, Chief Researcher, Department of Vascular Surgery,
Scientific Center of Surgery named after Acad. M.A.Topchubasheva, Baku, Azerbaijan
ORCID ID: https // orcid.org / 0000-0002-8913-0674
Ibrahimova F.R.
Junior Researcher, Department of Vascular Surgery,
Scientific Center of Surgery named after Acad. M.A.Topchubasheva, Baku, Azerbaijan
ORCID.ID: https // orcid.org / 0000-0002-3830-4737
DOI: 10.5281/zenodo.7142854

КОРРЕКЦИЯ ГЕМОСТАЗА И ГЕМОРЕОЛОГИИ С ПРИМЕНЕНИЕМ ВНУТРИВЕННОГО ЛАЗЕРНОГО ОБЛУЧЕНИЯ КРОВИ В ПЕРИОПЕРАЦИОННОМ ПЕРИОДЕ ПРИ НЕПРЯМОЙ РЕВАСКУЛЯРИЗАЦИИ У БОЛЬНЫХ С ОБЛИТЕРИРУЮЩИМ ТРОМБАНГИИТОМ В СТАДИИ КРИТИЧЕСКОЙ ИШЕМИИ

Косаев Ж.В.,
Кандидат медицинских наук, главный научный сотрудник отделения сосудистой хирургии .
Научный центр хирургии им. акад. М.А.Топчубашева, Баку, Азербайджан
ORCID ID: https // orcid.org / 0000-0001-6625-2698
Гасанов И.А.,
Доктор медицинских наук, доцент,
Заведующий кафедрой, кафедра спортивной медицины и реабилитации;
Азербайджанская государственная академия физической культуры и спорта,
Баку, Азербайджан
ORCID ID: https // orcid.org / 0000-0002-2040-6580
Абушов Н.С.,
Доктор медицинских наук, профессор,
Руководитель отделения сосудистой хирургии.
Научный центр хирургии им. акад. М.А.Топчубашева, Баку, Азербайджан
ORCID ID: https // orcid.org / 0000-0002-5978-7800;
Таги-заде Г.Т.,
Кандидат медицинских наук, главный научный сотрудник отделения сосудистой хирургии,
Научный центр хирургии им. акад. М.А.Топчубашева, Баку, Азербайджан
ORCID ID: https // orcid.org / 0000-0002-8913-0674
Ибрагимова Ф.Р.
Младший научный сотрудник, отделение сосудистой хирургии,
Научный центр хирургии им. акад. М.А.Топчубашева, Баку, Азербайджан
ORCID.ID: https // orcid.org / 0000-0002-3830-4737

Abstract

Objective: To study changes in hemostasis and hemorheology in patients with thromboangiitis obliterating (OT) in the stage of critical ischemia (CI) and the possibility of their correction using intravenous laser irradiation of blood (ILIB) in the perioperative period with indirect revascularization. **Material and methods of research**: A

prospective controlled clinical trial was conducted in 135 patients with OT in the CI stage. Due to the impossibility of conducting shuntable operations, 69 patients (the main group) underwent indirect revascularization: lumbar sympathectomy and revascularizing osteotrepanation separately and in combination. A large amputation was performed in 3 patients. In the main group in the perioperative period, ILIB was carried out simultaneously with the standard treatment. In this group, 66 (95.7%) patients managed to preserve the supporting function of the limb. In 66 (44.6%) patients (control group), complex conservative and general surgical treatment was performed. In this group, 19 (28.8%) patients had large amputations at the level of the lower leg and thigh. In 47 (71.2%) patients, it was possible to preserve the supporting function of the limb. In dynamics, the parameters of hemostasis (fibrinogen, fibrinolytic activity, fibrin degradation products, antithrombin-III activity) and hemorheology (deformability of erythrocytes-DE, von Willebrand-FV factor, thrombo-leukocyte aggregates - TLA) were studied. Indicators of hemostasis and hemorheology parameters were compared with identical parameters of 48 practically healthy individuals ("reference group"). **Results:**. Upon admission to the clinic in patients with OT in the CI stage, a sharp change in hemostasis towards hypercoagulation and a deterioration in hemorheology were detected. The inclusion of VLOK in the complex of therapeutic measures in the perioperative period with indirect revascularization led to the leveling of all indicators of the coagulation system ($p<0.01$-0.001; $r = 0.3 - 0.5$) and hemorheology (for DE - $p<0.001$; $r = 0.5$; for FV - $p<0.01$; $r = 0.4$ and for TLA - $p<0.001$; $r = 0.6$). **Conclusions.** The use of ILIB together with standard treatment in the perioperative period with indirect revascularization reliably corrects hemostasis and hemorheology in patients with OT in the CI stage.

Аннотация

Цель: Изучить изменения гемостаза и гемореологии у больных с облитерирующим тромбангиитом (ОТ) в стадии критической ишемии (КИ) и возможности их коррекции с применением внутривенного лазерного облучения крови (ВЛОК) в периоперационном периоде при непрямой реваскуляризации. **Материал и методы исследования:** Проведено проспективное контролируемое клиническое исследование у 135 больных с ОТ в стадии КИ. Из-за невозможности проведения шунтабельных операций 69 больным (основная группа) была проведена непрямая реваскуляризация: поясничная симпатэктомия и реваскуляризирующая остеотрепанация в отдельности и в соечетании. Большая ампутация выполнена у 3 пациентов. В основной группе в периоперационном периоде одновременно со стандартным лечением проводилось ВЛОК. В этой группе у 66(95,7%) пациентов удалось сохранить опорную функцию конечности. У 66(44,6%) пациентов (контрольная группа) проводилось комплексное консервативное и общехирургическое лечение. В этой группе у 19(28,8%) пациентов выполнены большие ампутации на уровне голени и бедра. У 47(71,2%) пациентов удалось сохранить опорную функцию конечности. В динамике изучали параметры гемостаза (фибриноген-Ф, фибринолитическая активность-ФА, продукты деградации фибрина-ПДФ, активность антитромбина –III- АА - III) и гемореологии (деформабельность эритроцитов-ДЭ, фактор Виллебранда-ФВ тромбо-лейкоцитарные аггрегаты – ТЛА).Показатели параметров гемостаза и гемореологии сравнивали с идентичными параметрами 48 практически здоровых лиц («референсная группа»). **Результаты**. При поступлении в клинику у больных с ОТ в стадии КИ выявлено резкое изменения гемостаза в сторону гиперкоагуляции и ухудшение гемореологии. Включение ВЛОК в комплекс лечебных мероприятий в периоперационном периоде при непрямой реваскуляризаии приводило к нивелированию всех показателей свертывающей системы ($p<0,01$-$0,001$; $r = 0,3 – 0,5$) и гемореологии (для ДЭ – $p<0,001$; $r =0,5$; для ФВ - $p<0,01$; $r =0,4$ и для ТЛА - $p<0,001$; $r =0,6$). **Вывод.** Использование ВЛОК вместе с стандартным лечением в периоперационном периоде при непрямой реваскуляризации достоверно коррегирует гемостаз и гемореологию у больных с ОТ в стадии КИ.

Keywords: thromboangiitis obliterans, critical ischemia of the lower extremities, indirect revascularization, hemostasis, hemoreology, intravenous laser irradiation of blood.

Ключевые слова: облитериующий тромбангиит, критическая ишемия нижних конечностей, непрямая реваскуляризация, гемостаз, гемореология, внутривенное лазерное облучение крови.

Облитерирующие заболевания встречаются у 3% населения. Прогрессирование стено-окклюзирующего процесса артерий приводит к развитию критической ишемии нижних конечностей(КИНК) в 35-65% случаев [9]. В патогенезе развития КИНК немаловажную роль играют нарушения в системе гемостаза и гемореологии. Тяжелая степень хронической ишемии конечности характеризуется активацией прокоагулянтной и угнетением антикогулянтной системы, нарушением гемореологии [3,8,10,16]

Вопросы лечения больных с КИНК остается актуальной проблемой сосудистой хирургии. Прямые методы реваскуляризации остаются приоритетными в хирургическом лечении больных с КИНК. При дистальном поражении артерий и невозможности проведения шунтабельных операций для сохранения конечности, как альтернатива к ампутации, применяются непрямые методы реваскуляризации. Эффективность непрямых методов реваскуляризации во многом зависить от степени стимуляции периферического кровообращения и улучшения микроциркуляции в результате нормализации нарушений гемостаза и гемореологии , коррекция которых проводится антикоагулянтами, антиагрегатными препаратами и немедикаментозными способами [5,9]. В литературе имеются сообщения об эффективности применения внутривенного лазерного облучения крови (ВЛОК) в комплексном лечении больных с заболеваниями

периферических артерий и критической ишемией нижних конечностей [1,2,4,5,6,7].

Цель исследования. Изучить изменения гемостаза и гемореологии у больных с облитерирующим тромбангиитом (ОТ) в стадии критической ишемии (КИ) и возможности их коррекции с применением ВЛОК в периоперационном периоде при непрямой реваскуляризации.

Материал и методы исследования. Проведено проспективное контролируемое клиническое исследование. На проведение данного исследования было получено разрешение Этического комитета Научного Центра Хирургии им. акад. М.А. Топчубашова. Все пациенты перед началом лечения были ознакомлены со всеми аспектами хирургического лечения и перед включением в него подписали соответствующее информационное согласие.

Исследование проводилось у 135 больных с ОТ в стадии КИ , находившихся на стационарном лечении в отделении сосудистой хирургии Научного Центра Хирургии им.акад.М.А Топчубашова, в возрасте от 28 до 59-х лет. Мужчин -128(94,8%), женщин – 7(5,2%). Длительность развития критической ишемии составляла от 2-х мес. до 6-хлет. У всех больных диагностирована III - IV степень хронической ишемии по классификации Fontane-Покровского. Неинвазивными методами исследования и мультиспиральной компютерно-томографической ангиографией у всех больных выявлена нереконструктабельная окклюзия бедренно-подколенно- тибиального и тибиально-стопного сегментов артерий.

Из-за невозможности проведения шунтабельных операций 69 больным (основная группа) была проведена непрямая реваскуляризация: ПСЭ у 27 пациентов; ПСЭ с малой ампутацией у 17 пациентов; ПСЭ с большой ампутацией у 3 пациентов; ПСЭ + РОТ у 16 пациентов; РОТ у 6 пациентов. В основной группе в периоперационном периоде одновременно со стандартным лечением проводилось внутривенное лазерное облучение крови(ВЛОК). ВЛОК проводилось аппаратом «Мустанг 2000» в следующих параметрах: длина волны -0,063 мкм, мощность лазерного излучение в конце световода - 5 мВт, экспозиция – 30 мин., курс лечения -10-12 сеансов. В этой группе у 66(95,7%) пациентов удалось сохранить опорную функцию конечности.

У 66(44,6%) пациентов (контрольная группа) из-за отказа больных от непрямой реваскуляризации и при наличии противопоказаний к этим операциям проводилось комплексное консервативное и общехирургическое лечение. В этой группе у 33(50%) пациентов выполнены малые ампутации (экзартикуляция пальцев с резекцией головки плюсневых костей, трансметатарсальная ампутация), у 19(28,8%) пациентов - большие ампутации на уровне голени и бедра. У 14(21,2%) пациентов некротическая рана на стопе зажила. В этой группе в ближайшем периоде удалось сохранить опорную функцию конечности у 47(71,2%) пациентов. В контрольной группе в периоперационном периоде проводилось стандартное лечение.

По длительности и степени хронической ишемии, по возрасту и полу, по характеру стено-окклюзий артерий и сопутствующих заболеваний обе группы были сопоставимы.

При поступлении в клинику и в конце стационарного лечения нами изучены параметры гемостаза [фибриноген (Ф), фибринолитческая активность(ФА), продукты деградации фибрина(ПДФ), активность антитромбина- III(АА- III)] и гемореологии [деформабельность эритроцитов(ДЭ), фактор Виллебранда (ФВ), тромбо-лейкоцитарные агрегаты (ТЛА) в периферической крови].

Полученные данные были обработаны с вычислением средней арифметической (М) , ее средней ошибки (m), коэффициента корреляции (r) и критерия согласия Пирсона (x^2) при уровне доверительной вероятности Р=0,95 (p<0,05**)**.[12,17].

Результаты и их обсуждение. При поступлении в клинику , в сравнении с показателями референсной группы, у больных с ОТ в стадии КИ наблюдали активацию прокоагулянтной системы и угнетение противосвертывающей системы. (Табл.1). Так, у больных обеих клинических групп наблюдали резко выраженное повышение уровня Ф соответственно на 40,9% (p < 0,05), 42,5%(p < 0,05), ПДФ – соответственно на 2,33 раза (p < 0,05), 2,4 раза (p < 0,05), зафиксировано резкое уменьшение уровня ФА соответственно на 39,8%(p < 0,05), 39,7% (p < 0,05), АА-III – соответственно на 24,5% (p < 0,05). 23,1% (p < 0,05).

В контрольной группе больных перед выпиской из стационара констатирована незначительная положительная динамика коагулологических показателей. Так, наблюдали тенденцию к уменьшению уровня показателей Ф, ПДФ соответственно на 7,3% (p>0,05),14,3% (p>0,05), тенденцию к увеличению уровня ФА., АА-III соответственно на

Таблица 1

Динамика показателей гемостаза в зависимости от характера лечения в периоперационном периоде при непрямой реваскуляризации (M±m;p<0,05) (M±m; p<0,95

Группы исследования / Показатели	Референсная группа n=48	Контрольная группа n=66		Основная группа n=69	
		А	Б	А	Б
Фибриноген(мг/л)	12,7±1,1	17,9±1,4	16,6±1,2	18,1±1,5	14,2±1,3*
Фибринолитическая активность (%)	12,1±1,0	7,4±0,4	8,6±0,6*	7,3±0,3	9,2±0,5*
Продукты деградации фибрина(мкг/л)	8,4±0,75	19,6±1,6	16,8±1,3	20,2±1,7	12,4±1,4*
Активность антитромбина-III (%)	100,8±8,1	76,1±5,9	81,3±6,2	77,5±5,6	93,2±6,1*

Примечание : контрольная группа - проводение стандартной терапии; основная группа -проведение стандартной терапии + внутривенное лазерное облучение крови.

А – результаты при поступлении в клинику; Б – результаты в конце стационарного лечения;

*-Изменение показателей внутри группы при поступлении и в конце стационарного лечения по горизонтальной линии статистически достоверно(p <0,05).

16,2% (p<0,05) , 6,8% (p>0,05) (Табл. 1). В основной группе больных отмечено достоверное нивелирование показателей гемостаза. В сравнении с исходными данными в конце стационарного лечения наблюдали снижение уровня Ф и ПДФ соответственно на 21,5% (p<0,05), 38,7% (p<0,05), нарастание уровня ФА., АА-III соответственно на 26,0% (p<0,05), 20,3%(p<0,05)

Нами проведена статистическая обработка с вычислением коэффициента корреляции (r) и критерия согласия Пирсона (x^2) при уровне доверительной вероятности P=0,95 (p<0,05).(Табл.2).

Таблица 2

Взаимосвязь изменения показателей гемостаза с характером лечения в периоперационном периоде при непрямой реваскуляризации(χ^2; p; r)

Показатели \ Группы исследования		Контрольная группа n=66	Основная группа n=69	
Фибриноген	уменьшен	32	51	χ^2=9,210 p<0.01 r=0,3
	без изменения	34	18	
Фибринолитическая активность	повышен	31	53	χ^2=12,780 p <0,001 r=0,5
	без изменения	35	16	
Продукты деградации фибрина	уменьшен	29	52	χ^2=13,878 p <0,001 r = 0,5
	без изменения	37	17	
Активность антитромбина-III	повышен	31	50	χ^2=9,135 p <0,01 r = 0,3
	без изменения	35	19	

Примечание. Контрольная группа - проведение стандартной терапии; Основная - проведение стандартной терапии + внутривенное лазерное облучение крови.

Как видно из таблицы, связь между всеми показателями гемостаза и характером лечения в периоперационном периоде при непрямой реваскуляризации статистически значима (p<0,01 – 0,001) и между ними имеется средняя корреляция(r=0,4-0,6). В основной группе с АА-III и характером лечения в периоперационном периоде имеется слабая корреляционная связь(r = 0,3).

При поступлении в клинику в сравнении с показателями «референс»ной группы у больных всех клинических групп (контрольная и основная группы) наблюдали выраженное нарушение гемореологии : уменьшение ДЭ соответственно на 24,9% (p<0,05), 27,0% (p<0,05), повышение ФВ – соответственно на 20,6% (p<0,05), 21,2% (p<0,05), ТЛА в периферической крови выявлены соответственно у 62(93,9%) и 65(94,2%) больных.

При повторном исследовании у больных контрольной группы повышение ДЭ (на 6,3%) оказалось недостоверной (p>0,05), а у больных основной группы ДЭ достоверно (p<0,05) повысилась на 21,7% (p<0,05) Табл.3). При повторном исследовании у пациентов контрольной группы наблюдали только тенденцию в коррекции ФВ (уменьшение на 6,7% ; p>0,05), а у контингента основной группы - умеренное (на 13,5%) , но достоверное уменьшение (p<0,05). В контрольной и основной группах перед выпиской из стационара при повторном исследовании ТЛА в периферической крови обнаружены соответственно у 41(62,1%) и 17(24,6%) больных.

Таблица 3

Динамика показателей гемореологии в зависимости от характера лечения в периоперационном периоде при непрямой реваскуляризации (M±m; p<0,05)

Показатели \ Группы исследования	Референсная группа n=48	Контрольная группа n=66		Основная группа n=69	
		А	Б	А	Б
Деформабельность эритроцитов(%)	1,89±0,16	1,42±0,11	1,51±0,13	1,38±0,11	1,68±0,15*
Фактор Виллебранда (%)	114,8±9,9	138,5±6,6	129,2±5,9	139,1±7,2	120,3,2±6,9*
Тромбо-лейкоцитарные аггрегаты	у 3(6,3%) больных	у 62(93,9%) больных	у 41(62,1%) больных	у 65(94,2%) больных	у 17(26,2%) больных

Примечание :контрольная группа - проведение стандартной терапии; основная группа - проведение стандартной терапии +внутривенное лазерное облучение крови ;

А – результаты при поступлении в клинику; Б – результаты в конце стационарного лечения;

*-изменение показателей внутри группы при поступлении и в конце стационарного лечения горизонтальной линии статистически достоверно(p <0,05).

Таблица 4

Взаимосвязь изменения показателей гемореологии с характером лечения в периоперационном периоде при непрямой реваскуляризации (χ^2; p; r)

Показатели \ Группы исследования		Контрольная группа n=66	Основная группа n=69	
Деформабельность эритроцитов	повышена	28	53	χ^2=16,621 p<0.001 r=0,5
	без изменения	38	16	
Фактор фон Виллебранда	уменьшен	24	44	χ^2=10,134 p <0,01 r=0,4
	без изменения	42	25	
Тромбо-лейкоцитарные аггрегаты	обнаружен	41	17	χ^2=19,341 p <0,001 r = 0,6
	не обнаружен	25	52	

Примечание. Контрольная группа - проведение стандартной терапии; Основная группа - проведение стандартной терапии + внутривенное лазерное облучение крови.

Для каждого параметра вычисляли коэффициент корреляции (r) и критерию согласия Пирсона (x^2) при уровне доверительной вероятности P=0,95 (p<0,05). В основной группе получены следующие данные: для ДЭ , ФВ и ТЛА соответственно r = 0,5, χ^2 =16,621, p<0,001; r = 0,4, χ^2 =10,134, p<0,01 ; r = 0,6, χ^2 =19,341, p <0,001(Табл.4).

Таким образом, связь между показателями ДЭ, ФВ и ТЛА в основной группе и характером лечения в периоперационном периоде при непрямой реваскуляризации статистически значима , имеется средняя корреляционная связь.

У больных с ОТ в стадии КИ выявлены гиперкоагуляция и ухудшение гемореологии, причем более выраженное нарушение отмечено у больных с поражением артерий бедренно-подколенного , подколеннно-берцевого сегментов артерий и с тяжелыми сопутствующими патологиями. Изменения системы гемостаза и гемореологии у больных облитерирующими заболеваниями артерий и критической ишемией нижних конечностей и результаты коррекции этих нарушений были идентичны с изменениями этих показателей, выявленные при исследованиях других авторов [3,13,14,16]. Активация прокоагуляционного и угнетение антикоагулятного звена гемостаза, ухудшение реологического статуса, нарушение других параметров гомеостаза крови сопровождается прогрессированием облитерирующего процесса в артериях, усугублением степени ишемии в результате нарушения микроциркуляции [3,10,11] **,** которые приводят к развитию осложнений в мягких тканях в виде некроза. Применение ВЛОК в периоперационном периоде при непрямой реваскуляризации у больных с ОТ в стадии КИ достоверно нивелирует показатели гемостаза и гемореологии [1,3,4,5,6]. Сбалансирование прокоагулянтного и антикоагулянтного звена гемостаза, положительная динамика в гемореологии способствуют увеличению числа функционирующих сосудов микроциркуляторного русла [15], улучшению перфузии тканей и нарастанию кислородного снабжения тканей в ишемизированной конечности.

Выводы. 1. Использование ВЛОК в периоперационном периоде при непрямой реваскуляризации для коррекции показателей гемостаза и гемореологии у больных с ОТ в стадии КИНК является патогенетически обоснованным.

2. Достоверное нивелирование показателей гемостаза и гемореологии , наличие корреляционной связи между изменениями изученных параметров и фактором, влияющий на них, позволяют рекомендовать динамику этих показателей как обьективную критерию эффективности коррекции у больных с ОТ в стадии КИ.

Konflict of interests

The autores state that this work, its theme, subject and content do dont affect competing interests

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HIGH-FREQUENCY AUDIOMETRY IN THE DIAGNOSIS OF PATIENTS WITH TINNITUS

Suvorkina A.,
Odessa National Medical University
Otolaryngologist of the department of Otorhinolaryngology
Valyhovsky lane, 2, Odessa, Ukraine
Suvorkina O.
Audiologist of Odessa Medical Hearing center
Shevchenko Prospect, 27, Odessa, Ukraine
DOI: 10.5281/zenodo.7142872

Abstract

This study describes the problem of tinnitus, the perception of sound in the absence of any objective physical sound source. Hearing loss is an important risk factor of tinnitus. Therefore, it is very important to use all available resources in the early stages of diagnosis.

But a large number of patients with tinnitus have normal hearing thresholds on pure tone audiometry in the standard frequency range (125 Hz – 8000 Hz). In our study, we used high-frequency audiometry in an extended range from 9,000 Hz to 20,000 Hz. Our research shows that high-frequency audiometry provides additional information in patients with tinnitus who have a normal standard audiogram. Therefore, we recommend the use of high-frequency audiometry in the early stages in the algorithm for diagnosing high-frequency tinnitus for further correct management of patients with tinnitus, which will improve their quality of life.

Keywords: tinnitus, high-frequency audiometry, extended frequency range, hearing loss, quality of life

Introduction. Tinnitus is a widespread problem of the 21st century according to rising rhythm of life and increasing acoustic load. Based on literature data, about 10-15% of the adult population complains of tinnitus [1]. Tinnitus is a noise in the ears, often described by patients as ringing, whistling or buzzing. It is a complex symptom defined as the perception of sound that does not have an objective, appropriate external source. It is subjective since the sound can only be heard by the patient and there are no objective measures to determine its presence or measure it. Tinnitus is often accompanied by depression and anxiety disorders, which negatively affects the quality of life and functional state of health of patients [2]. To estimate the impact of tinnitus on a person's quality of life, various questionnaires are used (Tinnitus Handicap Questionnaire, Tinnitus Handicap Inventory (THI) , Tinnitus Functional Index, Tinnitus Primary Function Questionnaire) [3].

The most common cause of noise is hearing loss, since the frequency spectrum of noise most often corresponds to the frequency range of hearing loss [4,5,6]. However, in such cases, disturbance is usually detected using traditional tone audiometry in the frequency range from 125 Hz - 8 kHz, which is the most important spectrum for speech understanding and is determined by air and bone conduction using bone vibrator headphones respectively, which cannot exclude damage of hair cells in the extended high-frequency spectrum [7]. There are studies describing HF audiometry, but normative data are still absent [8]. Existing researches show that threshold measurement in an extended high frequency range is used for early detection of hearing loss, monitoring of auditory function in people working in noise and predisposition to developing occupational sensorineural hearing loss; in patients treated with ototoxic drugs [9].

The aim of this study was to find out whether the results of HF audiometry would provide any additional clinically relevant information in patients with normal hearing thresholds in the standard range up to 8000 Hz. In examining ща patients with tinnitus complaints in the high frequency range (“crickets in the ears”, cicadas, the sound of a broken TV), we used high-frequency audiometry.

Materials and methods. From September 2020 to January 2022 we examined 75 patients (35 women and 40 men) with complaints of high-frequency tinnitus. The average age was 37.25. Selection criteria: age up to 50 years, complaints of high-frequency tinnitus (whistling, ringing) with normal tone audiometry thresholds up to 8000 Hz, > 38 points on the THI questionnaire scale, normal tympanometry parameters (Tympanogram type A, registration acoustic reflex).

We divided the patients into 3 groups:

In the first group, we examined 25 patients - 33.3% of the total. The average age in the group was 35.8. All 25 people complained of high frequency tinnitus. We excluded the professional factor of increased acoustic load at work. At the same time, in the first group, we identified 2 subgroups: a) patients with unilateral noise and b) patients with bilateral noise. The second group consisted of 27 people with complaints of tinnitus in both ears (36%) with an average work experience in conditions of increased acoustic load of 5 years. The average age in the group was 37.2. In the third group, we included 18 volunteers without complaints with normal average hearing thresholds in the frequency range from 125 Hz to 8000 Hz, whose average age was 32.5. All patients filled the Tinnitus Handicap Inventory questionnaire, the results of which were estimated using the Tinnitus Handicap Inventory Severity Scale.

We also included tympanometry and acoustic reflex testing in the algorithm of examination to exclude the conductive component. All patients underwent pure tone audiometry in the traditional range from 125 Hz to 8000 Hz, as well as high-frequency audiometry in the range from 9000 to 20000 Hz. Pure tone audiometry

was performed using an AD629 audiometer. The average hearing thresholds for air and bone conduction were determined by the standard method in the frequency range from 125 Hz to 8000 Hz. Extended high-frequency audiometry was carried out in a complex manner using the AD629 audiometer and DD450 high-frequency headphones. The reduction in hearing thresholds was approved when reaching a level of 20 dB at one or more frequencies.

Results. We found that all 75 patients with tinnitus had normal hearing thresholds on the audiogram in the standard range of 125 Hz to 8000 Hz (<15 dB). High frequency audiometry in patients of the first group with complaints of unilateral tinnitus revealed reduction in hearing thresholds in the range from 9000 to 20000 Hz on the affected side, and the tone of disturbing noise coincided with the corresponding frequency. The average hearing threshold was 27.26 ± 12.25. The highest hearing thresholds were noted at frequencies of 14000-16000 Hz (Fig. 1).

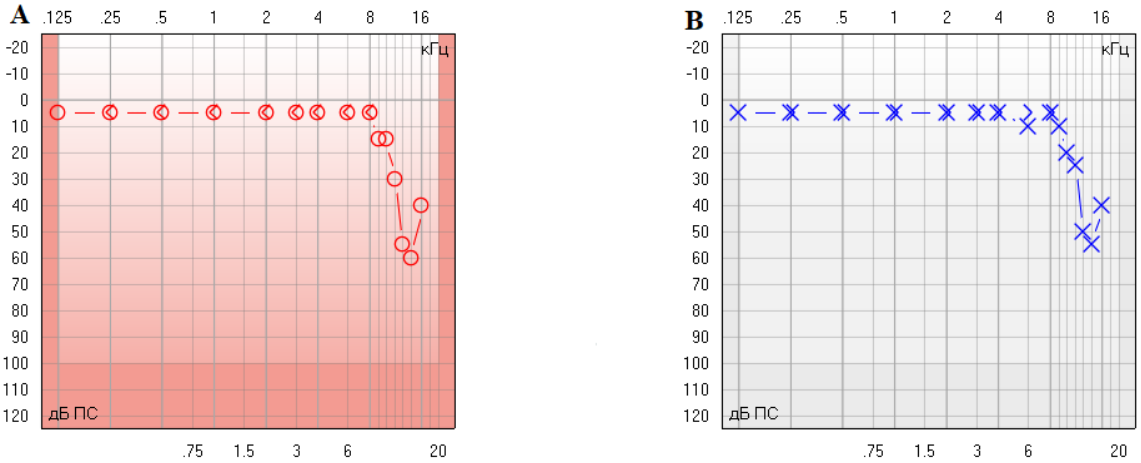

Fig.l.A. High frequency audiogram of right sided tinnitus with normal thresholds on the left ear. B. High frequency audiogram of left sided tinnitus with normal thresholds on the right side.

In the group with bilateral noise decrease of the average thresholds was observed on both sides and riched to 35.79 ± 6.74, and the patients also noted that the sound of the applied signal at the most affected frequency "merges" with its own noise and causes the greatest subjective difficulty in the examination process. The highest hearing thresholds were also noted at frequencies of 14000-16000 Hz.

In the second group of patients who had experience of working in noisy conditions, there was also decrease of the average threshold of audibility of high frequencies on both sides amounted to 42.25 ± 10.12. We received the highest hearing thresholds at frequencies of 12000 Hz, 14000 and 16 Hz (Fig. 2 A). In 12 people of the second group, hearing thresholds at frequencies of 18 kHz and 20 kHz were not recorded (16% of the total number of examined).

In the third control group, patients showed normal average hearing thresholds in the extended high frequency range - 2.28 ± 1.84 (Fig. 2 B).

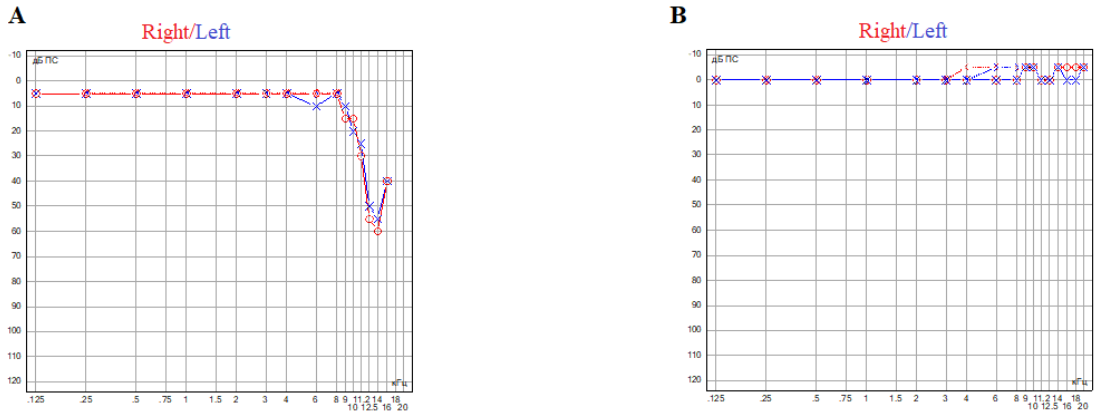

Fig. 2.A. High frequency audiogram with the highest hearing thresholds at frequencies of 12000 Hz. 14000 and 16 Hz. B. High frequency audiogram with normal average hearing thresholds in the extended high frequency range.

Thus, our studies confirm that HF audiometry is more sensitive for diagnosing hearing loss than standard audiometry. We also found a relationship between the character of noise in one ear and the laterality of tinnitus. Patients with left-sided tinnitus also have more expressed HF audiometry changes on the left ear, while patients with right-sided tinnitus have reduced thresholds in HF range on the right ear. Correspondence between the laterality of the noise and the asymmetry of the impairment confirms opinion that hearing loss is involved in the formation of tinnitus and proves the relevance of high-frequency audiometry in the diagnosis of tinnitus.

Conclusions. Thus, we not only demonstrate well known relationship between the presence of tinnitus and hearing loss. In our study, we also note the relationship between laterality and height of tinnitus, which is important in the early stages of diagnosis to prevent the progression of the process and adequate correction tactics, which will be the goal of our next study. In tinnitus patients with normal thresholds, high-frequency tonal audiometry provides additional information. Also, the relationship between the directionality and tone of tinnitus suggests a possible causal role for high-frequency hearing loss in the etiopathogenesis of tinnitus. Therefore, we recommend the use of high-frequency audiometry in the early stages of tinnitus diagnosis. This allows early correction which will improve the quality of life of such patients.

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PHILOLOGICAL SCIENCES

VIEWS ABOUT GLOBAL ENGLISH AND DETERMINANTS OF ITS USAGE

Farhadova Saadat K.D.
PhD candidate, Khazar University Azerbaijan
Address: Azerbaijan, Baku, 54
Mammad Rahim st. house 3, apt. 29
DOI: 10.5281/zenodo.7142886

ГЛОБАЛЬНЫЙ АНГЛИЙСКИЙ ЯЗЫК И ДЕТЕРМИНАНТЫ ЕГО ИСПОЛЬЗОВАНИЯ

Фархадова Саадет К.Д.
Кандидат наук, Университет Хазар, Азербайджан
Адрес: Азербайджан, Баку, 54
Мамед Рахим ул. дом 3, кв. 29

Abstract

Global English embraces some factors that facilitate to its harmonic usage over the individual world countries. From this point, “lingua franca” has become a common communication device for the hundred millions of people. Nevertheless, recently there have also emerged some counteracting opinions on the extensive usage of English language by carriers of mother tongue. Such situation urges some language centers to more properly investigate the “factor analyses” of Global English determinants. The article makes some necessary theoretical and practical investigations to find out the major identifiers of Global English usage.

Аннотация

Глобальный английский включает в себя некоторые факторы, которые способствуют его гармоничному использованию в отдельных странах мира. С этой точки зрений, «lingua franca» стал наиболее общим средством общения сотен миллионов людей. Тем не менее, в последнее время появились и противоположные мнения о широком использовании английского языка носителями родного языка. Такая ситуация побуждает некоторые языковые центры более тщательно исследовать «факторный анализ» детерминантов Global English. В статье проводятся некоторые необходимые теоретические и практические исследования, чтобы выяснить основные детерминанты использования глобального английского языка.

Keywords: Global English, determining factors of a language use, ESP-EAP-EFB, history of ESL, language policy, contextual analysis of various purpose language usage

Ключевые слова: Глобальный английский, определяющие факторы использования языка, ESP-EAP-EFB, история ESL, языковая политика, контекстуальный анализ употребления языка в различных целях

Evidently language is considered a decisive or guiding factor in determination of national identity, formation of national culture, political will, national unity and some other national characteristics. However, the importance of national language does not eliminate the necessity of the second and sometimes the third language. That is, in the process of formation of each national language it may sometimes be needed to develop another, second language, for example English, along with the native tongue. In this regard, these days English is used by a number of nations as a global language as well as their mother tongue. It is rightly noted that "if we look through the statistics, we will see that despite the fact that English is the 3rd language after Chinese and Spanish in terms of its usage as a mother tongue, as it is considered a global language" [1, p.65]

There is no official definition for the "global" or "world" language, but anyway it essentially refers to a language learned and spoken internationally and which is characterized not only by the number of native and second language speakers, but also by its geographic location. Global English acts as a 'lingua franca', as a common language that allows people with different backgrounds and ethnicities to communicate on a more or less equitable basis. However, are these the only conditions making this language global? Let us much closely approach the the essence of the matter. It is evident that, in any way, a personality's need for identity consists of the desire (conscious or unconscious) to use "own" language for communication purpose, which is acquired naturally in the first years of one’s life. Such a language is habitually called as a mother tongue or a native language (the latter term may also have some other meanings). However, it is also a fact that "sameness" – monolingualism is considered the limiting case for satisfying such a need. Therefore, the concept of any language contact or the second language- bilingualism, is considered to be a socio- historical phenomenon that develops due to practical needs.

Since a language development is a dynamic process, it is not affected only by inevitable changes occurring within a language the language frame, a country or a group of languages, i.e. by intra linguistic changes, but also it gets affected by all the spectra of life and the course of general global economic and political trends. That is, along with the development of the mother

tongue itself, in the process of people's struggle for life and livelihood the conditions for triggering the usage of global language also get realized. It is the most universal means for self-expression of people. "A person who is a part of a certain society, who lives there or simply defines his/her existence, uses language, which is the most convenient tool to express his attitude to what is happening in society" [5, p.189]

However, which factors do become determining the dynamics of a language development? Do these factors always remain the same? It is inevitable that these conditions and factors can change since the formation and developmental dynamics of the language are unambiguously related to the situations conditioned by concrete socio-historical realities of a certain society. If in the past military factors were more effective in the expansion of the scale of the English language, these reasons can already be explained on rather a different level than these factors in the new development stage. In modern times, one of these reasons is that it is "taught as a second language more than other languages" [1, p.66]. Apparently, as a result of expansion the limits of global status of the English language, it has already become to strengthen its communicative, economic and technological capabilities. That is, "English has become a global language and more than 380 million people nowadays speak it as a first language and more than 200 million people take it as a second language, where another billion people are in the process of learning curve of this language" [2, p.1]. So, although English is mainly accepted as a means of communication in Western countries such as the United States, Canada or Great Britain, globalization, especially in the economic sector, has already turned English into a tool that facilitates to communication among people with different backgrounds and must.

The use of English is not the same in every country. "People in some countries (like the USA, Canada, England, etc.) grow up with it as their mother tongue, while others (like Ghana, Singapore, or India) benefit from this in addition to their mother tongue because English is used in their governments, laws, and it is important for the media and education system in their countries as a whole. And in the third group of countries (such as China, Germany, Russia or Spain), English is studied as the main foreign language in schools" [3, p.5]. For example, as a result of the rapid development of Azerbaijan in the recent years the widespread use of the English language, in turn, has also influenced the migration flow to this country. It is rightly noted that nowadays "Azerbaijan is also becoming a country of last destination for an increasing number of foreign citizens and stateless persons" [4, p.1].

Apparently, the factors in the cause-and-effect chain such as geographical, military-political, communicative advantages, migration of people to other countries for education that necessitate transformation of English into a global language start more and more rigorously serving as globalizing conditions for the prioritized usage of English in the educational sector which is now may also be counted as a major impactful force. Perhaps, English has already become the world's language of communication, as it is widely used in various sectors; for example, in trade, technology, politics, and diplomacy. However, these spectra effect on this globalization process by different ways, where loss of cultural identity is considered one of the main resulting effects associated with globalization of English. At present, English as a global language has one form of influence on the language acquisition and cultural identity of people who adopt it as a second language in Africa and in the third world countries in Asia, and it has another form of impact in European countries.

Thanks to the harmonic language policy in Azerbaijan, the national language formation and some major related to this implementation processes in these directions have always been in the focus of attention by the government of Azerbaijan resulting in establishing the important economic, political and legal bases in the field of comprehensive usage of English language along with Azerbaijani. Because of thoughtful measures, Azerbaijan could preserve the harmonic development and coexistence of English, other languages and mother tongue. In the Decree of the President of the Republic of Azerbaijan dated April 9, 2013 No. 2837 on the approval of the "State Program on the use of the Azerbaijani language in accordance with the requirements of time and the development of linguistics in the country" it is noted that "for foreign citizens learning the Azerbaijani language and those Azerbaijanis who want to learn a foreign language provisions by more intensive preparation of educational materials" should be considered as one of the important measures [6]. As a result of the conducted correct and targeted language policy, many empirical works and conceptual efforts aimed at the research of English and Azerbaijani languages during the last twenty or thirty years, English has been accepted as a "lingua franca" (ELF). That is, as a common language among speakers of different mother tongues where there is not any kind of suppression of the native language. Although the trend towards ELF (English as a Lingua Franca) has got strengthened, whether it is the phenomenon itself or research, its linguistic co-existence in communication has also harmoniously developed. However, with the expansion of the global language possibilities of the English language, there also have emerged some new trends in some parts of the world which is called as "anti-ELF" groups. These 'anti-ELF's' fall broadly into two camps: 1) those who dislike the ELF phenomenon as threatening 'standard' English (it is not clear what they mean by this vague term) and 2) those who see the growing tendency of ELF research paradigms. The first group includes mostly ELT (English Language Teaching) professionals, who propose a new monolithic type of English—a new global Standard English. Even today, in support to this some trends, web sites and blogs are proliferating in the expansion of the internet to identify key trends and take suggestions for the possibilities of British ELT. “Access to original materials and the potentials to use them to co-create content in English has recently been a real game changer which may be affected by their advice, but also by the surprise and confusion expressed from time to time" [7]. In this regard, issues such as teaching quality skills in the field of self-em-

ployment and learning meaningful work transition experiences for young people both inside and outside the South Caucasus the inequalities such as gender, class, disability and geographical origin have already become much widespread in research paradigms. Therefore, in order to study the factors that are potential to influence these statuses, the UK organizations, especially the Oxford University Language Centers have more rigorously started investigating the possible negative effects of the global English. For this purpose they are implementing some consistent and purposeful projects to contribute to the elimination process of these inequalities. Some scholars even argue that there are some conflicting interests between **the ethnic minorities' full participation in the dominant society and the preservation of their ethnic identity and ethnic group language**. However, it is also known that ethnic groups can fully participate in the dominant society and the individual mother tongues have the opportunity to preserve their heritage and language in a pluralistic society without assimilation for social mobility.

We believe that the study of English standards is taken for granted, but despite the global spread of English in any form, the very interpretation of ELF in two diametrically opposed ideological ways is a proof that both of these groups cannot be fully justified in their opinions to be right; and, actually, ELF researchers suggest that both of the above groups are wrong.

The role of ESP (English for Specific Purposes) is also important in the widespread use of English along with mother tongue. English for Specific Purposes is often treated as a purely pragmatic enterprise, a set of theoretical, methodologically grounded practice with only practical implications. No pedagogic practice is sufficient for learners to function independently beyond the language and learning, and hence ESP takes a clear theoretical stance on these issues with a long-term commitment to linguistic analysis, contextual relevance, and the pedagogical replication of community-specific communicative events.

Emerging in the 1970s with the development of a paradigmatic shift in the study of language for communication purposes, ESP used theoretical positions that offered the best advantages for practice and helped to further refine the field by analyzing the concerns that arose. That is why we can characterize ESP as a distinctive methodological approach that emphasizes a set of teaching patterns which recognize specific learner/student needs and the learner's subject matter expertise. Such definition provides an optimal environment for ESP to be taught for target groups to learn the language features, skills and genres, and this is considered a research base for the fields in terms of the need to define the different roles required by ESP practitioner in this endeavor. ESP practitioners try to take place in different cognitive, social and cultural contexts to exhibit literate activity, expand their language skills and demonstrate specific goals and understanding abilities in front of relevant field representatives with their activities. In this regard, ESP is closer to EAP (English for Academic Purposes) and EFB (English for Business) in terms of its teaching capabilities, but it is not the same as them. We can see these differences from the contextual analysis of those fields and the way people refer to specific pragmatic contexts during their activities. At this point, ESP needs to be taken out of context as a display of social behavior and become important as discourse and literate practice. By other words, we can instill the term ESP in students by helping them discover how certain valued textual forms and practices are socially constructed in response to the common communicative purposes of certain social groups, referring to them as "socio-literate," and raising their scientific consciousness. That is, here the different aspects manifest themselves in three facets: 1. in specific social contexts; 2. in concrete forms and purposes and 3. in the relations between the roles of the participants. Since we are not talking about methods and forms of teaching English for different purposes and pedagogical methods, we keep these areas open for further and new researches.

The experience of the 90s played a special role in turning these fields into the special research subjects in the West. In this regard, Carol Huckin, Thomas N. Berkenkotter tried to clarify many interesting points in their research work entitled "Genre Knowledge in Disciplinary Communication Cognition/culture/power". Here, the authors outline the theory of genre knowledge from a socio-cognitive perspective and then elaborate on how it works through several case studies involving various forms of academic discourse, including scholarly journal articles, academic conventions, and postgraduate writing assignments. Through a grounded, largely inductive approach, they developed their theoretical framework consisting of the following five principles:

"**Dynamism** - genres are dynamic rhetorical forms that develop from actors' responses to recurring situations. Genres change over time in response to the socio-cognitive needs of the user; **Situation** - genres arise from the user's participation in communicative activities and are part of it; **Form and Content** - genre knowledge includes both form and content, including the sense of which content is appropriate and based on a specific purpose, situation and time; **Duality and Structure** – users both construct and reproduce social structures as they use genre rules; **Community Property** – genre conventions indicate the norms, epistemology, ideology and social ontology of the discourse community" [8].

Research has always played a strong role in teaching of ESP, and at this time, the scholars see the teacher not only as a consumer of this research, an analyst of the events and contexts in which the texts are used, but also as a user of these analysis and methods. It is based mainly on discourse analysis influenced by cross-cultural issues, social constructivism and Systemic Functional Linguistics. Based on pedagogical decisions of these sources and analysis, the teacher is constantly trying to interpret how some particular aspect of the real communicative world works and translate these concepts into practical classroom applications.

In the 90s of the last century, various different approaches to language choice and learning English as a second language began to develop further. In the early 1990s, a public body in the English education system

made a number of policy statements (for a selection see Macaro, 1997, 2001). These statements confirmed that, for all intents and purposes, English was the students' first language. This document says that “the foreign language (besides English) should be banned in the classroom and teachers should use only the target language" [9, p.35].

In the various surveys we have conducted some investigations on the role of the attitude towards the English language in our society, wher we have witnessed the increasing interest in the English language along with the Azerbaijani language. Thus, when analyzing the results of an oral survey conducted with 100 foreigners temporarily residing in the Republic of Azerbaijan and whose mother tongue is English. In terms of formation of identity, preservation of their mother tongue, and the study of intercultural relations, it was found that the interest in the Azerbaijani language is also of a great importance and as their mother tongue is for the national identity. (See: Table 1).

Table 1

"When learning a foreign language, the native language helps to maintain my identity" (results of an oral survey conducted with 100 foreign citizens temporarily residing in the Republic of Azerbaijan whose native language is English)

Completely disagree	8
Disagree	4
Agree	47
Completely agree	40
Hard to answer	1
Total	100

Finally, the survey has also covered the situation of with the language usage with the children. (See: Table 2) It became clear that the coexistence of mother tongue and foreign language does not create a great deal of impediment in preservation of national identity. Moreover, in most cases the developed in harmony helping the kids to much easily integrate to the local or hosting community.

Table 2

Language used with children by national identity

Communicating to kids in English	More in Azeri than in English	More in English than in Azeri	Both lang-s equally	Total
English	9,5%	80 %	23,1%	18,3%
Both lang-s	35,7 %	20%	53,8%	38,3%
Only Azeri	54,8%	-	23,1%	43,3%
Total	100%	100%	100%	100%

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TECHNICAL SCIENCES

SCREW PILING MECHANISMS

Kakharov Z.V.,
Senior Lecturer of the Railway Engineering
Tashkent State Transport University.
Uzbekistan Tashkent
Islomov A.S.
Assistant of the Railway Engineering
Tashkent State Transport University.
Uzbekistan Tashkent
DOI: 10.5281/zenodo.7142894

МЕХАНИЗМЫ ДЛЯ ПОГРУЖЕНИЕ ВИНТОВЫХ СВАЙ

Кахаров З.В.,
ст. преподаватель кафедры «Инженерия железных дорог»
Ташкентский государственный транспортный университет
Узбекистан г.Ташкент
Исломов А.С.
ассистент кафедры «Инженерия железных дорог»
Ташкентский государственный транспортный университет
Узбекистан г.Ташкент

Abstract
This article discusses one of the most promising devices for driving screw piles today - the MV-85 screwing mechanism. The graphs of tests of small screw piles with a sufficiently large pull-out bearing capacity are given.
Аннотация
В данной статье рассмотрены одно из наиболее перспективных на сегодня устройств для погружения винтовых свай – механизм завинчивания МВ-85. Приведен графики испытаний винтовых свай малого с достаточно большой несущей способностью на выдергивание.

Keywords: screw piles, screw pile driving, low-rise building foundations, building bearing capacity.
Ключевые слова: винтовые сваи, погружение винтовых свай, фундаменты малоэтажных здании, несущей способность здания.

При небольшом объеме работ погружение винтовых свай может осуществляться тросовыми кабестанами с использованием лебедок трелевочных тракторов, автомобильных кранов и тягачей.

Но наилучшим способом зарекомендовали себя гидрокабестаны, способные развить крутящий момент более 100 кНм (10 тсм), и навешиваемые как сменное оборудование на экскаваторы (например, Е-14 (Е-18) с емкостью ковша 0,5 м^3) или иную строительную технику.

Как альтернатива гидрокабестану разработано одно из наиболее перспективных на сегодня устройств для погружения винтовых свай – механизм завинчивания МВ-85 (выпускается ОАО «Завод Стройдормаш», г. Алапаевск), представляющий собой редуктор с большим передаточным отношением и приводом от гидромотора и устанавливающийся в качестве навесного оборудования на краны, экскаваторы и краны манипуляторы.

На входном вале механизма установлен «патрон» для фиксации винтовой сваи и обеспечения ее свободного перемещения в процессе погружения. Управление механизмом вращения МВ-85 осуществляется с рабочего места оператора.

Для перемещения механизма вращения МВ-85 и сваи на точку погружения и отслеживания вертикального перемещения «патрона» применяется кран манипулятор с грузовым моментом 300 кН, установленный на шасси автомобиля Урал-4320. Имеется возможность установки МВ-85 и на другие виды кранов, экскаваторов и манипуляторов. Техническая характеристика устройств для погружения винтовых свай – механизм завинчивания МВ-85 приведены в табл.1.

Для случаев, когда необходимо бурение лидерных скважин под винтовые сваи или выполнение других видов буровых работ, конструкторской службой завода «Стройдормаш» предложено комплексное решение – универсальная бурильная машина УБМ-85, которая может выполнять шнековое бурение и завинчивание свай.

Таблица 1.

Техническая характеристика МВ-85

Максимальный момент при завинчивании сваи, кНм	85
Количество оборотов при завинчивании сваи, об./мин	10
Максимальный момент при бурении лидирующей скважины, кН/м	15
Количество оборотов при бурении лидирующей скважины, об./мин	60
Максимальная глубина погружения сваи, м	5-5,5,
Высота навесного оборудования, мм	2000
Масса навесного оборудования, кг	1500

Механизм вращения МВ-85 успешно применялся при возведении фундаментов под опоры контактной сети железных дорог и для строительства линии ВЛ 220 кВ.

Винтовые сваи малых диаметров привлекательны для возведения фундаментов в малоэтажном (дачном и коттеджном) строительстве. Их преимущество в сравнении с другими видами фундаментов не только в сокращении сроков работ (до нескольких дней), но и конкурентоспособной цене. Фундамент на винтовых сваях малого диаметра обходится заказчику в 1,5–2 раза дешевле, чем ленточный, не говоря уже о монолитной плите.

Оптимальным вариантом для фундаментов бревенчатых, панельных и каркасных домов являются сваи малого диаметра с лопастью 300 мм и стволом 108 мм. Они не требуют применения строительной техники, их вполне по силам завинтить вручную четырем рабочим [1].

Необходимо отметить, что винтовые сваи малого диаметра обладают достаточно большой несущей способностью, что наглядно доказывают графики испытаний свай на выдергивание, приведенные на рис. 1.

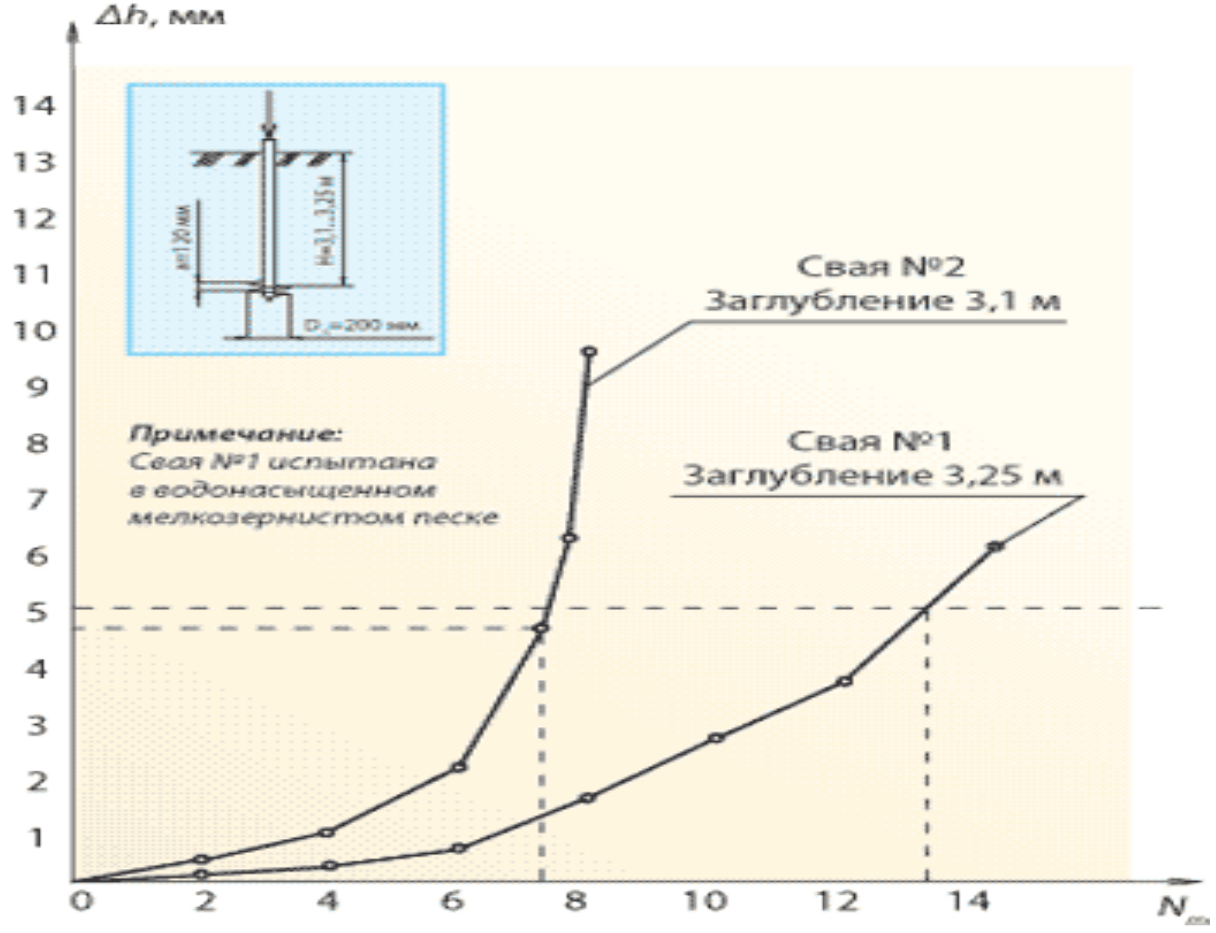

Рис. 1. График испытания свай на выдергивание в водонасыщенном песке.

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