Advanced Studies in Biology, Vol. 17, 2025, no. 1, 11 - 17
HIKARI Ltd, www.m-hikari.com
https://doi.org/10.12988/asb.2025.91967

Study of the Area, Environmental Conditions of the "Binagadineft" NGCI Mines in the Absheron Peninsula of the Republic of Azerbaijan, and Study of Vegetation-Soil Cover Contaminated by Oil and Oil Products

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Abstract

This article deals with the study of the area, ecological conditions, as well as the soil and vegetation cover contaminated with oil and oil products, located in the territory of the Absheron Peninsula, in the operation of the oil fields operated by the SOCAR "Binagadineft" Oil Company or the "Binagadi oil Company" Operating Company.

From this point of view, it is known from the research that the Absheron peninsula is the richest oil extraction region in the republic. In the past years, due to the lack of advanced oil extraction technology in the area, non-observance of protection of environmental conditions, the formation of soil contaminated with oil, oil products and groundwater, as well as the lack of natural vegetation occurred here.

In this regard, soil pollution in the area of the mines and deposits of "Binaqadineft" NGCI, which was studied, had a negative effect on the ecological conditions of the area and degraded the plant-soil cover. To prevent such a negative process, recultivation of oil-contaminated lands is recommended.

Keywords: type, formation, association, pollution

Introduction

Protection of the environment and restoration of phytocenoses in the ecosystem, including the Absheron Peninsula, by increasing the fertility of soils contaminated with oil and oil products, requires scientific foundations.

Information on environmental studies of oil-contaminated soils in the Absheron Peninsula is given in the works of G.Sh. Yagubov [2003], G.Sh. Mammadov [2005], S.B. Agayev [2007], A.B. Mirzayev [2007] and other research scientists.

Scientific articles published on the works performed on the Absheron Peninsula were referred to during the conducted scientific research (Gurbanov, E. M., Sh, A. S., & Asadova, B. Q. 2023, Cerppanov S.K. 1995). While taking soil samples from the mines of "Binaqadineft" NQCI, the species composition and structure of oil-contaminated vegetation (Mirzayev A.B., Shikhaliyev F.B. 2012) were recorded. In particular, higher plants contaminated with petroleum products (fuel oil, bitumen) found here were herbarium. Herbariums of those plants are stored in the "Herbari Fund" of the Department of Botany and Plant Physiology, Baku State University. The names of the species are recorded in Latin and Azerbaijani (Флора Азербайджана.1950-1961, V. C. Hajiyev, T. E. Gasimova. 2008). In phytoecological description No. 1, biomorphic species are given in Latin. The area of "Binagadineft" contaminated with oil and oil products on the Absheron Peninsula, the lands related to ecological conditions are disclosed below (based on research and observations).

Material and methods

The classification of oil-contaminated soils in Azerbaijan, especially on the Absheron Peninsula, was shown for the first time by G.Sh. Yagubov and G.Sh. Mammadov [2003,2005].

The total area of man-made degraded lands of the peninsula as a result of oil and gas production is 10,951 hectares, of which 3,180 hectares are contaminated with fuel oil, 3,878 hectares with bitumen, 2,381 hectares are covered by drilling waste, and 1,512 hectares are flooded with mine waters (Agayev Sh.B., Afkarov G.Kh. 2007). Soils contaminated with fuel oil are mostly observed in Binagadi region and soils contaminated with bitumen are observed in Buzovna-Mashtag massif.

On the Absheron peninsula, soils are slightly, moderately and completely contaminated with oil; in this sense, the territory of "Binaqadineft" is considered to be completely polluted land.

According to the research of N.F. Hakimova (2005), the composition of the crude oil that caused pollution in the mine of Binagadineft in Binagadi region is 87% carbon, 12.37% hydrogen, 0.23% sulfur and 0.088% nitrogen (Hakimova N.F. 2005).

According to A.B.Mirzayev, F.B.Shikhaliyev (2012) and G.Sh.Yagubov (2003), the ecological characteristics of the Absheron peninsula show that 33,300 hectares of our republic have oil-contaminated land, of which 10,000 hectares are highly polluted. However, the area of man-made damaged and oil-contaminated lands in Azerbaijan is 12 thousand hectares (Gurbanov, E., Aslanova, S., & Ibrahimov, S. 2023).

It should be added to the environmental conditions of the operating areas of the "Binagadi Oil Company" based on the characteristics of its geographical location that the area of the corresponding mines is included in the old mining zone of the Absheron peninsula, and is also located in the northwestern part of Baku city and at a distance of 8-10 km from the city. Oil production is carried out in the Binagadi, Sulutepe, Chakhnaglar, Qirmaki, Shabandag, Siyansor, Mahammadli and Masazir fields of this operating company.

2,579 hectares of the peninsula belong to the company's production zone; 3,657 wells were drilled in the area from the time of its creation until the last year, 2,202 of which were canceled and not operated (Kurbanov, E., Aslanova, S., & Ibragimov, S. 2023).

The 24.7-hectare area intended for recultivation is located between Balakhani-Binagadi and Mehdiabad-Baku highways of that company.

The climate of the Absheron Peninsula belongs to the temperate-hot and dry-subtropical type. The average monthly air temperature reaches 13.7-14.6˚C; the annual amount of precipitation varies between 129-268 mm. In our opinion, the climate factor plays an important role in the development of vegetation as well as environmental conditions (Qurbanov, E. M., & Cabbarov, M. T. 2017).

Binagadi-Khirdalan-Kecheldag oil field is located 9 km north of Baku city; the bed is Masazir from the north; It is bounded by Binagadi lakes and Digah village, Kyrmaki valley from the east, the northern and northwestern slope of the Baku mulda (slope) from the south, and the Shabandag ridge from the west.

Lakes and salt marshes surround the orography or relief of «Binaqadineft» NGCI mines consists of a low hill extending in the direction of latitude, and the north and south of the mine area.

As we commented earlier, samples were taken from oil-contaminated soils in the mining areas of the Binagadi field; soil samples were analyzed in the Complex Research Laboratory of the Department of Ecology of SOCAR.

Based on the results of the analysis, a "map-scheme for classification" of "Binagadi Oil Company" JSC polluted areas was prepared according to the degree of pollution (reservoir waters and oil products, in %).

Results and discussion

Contamination of the studied "Binagadineft" mines with formation water can pose a serious threat to the ecological conditions of the Absheron peninsula. Therefore, measures are being taken to prevent oil and oil products, as well as groundwater pollution (recultivation) (Qurbanov, E. M., & Cabbarov, M. T. 2017).

In the phytoecological studies conducted by us in 2021, a research object was selected in the mining area of "Binaqadineft" (Qurbanov, E. M., & Cabbarov, M. T. 2017, Ярошенко П.Д. 1969). In this regard, the species composition and structure of vegetation in oil-contaminated saline soil was recorded (phytoecological description-1, p.15).

Based on the description, the following phytocenological classification is given:

I. Desert (Deserta) vegetation type

1. **Salsoleta-Alhagietum-Petrosimoniosum** formation group;

1.1 Salsoleta dendroides-Alhagietum pseudoalhagi-Petrosimoniosum assosiation.

1.2 Salsoletum dendroides-Alhagiosum pseudoalhagi;

1.3 Alhagietum pseudoalhagi-Petrosimoniosum brachiata

The vegetation of the formation (association) depicted above is found in oil-contaminated saline soils. There are 15 types of higher plants in the genus; among them, according to biomorphological analysis, 1 species (6.7%) is a shrub, 1 species (6.7%) is a semi-shrub, 5 species (33.3%) are perennial, 1 species (6.7%) is biennial and 7 species (46.6 %) annual herbs; according to the ecological analysis, 6 types (40%) of those species belong to halophytes, 5 species (33.4%) to xerophytes, 2 species (13.3%) to mesoxerophytes and 2 species (13.3%) to mesophytes.

The abundance of the dominant Petrosimonia brachiata of the formation as well as the association is estimated at 3-4 points, the abundance of the subdominant Alhagi pseudoalhagi at 2-3 points, and the abundance of Salsola dendroides at 2 points.

According to its phytocenosis structure, it has 2 levels: II (upper) level or floor Sualda dendroides, Salsola dendroides, Alhagi pseudoalhagi) etc.; On the III (bottom) floor, Petrosimonia brachiata, Limonium caspica, Climacoptera crassa, Eremopyrum orientale, etc. salt-resistant (halophyte) plants are found.

The total projective cover of vegetation is 40-70%, and the average height reaches 20-5 cm.

It is important to note that P. brachiata halophyta in the vegetation indicates severe salinization of oil-contaminated soils in the territory of "Binagadineft" (Эльшад, К., & Санубар, А. 2024, Agayev Sh.B., Afkarov G.Kh. 2007).

Phytoecological description 1.

Binagadi district territory "Binaqadineft" NGCI mining area, 0.5 km from the Qırmaki mud volcano, species composition and structure of the **Salsoleta-Alhagietum-Petrosimoniosum** formation spreading in oil-contaminated saline soil

May 18, 2021.

№	Biomorphic species	Ecological groups	Abundance	Level and height (in cm)	Phenological phases
1	**Bushes** *Sualda dendroides* (C.A.M.) Moq.	Halophyte	1	II (80)	veg.
2	**Semi-bushes** *Salsola dendroides* Pall.	Mesoxerophyte	2	II (70)	veg.
3	**Perennial herbs** *Alhagi pseudoalhagi* (Bieb.) Fisch.	Xerophyte	2-3	II (45)	blssm.
4	*Limonium caspicum* (Willd.) Gams.	Halophyte	1-2	III (30)	blls m.
5	*Artemisia lerchiana* Web.	Xerophyte	1-2	III (25)	veg.
6	*Cynodon dactylon* (L.) Pers.	Mesophyte	1-2	III (20)	blss m.
7	*Aeluropus litteralis* (Gauan Parb.)	Halophyte	1-2	III (15)	blss m.
8	**Biennial herbs** *Cirsium vulgare* (Savi) Ten.	Halophyte	1-2	III (15)	veg.
9	**Birillik otlar** *Petrosimonia brachiata* (Pall.) Bunge.	Halophyte	3-4	III (25)	veg.
10	*Climacoptera crassa* (Bieb.) Botsch.	Halophyte	1-2	III (15)	veg.
11	*Hordeum leporinum* Link.	Xerophyte	1-2	III (10)	blss m.
12	*Eremopyrum orientale* (L.) Vaub. et Spach.	Halophyte	1	III (20)	blls m.
13	*Lolium rifidum* Gaudin.	Xerophyte	1	III (15)	blss m.
14	*Lepidium ruderale* L.	Mesoxerophyte	1	III (10)	blss m.
15	*Allium rubellum* Bieb.	Xerophyte	1	III (5)	blss m.

Conclusion

1. It is expedient to sow the seeds of various grasses in the fall, and the seeds of grains and legumes in the early spring, according to the soil and climate conditions of the studied oil-contaminated area.
2. In this regard, it is recommended to carry out biological reclamation measures in that area, that is, to pour soil around the polluted oil wells, to create a lawn, and to use turf plants when sowing a mixture of grass plants.
3. In order to restore the ecological balance in the oil-contaminated lands of the "Binagadi Oil Company" Operating Company, the following measures are proposed to eliminate re-pollution, violations of environmental norms and laws:

a. in the cleaning of the area, the reclamation should start with the technical method and end with the biological cleaning method;

b. drying of ponds filled with groundwater, mechanical cleaning of bottom sediments, transfer of fertile soil from outside to the field and bioremediation;

c. transportation of bitumen, asphaltene, as well as concrete scraps and construction materials from the vicinity of decommissioned oil wells;

d. prevention of oil products from oil wells and tanks flowing directly into the terrain.

4. Vegetation spreading on the oil-contaminated soil cover in oil fields and fields is organized into 1 vegetation type, 1 formation group and 3 associations, including 15 types of higher or flowering plants in the species composition of the blackberry-thistle-thorn formation belonging to the desert vegetation.
5. Agrotechnical and phytomeliorative measures should be implemented by using indicator plants (while carrying out biological recultivation) to increase the fertility of soils contaminated with saline oil and oil products explored in the territory of "Binaqadineft" and to restore the initial vegetation in the area.

References

[1] Agayev Sh.B., Afkarov G.Kh., *Disturbed and Polluted Soils of the Absheron Peninsula*, their formation, reclamation problems, 2007, Baku, 33.

[2] Cerppanov S.K. *Vascular Plants of Russia and Agrosent States the Forker USSR*. American Branch Cambridge University Press., 1995, 992.

[3] Gurbanov E.M., Akhundova A.A. *Investigation of Phytoecological İndicators for Biological Recultivation of Soilds Polluted with Oil in Absheron Peninsula*, "Novation" Kutaisi scientific centre, N4,. 2009, 88-95.

[4] Gurbanov, E. M., Sh, A. S., & Asadova, B. Q.. Phytoecologıcal Research On Oıl-Contamınated Soıls Of "Shırvanneft" Oıl And Gas Development Area And Its Recultıvatıon (Azerbaıjan). Труды Мордовского государственного природного заповедника им. ПГ Смидовича, **33** (2023), 172-183. https://doi.org/10.24412/cl-31646-2686-7117-2023-33-172-183

[5] Gurbanov, E., Aslanova, S., & Ibrahimov, S.. The Alhagieto-Salsoletum-Artemisiosum fosmation group at the SiyazanNeft NQCI mine, *AS-Proceedings*, **1** (2023), no. 3, 17. https://doi.org/10.59287/as-proceedings.260

[6] Hakimova N.F. *Ecological Fertility Model of Oil-Mining Soils of the Absheron Peninsula*: (candidate of biological sciences thesis), Baku, 2005, 19.

[7] Kurbanov, E., Aslanova, S., & Ibragimov, S.). Types of Hole-Meadow and Wetlands Vegetation in Oil-contaminated Soils Siyazan District (Azerbaijan), *Bulletin of Science and Practice*, **9** (2023), 74-79. https://doi.org/10.33619/2414-2948/88/08

[8] Qurbanov, E. M., & Cabbarov, M. T.. Geobotany. Baku: Baku State University publishing house, 2017.

[9] Mammadov G.Sh., Khalilov M.Y *Ecology and Environmental Protection*. Baku, Elm:. 2005, 472-476.

[10] Man-made land degradation / National Atlas of the Republic of Azerbaijan (scale 1:500000), DTXK, Baku, 2014, 195.

[11] Mirzayev A.B., Shikhaliyev F.B. Environmental problems of the Absheron Peninsula and oil mining areas located in the Azerbaijani sector of the Caspian Sea and ways to overcome them. Baku, Science. (2012), 368.

[12] V. C. Hajiyev, T. E. Gasimova, *Dictionary of the Flora of Azerbaijan*, tert.ed. Baku, (2008), 272 .

[13] Yagubov G.S., Study of man-made disturbed lands of the Republic of Azerbaijan, genetic characteristics and ways of their recultivation. Baku "Vatan", 2003m 204 p.

[14] Флора Азербайджана. Баку. Изд-во АН Азерб. ССР. Т. I-8, 1950-1961.

[15] Эльшад, К., & Санубар, А.. ЭКОЛОГИЧЕСКАЯ КЛАССИФИКАЦИЯ ПОЧВЕННО-РАСТИТЕЛЬНЫХ ТЕРРИТОРИЙ, ЗАГРЯЗНЕННЫХ МИНЕРАЛИЗОВАННЫМИ ВОДАМИ НА АПШЕРОНСКОМ ПОЛУОСТРОВЕ, *German International Journal of Modern Science/Deutsche Internationale Zeitschrift für Zeitgenössische Wissenschaft*, **75** (2024).

[16] Ярошенко П.Д., *Геоботаника,* Москва, Просвещение, 1969, 200 с.

Received: December 11, 2024; Published: January 9, 2025