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ҚАЙЫРЫМДЫЛЫҚ ҚОРЫ HALYK CHARITY FOUNDATION

«ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫ» РҚБ
«ХАЛЫҚ» ЖҚ

ХАБАРЛАРЫ

ИЗВЕСТИЯ

РОО «НАЦИОНАЛЬНОЙ
АКАДЕМИИ НАУК РЕСПУБЛИКИ
КАЗАХСТАН»
ЧФ «Халық»

N E W S

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Қазақстан Республикасы Ұлттық ғылым академиясы «ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Webof Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

ЧФ «ХАЛЫҚ»

В 2016 году для развития и улучшения качества жизни казахстанцев был создан частный Благотворительный фонд «Халык». За годы своей деятельности на реализацию благотворительных проектов в областях образования и науки, социальной защиты, культуры, здравоохранения и спорта, Фонд выделил более 45 миллиардов тенге.

Особое внимание Благотворительный фонд «Халык» уделяет образовательным программам, считая это направление одним из ключевых в своей деятельности. Оказывая поддержку отечественному образованию, Фонд вносит свой посильный вклад в развитие качественного образования в Казахстане. Тем самым способствуя росту числа людей, способных менять жизнь в стране к лучшему – профессионалов в различных сферах, потенциальных лидеров и «великих умов». Одной из значимых инициатив фонда «Халык» в образовательной сфере стал проект Ozgeris powered by Halyk Fund – первый в стране бизнес-инкубатор для учащихся 9-11 классов, который помогает развивать необходимые в современном мире предпринимательские навыки. Так, на содействие малому бизнесу школьников было выделено более 200 грантов. Для поддержки талантливых и мотивированных детей Фонд неоднократно выделял гранты на обучение в Международной школе «Мирас» и в Astana IT University, а также помог казахстанским школьникам принять участие в престижном конкурсе «USTEM Robotics» в США. Авторские работы в рамках проекта «Тәлімгер», которому Фонд оказал поддержку, легли в основу учебной программы, учебников и учебно-методических книг по предмету «Основы предпринимательства и бизнеса», преподаваемого в 10-11 классах казахстанских школ и колледжей.

Помимо помощи школьникам, учащимся колледжей и студентам Фонд считает важным внести свой вклад в повышение квалификации педагогов, совершенствование их знаний и навыков, поскольку именно они являются проводниками знаний будущих поколений казахстанцев. При поддержке Фонда «Халык» в южной столице был организован ежегодный городской конкурс педагогов «Almaty Digital Ustaz.

Важной инициативой стал реализуемый проект по обучению основам финансовой грамотности преподавателей из восьми областей Казахстана, что должно оказать существенное влияние на воспитание финансовой грамотности и предпринимательского мышления у нового поколения граждан страны.

Необходимую помощь Фонд «Халык» оказывает и тем, кто особенно остро в ней нуждается. В рамках социальной защиты населения активно проводится

работа по поддержке детей, оставшихся без родителей, детей и взрослых из социально уязвимых слоев населения, людей с ограниченными возможностями, а также обеспечению нуждающихся социальным жильем, строительству социально важных объектов, таких как детские сады, детские площадки и физкультурно-оздоровительные комплексы.

В копилку добрых дел Фонда «Халык» можно добавить оказание помощи детскому спорту, куда относится поддержка в развитии детского футбола и карате в нашей стране. Жизненно важную помощь Благотворительный фонд «Халык» оказал нашим соотечественникам во время недавней пандемии COVID-19. Тогда, в разгар тяжелой борьбы с коронавирусной инфекцией Фонд выделил свыше 11 миллиардов тенге на приобретение необходимого медицинского оборудования и дорогостоящих медицинских препаратов, автомобилей скорой медицинской помощи и средств защиты, адресную материальную помощь социально уязвимым слоям населения и денежные выплаты медицинским работникам.

В 2023 году наряду с другими проектами, нацеленными на повышение благосостояния казахстанских граждан Фонд решил уделить особое внимание науке, поскольку она является частью общественной культуры, а уровень ее развития определяет уровень развития государства.

Поддержка Фондом выпуска журналов Национальной Академии наук Республики Казахстан, которые входят в международные фонды Scopus и Wos и в которых публикуются статьи отечественных ученых, докторантов и магистрантов, а также научных сотрудников высших учебных заведений и научно-исследовательских институтов нашей страны является не менее значимым вкладом Фонда в развитие казахстанского общества.

С уважением,
Благотворительный Фонд «Халык»!

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ECOLOGICAL ASSESSMENT OF SOIL CONDITION IN ZHYLYOI DISTRICT OF ATYRAU REGION

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Abstract. The level of concentration of heavy metals in the soil negatively affects the quality of the soil. This study examined the quality and ecological condition of the soil in the Zhylyoi district of the Atyrau region associated with the accumulation of heavy metals, which is of great practical importance for monitoring the condition of soils and assessing the degree of their pollution. All studies to assess the ecological condition of the soil were carried out near deposits located in the study area. The results of the study make it possible to reliably determine the rate and degree of soil pollution. When conducting observations, generally accepted techniques and methods were used. The soils of the study area are represented by sandy, sandy loam and light loamy varieties. In general, the soil quality in the study area is good, and the average concentration of all heavy metal elements does not exceed the permissible MPC level. From the results of the study, it follows that the influence of oil fields in the Zhylyoi district of the Atyrau region on the ecological state of soils has not been identified. Therefore, it is necessary to monitor heavy

metals in soils from oil-producing areas to prevent associated environmental and health risks, which is the main objective of this review.

Keywords: soil, ecological state, heavy metals, Zhylyoi, deposits, Atyrau region

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АТЫРАУ ОБЛЫСЫ ЖЫЛЫОЙ АУДАНЫ ТОПЫРАҚ ЖАҒДАЙЫНА ЭКОЛОГИЯЛЫҚ БАҒАЛАУ

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Аннотация. Топырақтағы ауыр металдардың концентрациясының деңгейі топырақтың сапасына теріс әсер етеді. Бұл зерттеуде Атырау облысы Жылыой ауданында топырақтың күйін бақылау және олардың ластану дәрежесін бағалау үшін үлкен практикалық маңызы бар ауыр металдардың жинақталуына байланысты топырақтың сапасы мен экологиялық жағдайы зерттелді. Топырақтың экологиялық жағдайын бағалау бойынша барлық зерттеулер зерттелетін аумақта орналасқан кен орындарының жанында жүргізілді. Зерттеу нәтижелері топырақтың ластану жылдамдығы мен дәрежесін сенімді анықтауға мүмкіндік береді. Бақылауларды жүргізу кезінде жалпы қабылданған әдістер мен әдістер қолданылды. Зерттелетін аумақтың топырақтары құмды, құмды сазды және жеңіл сазды сорттармен ұсынылған. Жалпы, зерттелетін аумақта топырақ сапасы жақсы, ал барлық ауыр металл элементтерінің орташа концентрациясы рұқсат етілген ШРК деңгейінен

аспайды. Зерттеу нәтижелерінен Атырау облысы Жылыой ауданындағы мұнай кен орындарының топырақтың экологиялық жағдайына әсері анықталмағаны анықталды. Сондықтан осы шолудың негізгі мақсаты экологиялық және денсаулыққа байланысты қауіптердің алдын алу үшін мұнай өндіретін аймақтардың топырақтарындағы ауыр металдарды бақылау болып табылады.

Түйін сөздер: топырақ, экологиялық жағдай, ауыр металдар, Жылыой, кен орындары, Атырау облысы

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ЭКОЛОГИЧЕСКАЯ ОЦЕНКА СОСТОЯНИЯ ПОЧВ ЖЫЛЫОЙСКОГО РАЙОНА АТЫРАУСКОЙ ОБЛАСТИ

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Аннотация. Уровень концентрации тяжелых металлов в почве отрицательно влияет на качество почвы. В этом исследовании изучалось качество и экологическое состояние почвы Жылыойского района Атырауской области, связанное с накоплением тяжелых металлов, которое имеет большое практическое значение для контроля за состоянием почв и оценки степени их загрязнения. Все исследования по оценке экологического состояния почвы проведены вблизи месторождений исследуемого района. Результаты исследования позволяют достоверно определить темпы и степень загрязнения почв. При проведении наблюдений были использованы общепринятые методики и

методы. Почвы исследуемой территории представлены песчаными, супесчаными и легкосуглинистыми разновидностями. В целом качество почвы в районе исследования хорошее, а средняя концентрация всех элементов тяжелых металлов не превышает допустимого уровня ПДК. Из результатов исследования следует вывод, что влияние нефтяных месторождений в Жылыойском районе Атырауской области на экологическое состояние почв не выявлено. Поэтому необходимо проводить мониторинг тяжелых металлов в почвах нефтяных районов, чтобы предотвратить связанные с ними риски для окружающей среды и здоровья, что и является основной целью данного обзора.

Ключевые слова: почва, экологическое состояние, тяжелые металлы, Жылыой, месторождения, Атырауская область

Introduction

In the process of development and operation of oil and gas fields, transportation of hydrocarbon raw materials, contamination of the soil cover and the environment with oil and oil products, oil gases and their combustion products, hydrogen sulfide and sulfur oxides, salinization with mineralized industrial wastewater, drilling fluid, drilling waste and etc. The scale and intensity of anthropogenic pressure on the ecosystem and their destruction in the oil and gas complex are becoming increasingly threatening.

Soil contamination by heavy metals is a serious cause of human health problems, which has attracted the attention of health and risk experts worldwide (Zhang et al., 2018). The main destabilizing factors of ecological functions and soil stability are the irrational use of water, land and natural raw materials, the use of soil-destructive methods and technologies for resource development, and anthropogenic overloads. In the desert and desert-steppe regions of Western Kazakhstan, large natural reserves of oil, gas, mineral salts and building materials have been discovered and are being intensively exploited. Over 90 % of oil and 100 billion m3 of gas are produced here, and in the future it is planned to increase oil production to 70–100 million tons. in year.

The progressive growth of anthropogenic load on the soil cover has greatly complicated the environmental situation in oil-producing regions. One of the contaminated regions of Western Kazakhstan, including the Atyrau region, is the Zhyloi district. This area of the region has now turned out to be one of the most environmentally destabilized territories in Kazakhstan, where various types of anthropogenically transformed soils have become widespread. The degradation and desertification of the soil cover is facilitated by the fragile nature of the desert: the predominance of flat terrain, a high degree of climate aridity, the widespread distribution of saline, carbonate, structureless soils, and their overall low thickness. Thin vegetation cover increases the albedo and temperature of the ground layer of the soil, increases wind speed and causes soil deflation (Kanbetov et al., 2023).

The formation of the oil and gas complex has significantly increased the anthropogenic load on the soil and vegetation cover. They are associated, first of

all, with the abnormally high reservoir pressure of the developed oil (700–900 atm. or more) and the aggressive properties of hydrocarbon raw materials (high content of resins, paraffin, hydrogen sulfide, etc.), and secondly, with the low quality of process equipment and the high degree of their accident rate. Another factor of anthropogenic load is the use of equipment with high carrying capacity and load on soils in the fields, the development of predominantly large oil and gas fields with favorable operating conditions, both economically viable and low natural fertility, buffering of desert soils to anthropogenic loads.

The main reasons for environmental disturbances of the soil cover in this area of the Atyrau region were frequent emergencies in the fields and, as a consequence, petrochemical pollution, salinization with industrial wastewater, accumulation of drill cuttings, various wastes, toxic chemicals, radioactive waste, etc. (Turebekova et al., 2016).

As a result, soils acquire new, predominantly negative characteristics and properties that differ from natural soil formation, requiring large material costs for restoration. These questions in science practically remained poorly studied; there are also no assessment criteria by which one can judge changes in the characteristics and properties of technogenically transformed soils, chemical and environmental indicators of oil waste and oils, etc.

Study area

The territory of the Atyrau region is located on the territory of the Caspian lowland, located below sea level. The region is also a large oil and gas region located in the west of the Republic of Kazakhstan. In the west, the region borders on the Astrakhan region of the Russian Federation, in the north - on West Kazakhstan, in the east - on Aktobe region and in the southeast - on Mangistau regions. The total area of the region occupies 118,631 km2. The Atyrau region includes 2 cities: Atyrau, Kulsary and 7 administrative districts: Isataisky, Makhambetsky, Indersky, Kzylkoginsky, Makatsky, Zhylyoisky and Kurmangazinsky. Zhylyoi district is the first largest district in the region with an area of 29,400 km^2. It is distributed between 46^{0}00 N 53^{0}58 E.

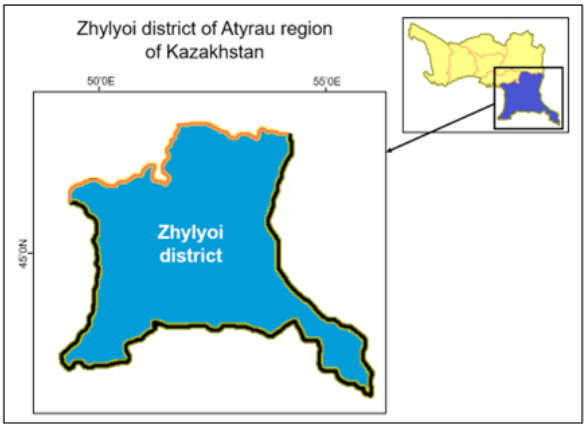

Figure 1. Map of Zhylyoi district of Atyrau region

The territory of the region is an almost flat, saline-sandy coastal plain with prevailing absolute heights from 0 to –27 m below sea level. The eastern part of the area is occupied by the slopes of the Pre-Ural Plateau (200–210 m above sea level). The climate of the region is temperate, sharply continental, with large annual and daily temperature ranges and low precipitation. In landscape terms, this is a typical northern desert, with predominant wormwood-saltweed vegetation on brown solonetzic soils, solonchaks and fine hilly sands (Diarov et al., 2003). The region is also one of the rapidly developing regions in economic and urban terms. Large oil and gas fields are located here. And the eastern part of the region is characterized by transhumance livestock farming.

Materials and research methods

Sampling, preservation, and analysis of the first day were carried out in strict accordance with regulatory documents and in accordance with GOST 17.4.4.02–84. Soils. Selection methods and sample preparation for chemical, bacteriological and helminthological analysis in accordance with GOST 17.4.3.01-83. Soils. Requirements for sampling. All analyzes were performed in a specialized chemical laboratory.

For chemical analysis, the pooled sample consists of no less than five point samples taken from one sample site. The mass of the combined sample must be at least 1 kg. Determinations of chemical contamination of soils were carried out on a sample plot measuring 10 x 10 m, selected in the most typical place. In the absence of visible contamination, a combined soil sample was prepared from five point samples taken at the test plot using the envelope method in equal quantities, which was accompanied by a label of the accepted form. Selection of point samples was carried out from a layer of 0-10 cm.

If contamination with oil and oil products was visually noted, soil sampling for analysis for oil product content was carried out to the entire depth of the contaminated layer from the underlying uncontaminated layer in accordance with GOST 17.4.4.02–84. To conduct a study of soil pollution, classical analysis methods were used.

Results and its discussion

The purpose of soil monitoring is to obtain analytical information about the condition of the soil and assess the possible impact of the economic activities of the enterprise. All studies to assess the ecological state of the soil were carried out near fields located in the Zhylyoi district of the Atyrau region in 2022–2023. To determine the degree of pollution at the deposits, environmental monitoring was carried out, which included the selection of sampling sites, collection of soil samples, processing and interpretation of data.

Heavy metals zinc, copper, lead, and cadmium were determined in soil samples. To monitor general and local soil contamination in the company's impact area, samples were collected and prepared for analysis in accordance with current regulatory requirements. We calculated the overall pollution index taking into account the varying toxicity of individual components, including pollution components of the second and third classes, and we also identified zones of varying degrees of environmental hazard (Table 1).

Table 1. Concentration of heavy metals in soil at deposits located in the Zhylyoi district of Atyrau region, 2023.

Heavy metals	Sampling point	Content, mg/kg
Cuprum (Cu)	Sample 1	2,966
	Sample 2	2,451
	Sample 3	2,178
	Sample 4	2,437
	Average	2,508
Cadmium (Cd)	Sample 1	0,058
	Sample 2	0,021
	Sample 3	0,040
	Sample 4	0,052
	Average	0,043
Plumbum (Pb)	Sample 1	4,194
	Sample 2	4,837
	Sample 3	5,283
	Sample 4	4,037
	Average	4,587
Zinc (Zh)	Sample 1	4,08
	Sample 2	4,37
	Sample 3	7,55
	Sample 4	4,29
	Average	5,07

Analyzes carried out in sampling different points of the deposits showed the copper content in soils ranges from 2.4 to 2.96 mg/kg with the MPC being 3.0 mg/kg. Honey is an important bioelement. When its content is less than 4-15 mg/kg, various diseases develop, such as anemia, lichen, and diseases of the skeletal system. The observed copper content in the soils of the Zhylyoi region corresponds to optimal living conditions for people and animals. The cadmium content in the soils of the study area ranges from 0.021 to 0.058 mg/kg. The maximum permissible concentration of cadmium for soil has not been established. Analyzes of soil samples at sampling points showed lead content in soils from 4.03 to 5.3 mg/kg with a MPC of 6.0 mg/kg. The observed content of lead in the soils of the Zhylyoi region corresponds to optimal living conditions for people and animals. The observed zinc content in soils ranges from 4.08 to 7.55 mg/kg with the MPC being 23.0 mg/kg. Considering that with an excess of zinc in soils, organisms get sick, and the development of anemia is stimulated in people. The content of zinc in the soils of the Zhylyoi region corresponds to optimal living conditions for people and animals. All results of studies of soil samples showed that the content of heavy metals at soil sampling points does not exceed the maximum permissible concentration (Figure 2).

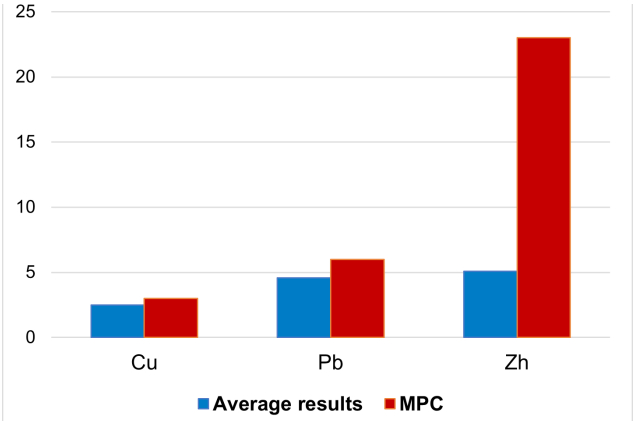

Figure 2. Results of the content of heavy metals in the soils of the Zhylyoi region in comparison with the maximum permissible concentration, mg/kg

In addition to our research, we monitored the soil within the oil wells of the study area using physicochemical methods of analysis. According to the research results, it was shown that the content of pollutants in the soil does not exceed the maximum permissible concentration (MPC) (Table 2).

Table 2. Soil monitoring using physicochemical methods

Name of impact sources (control points)	Name of pollutants	Actual monitoring result (mg/kg)
Borehole № 1	Cuprum (Cu)	0,006
	Cadmium (Cd)	0,001
	Plumbum (Pb)	0,002
Borehole № 2	Cuprum (Cu)	0,035
	Cadmium (Cd)	0,001
	Plumbum (Pb)	0,003
Borehole №3	Cuprum (Cu)	0,184
	Cadmium (Cd)	0,006
	Plumbum (Pb)	0,121

The research results showed that the content of heavy metals, copper, cadmium, lead is within acceptable concentrations. Technogenic influence leads to changes in individual elements of the relief - salinization and complete clearing of gullies, transformation of lakes into salt marshes, expansion and new formation of takyrs, and sometimes activation and enlargement of gully sections due to artificial flooding. Within areas that are intensively developing in industrial and economic relations (oil fields), flooding of the territory is mainly observed due to the unregulated discharge of large volumes of industrial waste in oil fields due to the high water content of oil reservoirs, which results in artificial flooding.

Conclusion

Soil is an important and currently scarce resource, and heavy metal contamination may limit its sustainable use. In this study, the ecological state of the soil in

the Zhylyoi district of the Atyrau region was studied. The main reasons for soil pollution during drilling in the region are an increase in load, such as technogenic destruction, petrochemical damage and salinization by wastewater, contamination with drilling fluid, waste on the soil and vegetation cover. As a result of our research, no technogenic geochemical anomalies of varying sizes or intensity of heavy metals were identified in the soils of the Zhylyoi district of the Atyrau region.

Carrying out work to establish the adequate condition of soils should be determined by their natural ability to restore the impact of disturbed soils on the surrounding area. And so, at present, the soils of this region have low economic value and are used only as pastures; from an environmental point of view, after completion of the work, it is necessary to reproduce them through technical and biological reclamation. At the next stages of development, it is necessary to carry out regular environmental monitoring, during which it is necessary to continue the study of pollutants in soils. This will make it possible to find out the value of background concentrations of chemical sources in the soils of these areas and respond to disturbances and soil contamination in time. Based on the results of the survey, no chemical contamination of the soil was detected. The content of heavy metals in soils, of which copper in soils ranges from 2.4 to 2.96 mg/kg, cadmium from 0.021 to 0.058 mg/kg, lead from 4.03 to 5.3 mg/kg, zinc from 4, 08 to 7.55 mg/kg of the permissible level indicates the absence of soil contamination with heavy metals. The results of laboratory analyzes suggest that the influence of anthropogenic factors on the ecological state of soils in the Zhylyoi district of the Atyrau region has not been identified. In general, the soil quality in the study area is good, and the average concentration of all heavy metal elements does not exceed the maximum permissible concentrations. However, the analysis results in this study may not be able to accurately determine the heavy metal contamination status of soil due to the complex environmental characteristics of the study area. However, this study examined the influence of exposure factors on external pollution sources, concentrations and total levels of heavy metals in soil. It is expected that the study will provide theoretical support for pollution control and sustainable development in the Zhylyoi district of Atyrau region.

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