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Research of Ecological-Chemical Indicators of Khojasan Lakes of the Absheron Peninsula

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Abstract

In our problematic world, lakes also have problems, which today, so to speak, are in a state of ecological stress. The lakes of the Absheron peninsula play an important role in moistening the climate, in cleansing the air basin of the capital. There are more than 250 lakes in Absheron. Over the past 150 years, with the development of industry in Azerbaijan, many lakes on the Absheron Peninsula have been polluted.

Keywords: Lake; Khojasan; Heavy Metals; Water Salinity; Soluble Oxygen; pH; Pollution; Environmental Monitoring

Introduction

The change in the level of the Caspian Sea also affects the ecological conditions of the Absheron lakes and their hydrological regime. As the sea level rises, the groundwater level also increases, and as a result, the amount of water in the Absheron lakes increases. When sea levels fall, the opposite process occurs. One of the reasons for this problem is the construction of new settlements in Absheron as a result of the rapid growth of industry. In settlements built in houses, due to the lack of a unified sewerage system, domestic wastewater is discharged into nearby lakes and surrounding areas. As a result, these reservoirs are polluted with harmful substances and are exposed to anthropogenic impacts.

Environmentalists also believe that the main reason for the pollution of the Apsheron Lakes is the lack of a unified sewerage system on the peninsula and the discharge of wastewater from newly built settlements and industrial enterprises into nearby lakes. On the shores of most lakes in Absheron there are residential areas - Khojasan, Kurdakhany, Bul-Bul, Amirjany, Zabrat, Zykh, Boyukshor and others.

Since the 1980s, faecal, domestic and industrial waters have been discharged through open channels without a treatment process into Lake Khojasan, which has seriously deteriorated the sanitary condition of the lake.

In accordance with the mineralization of the water of Lake Khojasan, it belongs to the group of salt-water lakes, and the mineralization of the water is much higher than that of others. The oxygen regime of the lake is completely broken. One of the main reasons why soluble oxygen is weak in the water of Lake Khojasan is the acceleration of biological processes as a result of the oxidation of pollutants. That is why the biochemical consumption of oxygen in the lake is several times higher. As a result of the influence of natural factors and wastewater into Lake Khojasan, the concentrations of cations and anions in the water also increase sharply with an increase in the mineralization of the lake. Thus, the amount of calcium, magnesium and chlorides is higher than the sanitary norm, and sulfates are several times higher.

The concentrations of oil products and phenols, which are the main pollutants of the lake, are many times higher than the MPC. Copper, cadmium, iron, zinc, manganese and other heavy metals are the main pollutants of the lake and exceed the MPC by several times. Synthetic surfactants in Lake Khojasan exceed the MPC by several times. Together with wastewater, surfactants enter the water of Lake Khojasan [1,2]. Synthetic surfactants contain sodium polyphosphates in which detergents are dissolved, as well as a number of additional ingredients that are toxic to aquatic organisms [3].

We carried out ecological monitoring of Lake Khojasan and thus discovered the sources of pollution of this lake. It was found that sewage is the main culprit of pollution.

The water of Lake Khojasan, located in the Absheron Peninsula of Azerbaijan, seems clean and transparent from a distance, but as soon as you get closer to the shore, the stench makes it hard to breathe and you can see how the lake and its shores are clogged with various debris. Moreover, sewage water flows into the lake from all sides.

We have previously written about the environmental problems of Absheron, in particular, about polluted suburban lakes. According to the state program "On the socio-economic development of Baku and its suburbs in 2014-2016", all the lakes of Absheron were to be cleaned. Cleaning of Lake Khojasan began, but soon the work to clean up the reservoir was stopped.

According to local residents, it is impossible to approach the shores of the lake in rainy weather, as they turn into a swamp. The sewage waters of the Khojasan settlement and part of the Yasamal district flow here. In addition, on the shores of the lake, heavy vehicles deliver various garbage and dump it into the water.

It should be noted that over a hundred houses, various factories and workshops are located near the lake. Local residents say that a park was supposed to be laid out here, but these plans remained on paper.

In order to study the degree of pollution of water and soil with heavy metals, we carried out monitoring studies to determine the content of some heavy metals in them [4]. During the monitoring, we took samples of water and bottom sediments from various places of Lake Khojasan, as well as from the soil near the lake, and carried out chemical analysis using atomic absorption spectroscopy (AAS).

Experimental part

Samples were taken from different areas and at different depths. The greatest contamination was observed in the surface layers, at a depth of up to 0.5 m. The volume of all samples taken was 1 l and 0.5 kg. The studies were carried out on AAS ZEEnit 700P. In all samples taken, the content of heavy metals several times exceeded the MPC norms. The results of the analyzes are given in Table 1.

heavy metals mkg/l	As	Hg	Cd	Cu	Co	Pb	Ni	Zn
Lake water sample	13,29	1,67	11,32	1,28	6,72	5,23	1,13	1,45
Bottom sediment sample	22,65	2,45	0,54	3,47	0,46	0,63	0,95	19,49
soil sample	61,26	0,79	0,6	2,69	0,48	1,78	2,16	18,57

Table 1: In all samples taken, the content of heavy metals several times exceeded the MPC norms.

And also found in the bottom sediments of iron 120.239 μg/kg, chromium 0.25 μg/kg, aluminum 178.26 μg/kg. Chromium 1.16 mkg/kg was found in the soil.

In water samples taken from Lake Khojasan, the amount of nitrates, nitrites, phosphates, ammonium ions was found. Found NO_3^-0,04 mg/l, NO_2^-0,11 mg/l, PO_4^{3-} -1,38 mg/l, NH_4^+-2,65 mg/l, pH-7,88, salinity of water 1747 mg/l, soluble oxygen 3,8 mg/l in water samples taken from Lake Khojasan.

Analysis results for soil sample from Lake Khojasan: $CaCO_3$-15, 29%, organic matters 21,40 g/kgdm, total phosphorus 42,88 mg/kgdm, total nitrogen 202 mg/kgdm, total sulphate 13, 85 mg/kgdm, total phosphate 190,6 mg/kgdm.

Analysis results for bottom sediments sample from Lake Khojasan: $CaCO_3$-4,72%, organic matters 100,49 g/kgdm, total phosphorus 4,87 mg/kgdm, total nitrogen 191 mg/kgdm, Sulphur 178 mg/kgdm, total Ca 9, 086 mg/kgdm, radiation 18 mkr/h.

Conclusion

Cleaning and regenerating the ecosystems of the lakes around Baku is very important: this will not only improve people's health, but also lay the foundation for reconstruction and environmental protection in the future.

With the support of the Korea Vegetation Growth Trust Fund and the World Bank, the city has already begun rehabilitation work at Hojasan Lake, which has significant potential for redevelopment. And because it is located above its associated water bodies, the water quality in Khojasan has a significant impact on the other three lakes. At the moment, international experts and specialists in the field of environmental protection are conducting research work on Lake Khojasan.

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