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**RESULTS OF GEOCHEMICAL INVESTIGATIONS  
OF THE NORTH-EASTERN PART OF CASPIAN (OIL PRODUCTS  
IN THE DONAL DEPOSITS IN THE URAL RIVER)**

**Abstract.** This article examines the results of geochemical studies of the north-eastern part of the Caspian Sea and the determination of petroleum products in bottom sediments in the Ural rivers. The analysis of the concentrations of oil products, organ chlorine pesticides, polychlorinated biphenyls, synthetic surfactants and phenols in the landfill is given. The region of the Northern Caspian adjacent to the Kazakhstan coast was chosen as the study area. The area under investigation is characterized by a gentle slope of the bottom and a slow increase in depth. The soils here are mostly muddy and silt or sandy.

Seasonal fluctuations in the level of the Caspian Sea do not exceed a few dm. Northeast coast of the Caspian Sea is characterized by high surges.

The site of the research is unique both in geochemical and hydro-chemical regimes, and in hydro biological characteristics. Complex studies of the main geochemical, hydrological and hydro chemical characteristics at stations located at the surface and bottom of the sea were carried out. Observation of bottom sediments of the Eastern part of the Northern Caspian was carried out in the autumn and spring period, and it was revealed that the concentration of oil products in the bottom sediments in the fall period decreases compared to the summer period. In general, based on the results of the conducted studies, a preliminary conclusion can be drawn that the natural self-cleaning potential of the North Caspian is in a state of some kind of dynamic equilibrium with modern anthropogenic loads.

**Key words:** oil products, organ chlorine pesticides, polychlorinated biphenyls, phenol, concentration.

**Introduction.** Granulometric composition of bottom sediments. Bottom sediments in the study area are sufficiently monotonous and are represented by shells, sands, aleurites, rarely aleuropelites and their combinations. The formation of bottom sediments is dominated by processes of biogenic accumulation, terrigenous demolition and chemogenic precipitation. [1]

The biogenic component of the sediments under study, is mainly included in fractions > 0.25 mm. Fraction > 1 mm is represented mainly by whole shells of lamellar branch and gastropod mollusks and their fragments. Fraction 1.0 - 0.1 mm is composed of fragments of shells of mollusks and foraminifera. Shells of mollusks consist mainly of calcite with the presence of aragonite and dolomite. Biogenic formations have a predominant development. Shell and sand are different in their composition. Under the influence of waves, the shell often forms on the bottom of linear and patchy-banded clusters a few meters wide.

The sands are represented by coarse, medium and fine-grained differences (fractions 1-0.25, 0.25-0.1 mm predominate). In composition, these are mainly detrital formations with a small admixture of terrigenous minerals. Sands are usually present as a filler and do not form isolated fields.

**Methods of research.** Three well-known elements of the triangle of knowledge - education, scientific research, innovation - are often underestimated for the development of a successful economy. In addition, the combination and synchronization of these three different industries form the basis for economic success.

**The discussion of the results.** The terrigenous component of precipitation is concentrated mainly in silts (fraction 0.1-0.05 mm). It is represented by quartz, feldspar, fragments of rocks, secondary, accessory and ore minerals. Terrigenous deposits have a significant development within the Kashagan range. The most common mineral is quartz. [2]

Aleuro-pelitic fraction (<0.05 mm) is present as an impurity and does not form independent differences. The maximum values are confined to the north-eastern and north-western parts of the polygon. The third constituent of bottom sediments are chemogenic oolites, which are extremely rare at the landfill stations. [3]

Considering the lithological composition of the bottom sediments, it should be noted that representatives of all the listed genetic types have been found almost everywhere. This is also evidenced by the basic statistical characteristics (Table 1).

Table 1 - The main statistical characteristics of the content of granulometric fractions (%) of bottom sediments

Fractions	Amount	Maximum	Medium	Minimum
	25	31,14	7,98	0,46
Fractions 10-5 mm	25	38,27	6,87	0,40
Fractions 5-2 mm	25	43,79	17,20	1,62
Fractions 2-1 mm	25	35,02	7,45	0,37
Fractions 1-0.5 mm	25	33,90	10,48	0,61
Fractions 0,5-0,25 mm	25	28,11	5,90	0,62
Fractions 0,25-0,1 mm	25	85,49	28,46	1,28
Fractions 0,1-0,05 mm	25	43,71	8,72	0,41
Fractions <0.05 mm	25	25,06	6,94	0,01

#### Petroleum products in bottom sediments

Studies have shown that the ability of bottom sediments to adsorb oil within each of the granulometric types, in turn, is also due to their dispersity in the density and cohesion of the particles. Thus, according to the data obtained (Table 2), a noticeable

the relationship between the granulometric composition of bottom sediments and the content of hydrocarbons sorbed on them. [4]

The content of oil in bottom sediments decreases from clayey silts to loamy and sandy loam and from dusty sands to large silt. At the same time, an increase in the content of hydrocarbons in bottom sediments is combined with a decrease in their relative density and an increase in dispersion, despite the considerable porosity and looseness that is common to the sediments studied. The reason for the increased concentrations in finely dispersed bottom sediments is undoubtedly the fact that they have a large sorption surface and, consequently, the ability to retain sorbed substances. [5-7]

However, in the case of a disturbed structure of bottom sediments or other effects, the sorption values of each of the granulometric types can vary significantly under the influence of hydrometeorological factors (wave, flow), dredging and hydrotechnical work, which was repeatedly observed in natural conditions.

Table 2 - The content of hydrocarbons in various types of bottom sediments

Type of sediment	Number of definitions	Average hydrocarbon content, mg / g dry ground	The limit of hydrocarbon fluctuations, mg / g dry ground
II clayey	7	6,6	1,0-17,1
II loam	4	1,5	0,5-2,0
II sandy loam	17	0,9	0,3-2,2
The sand is large	2	0,2	0,1-0,2
Sand Medium	2	0,7	0,1-0,7
Sand fine	1	2,2	-
Sand silty	2	6,4	3,8-8,9

Elevated levels of oil products in the bottom sediments of the Kashagan structure are observed in the southeastern part of the test site, which may indicate either anthropogenic contamination of the soil or the inflow from deep horizons. To more accurately determine the nature of the appearance of a high concentration of petroleum products in bottom sediments, additional research is needed at this site. [8]

Phenols in the bottom sediments of the landfill. The content of phenols in the bottom sediments on the Kashagan structure, in most cases does not exceed the detection limit of 0.05 mg / kg. The main statistical characteristics are presented in Table 3.

Table 3 - Basic statistical characteristics of the content of petroleum products and phenols (mg / kg) in bottom sediments

Parameter	Maximum	Medium	Minimum
Petroleum products	10,30	5,20	0,90
Phenols	0,34	<0,05	<0,02

#### Organochlorine pesticides in sediments

The contents of organochlorine pesticides in April 2003 were in almost all cases below detection limits, except for  $\alpha$ -HCH and  $\gamma$ -HCH. The main statistical characteristics are presented in Table 4

Table 4 - Basic statistical characteristics of the content of organochlorine pesticides ( $\mu$ g / g) in bottom sediments

Parametr	Maximum	Medium	Minimum
$\alpha$ - HCH	0,0009	0,0004	0,0002
$\gamma$ - HCH	0,0040	0,0012	0,0002
Heptachlor	<0,0005	<0,0005	<0,0005
4,4- DDE	<0,0005	<0,0005	<0,0005
4,4- DDD	0,0030	<0,0005	<0,0005
4,4DDT	0,0030	<0,002	<0,002

#### Polychlorinated biphenyls (PCBs) in bottom sediments

No connection forms independent fields, so a total value was used to characterize the area.

Elevated levels of PCBs in bottom sediments are found in the southeastern and central parts of the landfill. These anomalies can be explained either by technogenic pollution of the soil, or by the inflow of PCBs from deep horizons. [9]

A feature of polychlorinated biphenyls (PCBs) is their high chemical stability. The initial quantities of these substances entering the environment can be retained for a long time, circulating and spreading in the ecosystem.

Synthetic surfactants (SAB) in bottom sediments. Elevated concentrations of synthetic surfactants (SAWS) in bottom sediments on the Kashagan structure are observed in the northern part of the structure. The main statistical characteristics are presented in Table 5. [10-12]

Table 5 - The main statistical characteristics of the content of surfactants and PCBs (mg / g) in bottom sediments

Parametr	Amount	Maximum	Medium	Minimum
SPAC	25	44,00	<11,34	<0,1
PCBs	25	11,170	<2,046	<0,1

Analysis of concentrations of petroleum products, organochlorine pesticides, polychlorinated biphenyls, synthetic surfactants and phenols in the sediments of the landfill shows that soils on the investigated area can be classified as pure.

**Conclusions.** In general, based on the results of the conducted studies, a preliminary conclusion can be drawn that the natural self-cleaning potential of the North Caspian is in a state of some kind of dynamic equilibrium with modern anthropogenic loads. However, this balance can be violated under the influence of intensive expansion of economic activity both, first of all, on the water area of the Caspian Sea and on its coast.

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**КАСПИЙДІҢ СОЛТҮСТІК-ШЫҒЫС БӨЛІГІНІҢ ГЕОХИМИЯЛЫҚ ЗЕРТТЕУЛЕРІНІҢ  
НӘТИЖЕЛЕРІ (ЖАЙЫҚ ӨЗЕНІ СУ ТҮБІ ШӨГІНДІЛЕРІНДЕГІ МҰНАЙ ӨНІМДЕРІ)**

**Аннотация.** Бұл мақалада Каспий теңізінің солтүстік – шығыс бөлігінің геохимиялық зерттеулер нәтижесі және Жайық өзеніндегі су түбі шөгінділеріндегі мұнай өнімдерін анықтау қарастырылады. Мұнай өнімдері, хлорорганикалық пестицидтер, полихлорлы бифенилдер, полигон шөгінділеріндегі синтетикалық белсенді заттар мен фенолдар. Зерттеу аймағы ретінде Солтүстік Каспийдің Қазақстанның жағалауына жақын орналасқан шығыс учаскесі алынды. Зерттеу аймағы тегіс төмендеумен және тереңдіктің баяу өсуі арқылы сипатталады. Ол жерде топырақ көбінесе қышқылды немесе құмды болады.

Каспий теңізінің деңгейіндегі маусымдық ауытқулар бірнеше миллиметрден аспайды. Каспий теңізінің солтүстік-шығыс жағалауы жоғары қарқынмен сипатталады.

Зерттеу аймағы геохимиялық және гидрохимиялық режимдерде де, гидробиологиялық сипаттамаларда да қолайлы орналасқан. Теңіз бетінде және түбінде орналасқан станциялардағы негізгі геохимиялық, гидрологиялық және гидрохимиялық сипаттамаларын кешенді зерттеу. Солтүстік Каспийдің шығыс бөлігінің су түбіндегі шөгінділерді байқау күзгі және көктемгі кезеңдерде жүргізілді және күзгі кезеңдегі төменгі шөгінділердегі мұнай өнімдерінің шоғырлануы жазғы кезеңмен салыстырғанда төмендегені анықталды.

Жалпы, жүргізілген зерттеулердің нәтижелері бойынша Солтүстік Каспийдің табиғи өзін-өзі тазарту потенциалы заманауи антропогендік жүктемелермен біршама динамикалық тепе-теңдік жағдайында екендігін алдын-ала тұжырым жасауға болады.

**Түйін сөздер:** мұнай өнімдері, хлорорганикалық пестицидтер, полихлорильді бифенилдер, фенол, концентрация.

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## **РЕЗУЛЬТАТЫ ГЕОХИМИЧЕСКИХ ИССЛЕДОВАНИЙ СЕВЕРО-ВОСТОЧНОЙ ЧАСТИ КАСПИЯ (НЕФТЕПРОДУКТЫ В ДОННЫХ ОТЛОЖЕНИЯХ РЕКИ УРАЛ)**

**Аннотация.** В данной статье рассматриваются результаты геохимических исследований северо-восточной части Каспийского моря и определение нефтепродуктов в донных отложениях реки Урал. Дается анализ концентраций нефтепродуктов, хлорорганических пестицидов, полихлорированных бифенилов, синтетических поверхностно-активных веществ и фенолов на полигоне. Область Северного Каспия, прилегающая к казахстанскому побережью, была выбрана как область исследования. Исследованная область характеризуется наклоном дна и медленным увеличением глубины. Почвы здесь в основном грязевые, иловые или песчаные.

Сезонные колебания уровня Каспийского моря не превышают нескольких метров. Северо-восточное побережье Каспийского моря характеризуется высокими скачками.

Место исследования уникально как в геохимическом, так и в гидрогидрохимическом режимах, а также в гидробиологических характеристиках. Проведены комплексные исследования основных геохимических, гидрологических и гидрохимических характеристик на станциях, расположенных на поверхности и дне моря. Наблюдение донных осадков восточной части Северного Каспия проводилось в осенне-весенний период, и было обнаружено, что концентрация нефтепродуктов в донных отложениях в осеннем периоде уменьшается по сравнению с летним периодом. В целом, исходя из результатов проведенных исследований, можно сделать предварительный вывод о том, что природный самоочищающийся потенциал Северного Каспия находится в состоянии своего рода динамического равновесия с современными антропогенными нагрузками.

**Ключевые слова:** нефтепродукты, хлорорганические пестициды, полихлорированные бифенилы, фенол, концентрация.

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