Characteristics of oil-contaminated gray-brown soils of the Absheron Peninsula

Alovsat Guliyev[1], *Tunzala* Babayeva[2], and *Maya* Abdullayeva[3]

[1]Institute of Soil Science and Agrochemistry of ANAS, Baku, Azerbaijan
[2]Sumgait State University, Sumgayit, Azerbaijan
[3]Azerbaijan State Oil and Industry University

Abstract. Soil is an invaluable resource of the Earth. One of the factors that formed the foundations of human civilization was the land system. In modern times, the rapid growth of the population, the expansion of residential areas, the intensive development of mining, energy, transport and other fields have caused an increase in negative effects on the environment, including the properties of the soil. As a result, the reduction of biopotential occurred due to the decrease in area of soils and deterioration of their fertility indicators, especially physical, chemical, and biological composition. The provision of land suitable for agriculture in our republic is weak. This situation once again emphasizes the importance of efficient use of every inch of soil cover. It has been studied that as a result of soil contamination with oil products, the physical properties, natural morphological structure, productivity and ecological function of the soil are violated. The granulometric composition of oil-contaminated gray-brown soils of the Absheron Peninsula and the quantitative index of microorganisms were studied. It was determined that the soils are slightly clayey in the granulometric composition in the deep layers, sandy and upper layers. The amount of physical clay in the top layer to a depth of 0-100 cm (<0.01) is between 21.58-28.02%, at a depth of 100-200 cm this figure is between 11.71-19.76%. The amount of microorganisms in 1 ml of pure clay soil is about 4 · 106. In clayey soils, the number of microorganisms in low pollution (0.7%) is 3.4 · 106, in 5% pollution it is 1.9 · 106, and in high pollution (9.0%) it is 0.6 · 106.

1 Introduction

The most common pollutants of natural components are oil, oil product wastes and gas production. Losses during oil production, refining and use are estimated at $ 45 million a year. more than a ton. Of these, 22 mln. tons on land, 7 mln. tons to the sea and 16 mln. tons are released into the atmosphere.

In modern times, the development of society, urbanization, population growth, the development of all types of transport, large-scale burning of fuel in households and industry, and the application of mineral fertilizers and chemical agents against pests in agriculture cause environmental pollution. According to the natural protection committee, 480 miles per year to Baku metropolis. Tons of toxic substances enter through the air.

Experts have identified oil soils as a widespread contaminant. Oil pollution is exposed to agriculture, pastures, gardens, water bodies, groundwater, vegetation and other useful lands. Contamination of the soil with oil and oil products is dangerous. Pollutants affect the physical properties, natural morphological structure, productivity and ecological function of the soil. As a result of soil pollution with oil, the nutritional regime of plants is violated [1]. In this case, the soil particles stick together, the oil fractions become more oxidized and solidified. When pollution reaches a high level, the soil becomes an asphalt-like mass. Under conditions of high concentration of oil products, irreversible changes occur in the soil. Soil contaminated with petroleum products loses its ability to retain and retain moisture, weakens its hygroscopicity and water permeability.

If an accident occurs during the transportation of oil, in the first moments of the oil's spread to the ground, it is filtered under the influence of gravity and spreads to the level of groundwater. In the next stage, petroleum hydrocarbons do not mix with water, changing their location in groundwater. Thus, at the moment of the first pollution, the oil components, which cover a small area, change their location in the area and cover a large area. Light components of oil (C_5-C_{11}) evaporate from the soil surface.

Heavy fractions are filtered and descended to groundwater. In this case, the soil acts as a buffer between the source of contamination and groundwater. The depth of oil leakage from the soil depends on the properties of the oil and the porosity of the soil. If oil and oil products are repeatedly dumped in the area, the soil becomes more polluted. Soil degradation as a result of oil pollution is a multi-stage process. The first stage is the distribution of oil in the area within 24-27 months from the moment it falls to the ground. In this case, oil-contaminated soil is enriched with methane-naphthenic hydrocarbon and tar asphaltene fractions. In this case, as a result of oxidation reactions in the soil, alcohols, ethers and acids are formed, which do not exceed the concentration of hydrocarbons in the soil. In the second stage, the concentration of long-chain single n-alkanes, which dominates the biochemical processes in the soil, decreases. In the third stage of degradation, which lasts 48-52 days, the incubation of oil in the soil begins, and the first hydrocarbons and their displacement are not observed. In general, the breakdown of high-molecular hydrocarbons is a long-term process [2].

Soil pollution with oil has an irreparable effect on its morphological, physical, chemical, biological properties and productivity. The direct effect of crude oil on soil morphology is observed in the genetic layers of soil sections placed in Balakhani oil-contaminated soils. Contamination of soils with oil and its products can significantly change the composition, properties and structures of the soil. Soil pollution with oil and its products leads to its morphological properties, the color change of natural genetic layers along the profile - gray and dark shades change to light-brown color, and the deterioration of the soil structure. As a result, a form of man-made modification is created from zonal land areas. The liquid oil, which creates oxygen deficiency in the soil, causes the air to be displaced and the surface to be covered with a bituminous layer, and water does not absorb into the soil, and the mechanical particles of the soil stick together. As a result, anaerobic conditions are created, the oxidation-reduction potential slows down, and alkalinity in the soil increases. The soil particles are surrounded by a film of oil, as a result of which the soil does not absorb water and cannot retain moisture. The amount of hygroscopic moisture, water absorption, water capacity, evaporation in the top layer of the soil decreases. In case of oil pollution, the humus index in the soil increases, the quality of humus changes, humic and fulvic acids decrease, and hydrolyzed residues increase. The absorption capacity of the soil decreases due to the oil film covering the soil particles.

In addition to the strong effect of oil on the soil, salty oil formation waters cause chlorinated-sodium salinization and salinization of the soil. As a result, the soil composition changes completely. This is more dangerous than soil pollution with oil[3].

Soil contamination with oil and oil products seriously affects the number and composition of microbes in the soil. In the soil, ammonia and nitrogen-fixing bacteria increase, denitrification, sulfate-fixing bacteria, micromycetes, nitrification bacteria decrease, cellulose-decomposing bacteria and actinomycetes completely change. However, when the amount of oil in the soil is low, i.e. at the permissible rate, all types of microorganisms are activated in the soil and have a positive effect on the soil biota.

Oil-complex is a fatty substance consisting mainly of hydrocarbons. It contains high molecular tar-asphalten and low molecular oxygen compounds, nitrogen and sulfur organic compounds. In addition, oil is rich in water, salt, sulfur-hydrogen, metal and other elements.

In nature, oil is very different in appearance (from colorless to dull brown) and in consistency (from clear to solid). The amount of elements in the oil determines its physical properties and type. The fact that the specific gravity of oil is 0.80-0.95 indicates a change in its composition and properties. The specific gravity of oil is less and more than this indicator is rarely found in nature. According to their composition, hydrocarbons have the following classes. Alphatic (methane-cyclic saturated (naphthenic), cyclic unsaturated (aromatic), mixed (hybrid) methane-naphthenic naphthenic-aromatic types of hydrocarbons.

The methane hydrocarbon type of oil is gaseous, liquid and solid. Gas-like (methane, ethane, butane, etc.) is dissolved in liquid hydrocarbons and is separated from the composition when the pressure changes. High molecular weight hydrocarbons (paraffin) are dissolved in the trace oil. As paraffin freezes at low temperature, when it falls on the ground, it disrupts the exchange of substances between the air and the soil and the atmosphere between the soil and the atmosphere. As a result, the plant is destroyed.

When hydrocarbons contain a lot of methane, this oil belongs to the methane type. Its types include highly paraffinic oil (paraffin content more than 6%), paraffinic (6.0-1.5%) and low paraffinic (less than 1.5%). Naphthenic hydrocarbons are found in almost all types of petroleum. However, this type of hydrocarbon oil is very rare. Aromatic hydrocarbons include those with a low molecular structure (benzene, toluene, xylene). Among the many types of polyaromatic aromatic hydrocarbons in petroleum are 3,4-benz(a)pyrene and other xerogenic hydrocarbons. It is a resin and asphaltene with a high molecular aromatic structure, combining oxygen, sulfur, and nitrogen. Tar is a soft, sticky substance, while asphaltene is a solid substance. Both tar asphaltenes are soluble in liquid hydrocarbons. The amount of tar and asphaltene in the oil increases the specific gravity and viscosity of the oil. Thus, oil flows poorly and cannot create a stable pollution area in the soil. As a rule, tar oil does not contain solid paraffin, and high paraffin oil does not contain a significant amount of tar-asphaltenic substance. Naphthenic oil contains small amounts of both. The presence of sulfur in the oil is of fundamental importance. The oil contains sulfurous compounds (mercoptan, sulfide, thiophane) that give off a specific (specific) smell, as well as the usual element of sulfur. These sulfur compounds increase the toxicity of the oil. The amount of sulfur in the oil is: low sulfur (<0.5%) sulfur (0.5-2.0%) high sulfur (>2.0%).) [4].

Hydrocarbons in oil are divided into fractions according to their boiling point. Hydrocarbons with a boiling point of 200°C are called gasoline, kerosene (white oil) boiling at 200-300°C, and lignin boiling at 300°C to 400°C are called gasoil-fuel oil fraction.

Oil bitumen is a solid substance, it does not contain hydrocarbons, it is used in construction (rubber). If the gasoline fraction in oil is high, it evaporates quickly, and its effect on the natural environment passes relatively quickly. Hydrocarbons that boil at high temperatures are stable, and the impact of its components on the natural environment is very slow and severe.

The type of oil varies depending on its formation and place of accumulation. Different types of oil can be found in one region or area. Often, zonation is observed in the composition change due to the area and thickness of the oil reservoir rocks. It is possible to buy several types of products from the composition of oil. Among them: fuel (gasoline, lignin, kerosene, jet fuel, diesel, boiler, gas turbine fuels, as well as petroleum oil, paraffin, cerusin, petroleum jelly, petroleum bitumen lamp fuel (white petroleum-kerosene), solvents. Other petroleum products (coke, saja-gurum, antimony) oils, organic acids, etc.) [5]

Paraffin-ceserine-solid hydrocarbon is used in petrochemical, food industry and nature. Oil is a high-molecular hydrocarbon, a low-grade product used in machinery lubrication. Crude oil, fuel, oils, petroleum bitumen, soot (soot, soot) pollute the natural environment. The toxicity of oil is not the same in different species. The light fraction of oil and light oil products (gasoline, kerosene) have the highest toxic effect on living things. However, their effect remains for a long time, evaporates quickly, biodegrades quickly and spreads. The heavy part of solidified oil does not show. However, it deteriorates the properties of the soil, stops the water and air exchange of the plant and the soil

2 Materials and methods

Various oil refineries generate large amounts of waste during production. A number of comprehensive measures should be taken to prevent pollution of the environment with these wastes. It takes more than 25 years for the full recovery of the biocenosis of oil-contaminated soils - microflora, micro- and mesofauna, higher plants. The process of conversion of petroleum hydrocarbons in the soil is dynamic. All components of the oil are involved in the process, and they all move at different speeds at the same time. It was found that in places where oil products accumulate, large changes occur in the surface and deep layers of the soil, which leads to the deterioration of important physical and chemical parameters of the soil. Contamination with oil and oil products leads to fundamental changes in the morphological properties of the soil. Oil often penetrates to a depth of 5-10 cm, in some cases oil contamination reaches deeper layers. The damage caused by pollution of the environment with oil and oil products is quite high. Cleaning contaminated areas of oil and oil products takes a long time and is costly to implement [6-7].

During the experiment, the granulometric composition of the soil was determined by microbiological analysis by the method of NA Kaczynski - counting of colonies formed by planting in petri agar solution, transfer to new nutrient media, obtaining a pure culture, microscopic examination and identification of its purity.

3 Results and discussion

The history of soil oil pollution in the Absheron Peninsula is much older. Industrial oil pollution of lands in the Absheron Peninsula began in the late XIX century (about 1870). At that time, oil production was at low and smooth elevations of the relief, oil layers were extracted from hand-drilled wells close to the surface (in the places called Balakhani, Fatmai, Binagadi and Sulutepe). Beginning in the first quarter of the twentieth century, mechanical drilling of oil wells has accelerated its transportation, processing, as well as environmental pollution [8-9].

In order to study the oil-contaminated soils on the Absheron peninsula, sections were laid from different areas. Our researches were carried out on relatively high slopes. Here, for comparison, 4 soil sections were placed in uncontaminated soil (section N1) and in oil-contaminated soil at different depths. The description of these sections was written, and the total water weight, granulometric composition of the soil, volume weight, absorbed bases, pH in water suspension, carbonation, humus, nutrient elements-NPK, heavy metals, ray reflection and radioactive elements were determined in the taken soil and groundwater samples. We give a description of these lands.

Section No. 1. The south-facing slope within the oil fields was laid on grayish-brown soil contaminated with oil. The plant is ephemeral, camel's thorn meadow, wormwood, alfalfa, etc.

AУVCa - depth 0-15 cm granulometric renewal light clay, light color, gray-brown, granular without structure, shape soft, loose, roots, rhizomes, moisture dry, transition clear, boiling should be cleaned (in 10% hydrochloric acid).

AUCa 15-30 cm medium-grained, light-gray brown, the structure is fine-grained, the hardness is pus, root, rhizomes, new derivatives - small fish ears, moisture is dry, transition is clear, boiling is discovered.

BCa 30-70 cm - granulometric fresh granule, light gray-brown color, small captium, solid form, roots, rhizomes, white eyes (flat, gypsum), weak moisture, transition is gradual, boiling is fiery.

B/CCa 70-100- cm grained, light gray-brown, structure with small slats, kip, very few and weak roots, rhizomes, white embers are many, dense, moist, transition is gradual, boiling should change.

C1 100-125-cm light grainy, light gray-brown, without structure, kip, weak sparse roots, dry, transition is gradual, boiling is effective.

C2 125-160-cm light grainy, light gray, without structure, kip, very weak, sparse roots, weak moisture, transition is gradual, boiling is effective.

C3 160-200-cm light grainy, light gray, without structure, kip, weakly moist, transition is gradual, boiling is medium.

Cut #2. To the right of the Binagadi-Balakhani highway - 100 m to the south-west from intersection No. 1. The microrelief is smooth, inclined to the south, the soil is gray-brown, the granulometric composition is upper loam, soil-cultivating rock, fish ears, small stones, sand, various marine sediments, plants are ephemerals, sedges, meadow, alfalfa, wormwood, no groundwater, no waterlogging, erosion. no stopping, boiling is intense.

X. Depth 0-20-cm solidified oil residue (bitumen) color is black, without structure-layer, no moisture, transition-sharp, no boiling (due to the effect of oil).

B. 20-65-cm granular, open-black (oil sedimentation is felt), structure-smooth, dry, weakly humid, moist, transition is gradual (no roots), newly derived oil sediment, boiling-no.

C1 65-100 cm medium-grained, color-light gray-brown, without structure, kip, no new derivatives, white eyes, moist, transition is clear, boiling is intense.

C2 100-150 cm granulometric composition is sandy, sandy, light-gray in color, structureless, loose, no new derivatives, no rhizomes, moist, transition - gradual, boiling medium.

C3 150-200 cm - sandy, sandy, color-light-gray, structureless, empty, no new growths, moist, does not boil.

Cut #3. It is located 300m east of cut No. 1 in the area of oil fields No. 2, to the south (i.e. to the right) of the Binagadi-Balakhani road, in a smooth micro-sediment, in a large oil-contaminated solidified area between oil wells. The relief is bare, the oil wells have been removed, there are concrete bases, the grass plants are ephemeral, wormwood, meadow, etc.

X. Depth 0-30-cm dry, solid oil spills, black bituminized color, in layer form, very hard, dry, dust, sand, weak clay, mixture, transition very clear, no boiling.

X/B. 30-60-cm light grainy, dull brown color, (the light fraction of oil has settled) hard, fat, rhizomes dry, moist, transition clear, no boiling.

B. 60-80 cm medium-grained, light brown, kelp-like, hard, slightly rotten roots, transition is clear, boiling is very weak.

C1 80-111 cm. grainy, dark gray, without structure, kipthar, many white eyes, moist, transition clear, boiling medium. Due to the heavy graininess of the soil, oil has not been absorbed into this layer.

C2 111-130 cm. light clay, light-gray, structureless, soft texture, many white eyes, wet-watery, salty, medium boiling.

From C3 130 cm deep, oil-rich brine is collected., salty, water level up to one meter from the surface the next day.

Section No. 4. Binagadi was placed on the territory of the oil field No. 2 of oil and gas extraction department (OGED) 80-100 m east of the highway, on the right side of the groundwater channel flowing towards the Buyukshor Lake in a smooth micro-slope, close to the oil well, in a clayey, sandy, oil-bearing, relatively hardened surface. (fig.1).

Fig.1. Binagadi was placed on the territory of the oil field No. 2 of Binagadi Oil and Gas Extraction Department.

X. The depth is 0-60 cm thick, the color is black layered clay, sandy, relatively dry, oil spills, the lower part is soft, there is no clear transition.

X/B. 60-70 cm-beach, oil-soaked dark ash color, structureless, loose, new derivative-oil-soaked, moist, transition clear, no boiling.

70-100 cm - medium sand, dark ash color, structureless, layered, solid, new derivatives - oil deposited, transition is gradual, not boiling.

C 100-200 cm - the granulometric composition is sandy, the color is light ash, without structure, the form is empty, the light fraction of new derived oil is filtered, does not boil, ground water is collected. The next morning, the oily water was one meter below the surface.

From what we have mentioned above, it can be concluded that the morphogenetic layers of the soil in the lower part of the contamination of the light granular gray brown soils contaminated with crude oil waste in the area change according to the shades of brown color depending on the oil filtration. The oil fields of Binagadi (OGED) cover a wide range of applications (more than 2759 ha according to the information of SOCAR). Here, in the western part of the Kirmaki plateau, around the hand-dug oil wells, the thickness of degraded oil products pollution is 10-15 cm and more, in the west of the salty Buyukshor Lake, there are places with a thickness of 1.0-2 m of oil products filled with microsediments around Binagadi settlement. While the amount of hydrocarbons in old pollution is 5.0-10%, this indicator reaches 60-80% in 60 cm and deeper pollution. In particular, it should be noted that the amount of hydrocarbons in the 60 cm thickness, which is poured on the surface of the soil and the surface is relatively dry and hardened, reaches 73.4%. The analysis was carried out by the Aletosistem XL-Perkin Elulli company (2070-82; 2706. 6-74) at the Institute of Petrochemical Processes of ANAS on the ASTEM D 2887 apparatus. 60 cm - 73.46% of pollution - aromatic hydrocarbons - 52.18%, unsaturated hydrocarbons - 8.12%, naphthenic hydrocarbons - 13.20%, paraffins - 26.50%. Such heavy pollution not only has a serious negative effect on the morphology of the soil, but even the soil itself is deeply buried with waste carboschidroenes.

It should be noted that in the Absheron Peninsula, soils up to several hectares (5-10 and more hectares) have been contaminated. Crude oil spilled on the soil has a negative impact on its morphology, water, physical, physicochemical, chemical and biological properties. It destroys and changes its vegetation, soil organisms, microorganisms, enzymes and bacteria. In soils with a light granulometric composition, the light fraction of oil penetrates to the depths of the soil, reaches the groundwater and evaporates as it spills. The heavy fraction of oil accumulates on the surface of the soil and blocks its aeration. As a result, the soil completely loses its fertility. It ceases to be a land concept. Therefore, there is a need to restore the above-mentioned qualities of oil-contaminated soils and, accordingly, to determine the level of oil release into the soil for agricultural crops. (Table 1).

Table 1. Granulometric composition of oil-contaminated gray-brown soils of the Absheron Peninsula

Cut №	**Depth, Sm**	**Particle sizes, in mm**						
		1,0-0,25	0,25-0,05	0,05-0,01	0,01-0,005	0,005-0,001	<0,001	<0,01
1	0-10	7,99	58,93	5,19	12,59	7,74	4,13	24,37
	10-30	6,33	60,07	4,11	13,23	11,68	8,45	26,03
	30-60	5,13	55,59	9,12	11,09	10,08	7,34	28,02
	60-100	7,60	66,56	8,00	9,88	5,23	6,22	21,58
	100-120	4,25	68,00	6,42	5,11	7,03	6,45	19,76
	120-160	2,46	79,53	2,00	2,04	4,11	8,18	14,34
	160-200	2,24	79,79	2,12	2,54	5,02	6,05	11,71

The soils of the area are lightly clayey in granulometric composition in deep layers, sandy and upper layers. The amount of physical clay (<0.01) in the top layer of these soils to a depth of 0-100 cm varies between 21.58-28.02%. At a depth of 100-200 cm, this figure is slightly lighter and ranges from 11.71 to 19.76%. This indicator is moderately clayey. At a depth of 100-200 cm, these soils are slightly clayey and sandy.

It should be noted that it is not possible to carry out granulometric analysis in layers where a light fraction of oil is absorbed into the soil. Even after washing the soil with chemicals (benzene, toluene, etc.), the soil remains oily and the analysis is not carried out correctly by accepted methods

Studies have shown that oil has a negative effect on the development and biochemical activity of microorganisms. The reaction of soil microorganisms depends on the regulation of these microorganisms and their individual characteristics.

When the soil is poorly contaminated with oil and oil products, the number of such microorganisms decreases and carbon dioxide is formed. Recovery of microorganisms is observed about 6 months after contamination. The study of the consequences of soil vegetation pollution shows that in all contaminated areas, a small part of the vegetation is restored after 15 years.

In all cases, the release of oil into the environment during drilling completely destroys the flora [5]. (Table 2).

Table 2. Quantitative indicator of microorganisms in oil-contaminated clayey soils.

№	**Scheme of practice**	**Total number of microorganisms (1 ml)**
1	Clean soil (control)	$4.\ 10^6$
2	0.7% oil pollution	$3.4.\ 10^6$
3	5.0% oil pollution	$1.9.10^6$
4	9.0% oil pollution	$0.6.\ 10^6$

As a result of the analysis, it was found that the amount of microorganisms in soils not contaminated with clayey oil decreases as the percentage of oil pollution increases. Thus, the amount of microorganisms in 1 ml of pure clay soil is about 4·106. In clayey soils, the number of microorganisms in low pollution (0.7%) is 3.4·106, in 5% pollution it is 1.9·106 and in high pollution (9.0%) it is 0.6·106.

Table 3 shows that The hygroscopic moisture in the soil varies between almost 1%. The density of the soil fluctuates between 1.30-1.63 g/cm2. Buda indicates that the soils are sandy and sandy. The amount of humus in the upper 1m layer of the soil is 2.17-0.41%. Only the amount of humus in the top layer of cut No. 7 is relatively high compared to cut No. 6. It is related to the degradation of oil products after a long period of time, i.e. decomposition of soil contaminated with oil. The amount of nutrients in the soil (NPK) is 2-3 times less than the norm. The gray-brown soils spread on the Absheron peninsula are poorly supplied with nutrients. The indicator of pH in aqueous suspension is weakly alkaline and has an alkaline environment. A pH of 8-9 is a natural condition in the lower layers of the soil, and this is observed in the lower 40-210 cm layer. This indicator varies between 8.05-9.69%. Carbonation in the soil is weak and moderate, 6.48-10.80% is characteristic of the Absheron Peninsula (table 3).

Table 3. Some physico-chemical indicators of oil-contaminated gray-brown soils.

Cut №	**Depth**	**hygroscopicmoisture, %**	**Volume Weight g/cm3**	**Hummus, %**	**Total azore, mg/kg**	**Phosphorus mg/kg**	**Potassium mq/kq**	**PH water suspension**	**$CaCO_3$, %**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
5	0-116	**Contaminated with oil**							
	116-124	1,006	1,63					7,00	2,02
	124-143	1,01	1,51					9,60	1,59
	143 - 200	1,014	1,48					9,64	6,48
raw land	0-10	1,01	1,32	2,17	6,04	24,44	24,10	8,00	9,05
	10-17	1,01	1,41	2,09	5,17	15,56	24,10	8,07	4,59
	17-48	1,017	1,49	0,85	4,31	15,56	24,10	7,95	6,48
	48-70	1,013	1,43	0,72				7,90	5,75
	70-111	1,012	1,41	Not assigned				8,05	6,61
	111-200	1,012	1,49					8,05	2,16

Continuation of Table 3.

Cut №	Depth	hygroscopicmoisture, %	Volume Weight g/cm3	Hummus, %	Total azore, mg/kg	Phosphorus mg/kg	Potassium mq/kq	PH water suspension	$CaCO_3$, %
1	2	3	4	5	6	7	8	9	10
7 old dirty	0-10	1,015	1,32	5,82	6,90	17,78	72,30	7,48	6,32
	10-40	1,031	1,30	4,96	7,76	12,22	219,31	9,39	1,60
	40-85	1,0009	1,59	2,71	3,45	23,33	24,10	9,38	5,75
	85-145	1,012	1,66					9,69	7,48
	145-210	1,012	1,63					9,50	10,80
8	0-52		1,71	Contaminated with oil					
	52-70	1,018	1,53	0,62	3,45	15,56	24,10	8,50	8,33
	70-100	1,016	1,56	0,41	2,59	13,33	24,10	8,55	8,63
	100-140	1,017	1,47					8,56	8,47
	140-200	1,025	1,48					8,57	7,91
sandy beach clean land	0-25	1,018		1,03	46,56	17,78	48,20	7,73	4,75

4 Results

Conducted toxico-geographical researches - morphogenetic structures of natural-raw and oil-contaminated variants of sandy and gravelly gray-brown soils on the Absheron Peninsula were studied.

The depths of soil physical pollution with oil, physico-chemical properties of soil, use of oil, nutrients (NPK) were studied, changing the color of morphogenic layers in pollution (deeper in sandy soil), deterioration of water, physical and physico-chemical properties was created.

References

1. T. A. Hasanova, G. I. Mammadova, Universal Journal of Agrucultural Research **9(3)**, 63 (2021).
2. M. P. Babayev, E. A. Gurbanov, V. H. Hasanov, *Land degradation and protection in Azerbaijan* (Elm, Baku, 2010).

3. M. P. Babayev, V.A. Ahmadov, Rehabilitation of oil-contaminated lands of Absheron by research and agro-ameliorative methods. *Land degradation and protection in Azerbaijan* (Baku: Elm, 2012).
4. R. R. Akhmedova, N. D. Ashurova, T. M. Babaeva, *Ecological crisis of the Absheron Peninsula*. Ecology and oil and gas complex (National Academy of Sciences of the Republic of Kazakhstan, Kazakhstan, 2018), pp. 170-174.
5. N. M. Ismayilov, *Cleaning of oil-contaminated soils and drilling cuttings* (Baku: Elm, 2007).
6. R. R. Ahmadova, T. M. Babayeva, N. D. Ashurova, M. Y. Abdullayeva, AIP Conference Proceedings **2656**, 020012 (2022).
7. N. T. Aliyeva, R. A. Sadigov, M. Y. Abdullayeva, S. K. Ibragimov, World Science **4(76)**, (2022).
8. V. J. Karimov, *Greening of areas cleared of oil wastes - Phytoremediation*. Rehabilitation of Contaminated Soils - Proposed Methods (Baku: SOCAR, 2008), pp. 24-31.
9. U. Gadiyeva, G. Mammadova, T. Babayeva, A. Mikayilov, A. Mammadov, Journal of Survey in Fisheries Sciences **10(2S)**, 1175 (2023).
10. M. P. Babaev, V. A. Akhmedov, Research and restoration of oil-contaminated soils of Absheron by agro-reclamation methods. *Land degradation and protection in Azerbaijan.* (Elm, Baku, 2012).