

Study of the Ecological State of Lake Alakol in Zhetysu region

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Abstract. The article studies the ecological state of Lake Alakol and other objects of the Zhetysu region. The purpose of the research work is to study the level of heavy metal pollution of the components of the biosphere of Lake Alakol. During the research work, the concentrations of heavy metals in the main components of the biosphere (air, water, soil) of Lake Alakol and other objects of the Zhetysu region were determined. The level of heavy metal pollution of surface waters, soils of Lake Alakol and other objects was studied. Analysis of the content of heavy metals in surface water samples from the coastal areas of Lake Alakol shows that the concentration of cadmium in its maximum permissible concentration is 7-12 times higher. Analysis of the content of heavy metals shows in the soil samples of the Yrgaity River that the concentration of cobalt exceeds the maximum permissible concentration by 2.9 times. The values obtained during the study necessitated the study of the state of the main components of the biosphere.

1 Introduction

The concentrations of heavy metals in the main components of the biosphere (air, water, soil) of Lake Alakol and other objects of the Zhetysu region are determined in the scientific article. To determine the concentration of heavy metals, the following modern devices were used: atomic absorption spectrometer of the MGA 915 MD brand, spectrophotometer of the JENWAY 6320D brand, gas analyzer of the OKA-92T-O2 CO brand, electric respirator of the brand PU-4E.

The purpose of the research work is to study special protected areas (Alakol Reserve, Dzungarian Alatau, Alakol, Koshkarkol, Sasykkol, Balkhash lakes, Karatal, Aksu, Lepsi, Yrgaity River air surface water, soil study of the level of contamination with metals.

Objectives of research work are as follows:

1. scientific publications on the topic over the past 30 years literature review;
2. necessary instrument for air, water, soil sample research-search for names, buy them and work with them master the methods of creation;
3. sampling, storage and storage of air, water, soil samples master the methods of preparing for analysis;

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4. special Protected Areas (Alakol Reserve, Dzungarian Alakol, Koshkarkol, Lakes Sasykkol, Balkhash, Karatal, Aksu, Lepsi, Yrgaity River air, surface waters of rivers, study of the level of soil pollution with heavy metals; In the course of research work used adistems and curals.

Scientists have studied heavy metal pollution of the biosphere, atmospheric air, the Earth's surface and soil. We used an atomic absorption spectrometer of the MGA 915 brand, spectrophotometers of the JENWAY 6320b brand, gas analyzers OKA-92T-O₂CO brand, electric respirators of the PU-4E brand. Determination of heavy metals in samples of water, soil, dust and carbon monoxide (II) in the air was carried out by methods:

- 1) modern methods for the determination of heavy metals and their application for biological control.
- 2) Physico-chemical methods analysis of components of the natural environment. Educational and methodical manual.

2 Materials and methods

The purpose of the research work is investigation of the level of heavy metal pollution of surface waters and soils of protected areas (Alakolsky Reserve, Dzhungarsky Alatau, Altnemel GNPP), Alakol, Koshkarkol, Sasykkol, Lakes Balkhash, Karatal, Aksu, Lepsy, Tentek, Yrgaity River.

Objectives of the research work:

1. Review of the literature of scientific publications on the topic over the past 10 years.
2. Methods and methodology of air, water, and soil samples research.
3. Know the methods of preparation for the analysis of samples of air, water, soil, their storage. The scientific works of Kanagatov, Zh Zh., Seitova G.A., Butenova A.K., Bukenova E.A., Tokanbaev A.E. consider the issues of water resources protection to strengthen the competitiveness of Kazakhstan in the conditions of the fourth industrial revolution and the transition to a "Green economy". The dynamics of pollution of the Zhetysu region water basin is also studied and the ecological zoning of the territory is given [1]. All the research work was carried out in the scientific laboratory of the Department of Biology and Genetics at the Al-Farabi Kazakh National University.

For water sampling, we use plastic with a volume of 2 liters, we used cans. 3 vials before taking a sample are shaken 4 times with the water being removed, after which a water sample is taken, the date of sampling, the resulting location and coordinates are recorded.

In each bottle for 1 liter of water sample, to prevent spoilage, we added 3 ml of nitric acid concentrate.

Then we delivered water samples to the scientific laboratory of the Department of Biology and Genetics at the Al-Farabi Kazakh National University.

Bottled water passed through filter paper (R-12.5 cm; No. 90), then poured each bottle into heat-resistant glasses of 1 liter and put it in an electric stove for boiling. After boiling the water, a volume of 50-100 ml is taken for each water sample. And is determined by the installation of an atomic absorption spectrometer of the brand "JENWAY 6320D", a gas analyzer of the brand OKA-92T-O₂CO, an electric respirator of the brand PU-4E. Determination of heavy metals, dust and carbon (II) oxide in air in water and soil samples was carried out using methods in the following literature: 1) E. I. Granovsky, B. A. Nemenko modern methods for the determination of heavy metals and their application for biological control. - Almaty:1990. P-97 [2].

2) E. S. Andasbayev, A. K. Kenzhebekov, Zh. T. Omirbekova, A. J. Dzhankuldukova physico-chemical methods analysis of components of the natural environment. Educational

and methodical manual. - Taldykorgan: Publishing department of Zhetysu State University I. Zhansugurov University, 2013. P- 220. [3].

We took soil samples to study the level of soil contamination with heavy metals on the shore of Lake Alakol. To take soil samples at each point, the surface layer of soil was removed and a sample taken from the bottom layer. Samples were taken by the envelope method. A soil sample from the designated place of study is taken from two layers, three times, i.e. 0-5 cm and 40-50 cm deep. The selected soil sample was cleaned of various impurities (stone, glass, iron, roots). The soil was well mixed and taken for examination in an average amount. The selected soil samples are packaged in special bags, outside of which we draw the date of collection, the place of collection and the coordinate. Soil samples were delivered to the scientific laboratory at the Department of Molecular Biology and Genetics of the Faculty of Biology and Biotechnology of Al-Farabi Kazakh National University.

Soil samples were taken, packaged in special bags, canceled and placed in filter paper No. 90 (R - 12.5 cm). We placed the measured soil sample in a porcelain dish and ground it. We sift through a sieve with a diameter of 0.5 and place the soil sample on a filter paper weighing 1.3 g, and measuring on a scale to a total weight of 2.3 g [4].

The mass of the soil sample taken ($2.3\text{g} - 1.3\text{g} = 1.0\text{g}$) was 1.0 g. The selected 1gr of soil samples were placed in special enclosures, and concentrated 3ml of nitric acid of the OSCH brand, concentrated 2ml of chloric acid of the OSCH brand were added on top. Then we fasten the lid of the case and put it on heating in the oven at 1000C for 2 hours. Thus, we have completed the preparation for the detection of heavy metals in the soil sample. heavy metals in soil and water samples were found in the scientific laboratory of the Department of Molecular Biology and Genetics of the Faculty of Biology and Biotechnology of the Kazakh National University Al-Farabi on the atomic absorption spectrometer AAS1N, which has passed state inspection Environment contamination because of heavy metals is not only restricted to the aquatic ecosystem, even soil is also increasingly getting contaminated [5].

3 Results

The results obtained during the experiment and their analysis. Concentrations of heavy metals in surface water samples taken from different points on the shore of Lake Alakol are shown in Table No. 1 (mg/l).

The results obtained in the scientific laboratory of the Department of Biology and Genetics at the Al-Farabi Kazakh National University were on heavy metals of surface waters and soils of protected areas. In the study, the scientists used the methodology for determining heavy metals and their use for biological monitoring, physico-chemical methods for analyzing components of the natural environment.

Table 1. Shows the concentration of heavy metals (mg/l) in water samples from Lake Alakol.

Sample	Cu	Zn	Pb	Mn	Co	Ni	Cd
The shore of Lake Alakol	0.004	0.033	0.093	0.054	0.099	0.072	0.012
The shore of Lake Alakol Akshi Village	0.003	0.035	0.078	0.043	0.103	0.069	0.012
The shore of Lake Alakol Koktuma village	0.004	0.020	0.063	0.061	0.091	0.061	0.007

Compiled by the authors

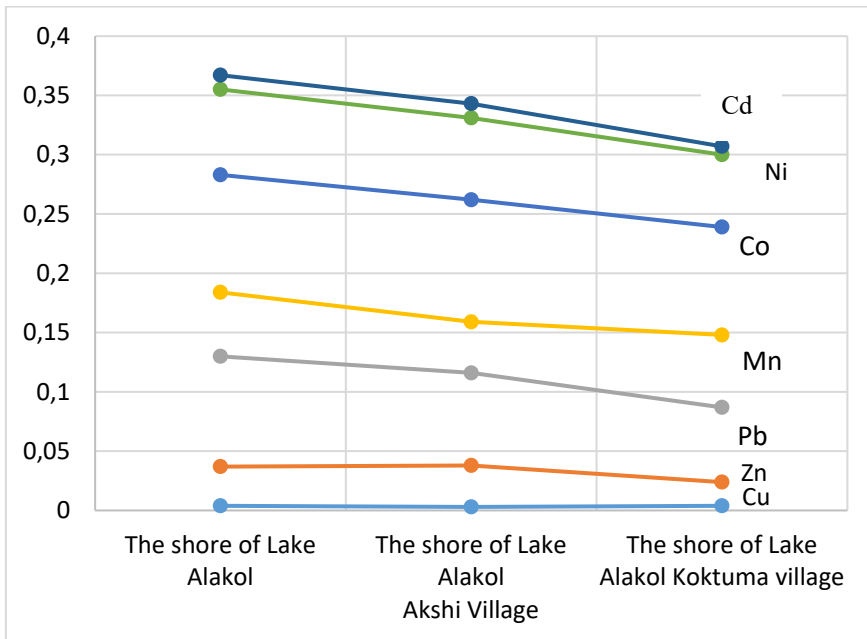


Fig. 1. The concentration of heavy metals (mg/l) in water samples from Lake Alakol. Compiled by the authors.

Analysis of the values of heavy metal concentrations in surface water samples given in Table No. 1 showed that among the studied ingredients, cadmium is 7 times higher than the MPC. And for the rest of the heavy metals, the values obtained do not exceed their MPC. The concentrations of heavy metals in soil samples taken from the shores of Lake Alakol at different points are shown in Table No. 2.

Table 2. Concentrations of heavy metals in soil values from Lake Alakol (mg/l).

Sample	Cu	Pb	Co	Ni	Mn
The shore of Lake Alakol	8.10	16.20	9.31	17.85	5510.0
The shore of Lake Alakol Akshi Village	17.29	26.33	11.12	23.01	2639.0
The shore of Lake Alakol Kaktuma village	10.50	16.20	10.07	17.55	4350.0

Compiled by the authors

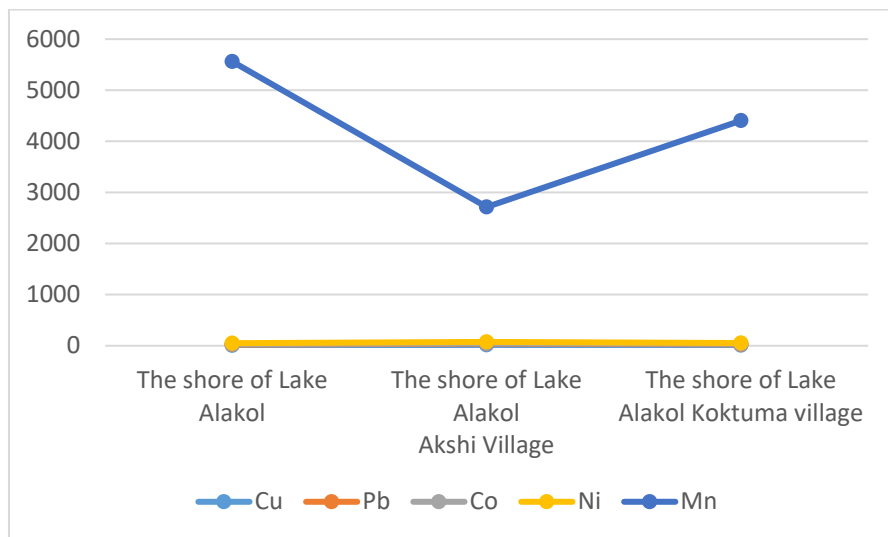


Fig. 2. Concentrations of heavy metals in soil values from Lake Alakol (mg/l). Compiled by the authors.

The analysis of the concentration values of heavy metals in samples taken from the shores of Lake Alakol, shown in Table No. 2, Figure 2 is more than twice higher than the MPC for cobalt, more than 1.75-3.67 MPC for manganese and lower than the MPC values for other metals, that is, zinc, nickel, lead.

The concentrations of heavy metals in soil samples taken from the honeytsy River are presented in Table 3.

Table 3. Concentrations of heavy metals (mg/l) in soil samples taken from the Yrgaity River.

Sample	Cu	Pb	Co	Ni	Mn
Yrgaity River	12.32	24.75	10.45	19.80	55.10

Compiled by the authors

Analysis of the values of heavy metal concentrations presented in Table 4 revealed that among the studied ingredients, only cobalt has a value 2.9 times higher than MPC. And for the rest of the heavy metals, the obtained values do not exceed the MPC.

Table 4. Concentrations of heavy metals (mg/L) in surface water samples taken from the Kokzhar inspection department.

Sample	Pb	Cd	Cu	Zn	Ni	Fe	Co	Mn
Experience Square No. 1	28.3	0.48	6.00	19.4	65.2	128.0	9.88	352.8
Experience Square No. 2	28.9	0.40	7.00	23.4	35.2	240.0	10.26	416.6
Experience Square No. 3	28.9	0.46	4.75	20.5	28.8	144.0	9.50	357.0
Experience Square No. 4	27.7	0.38	4.25	17.1	22.4	160.0	9.12	315.0

Compiled by the authors

The values of the concentrations of heavy metals presented in Table 4 in the studied water samples showed that they do not exceed the MPC.

4 Discussion

A study was conducted on the territory of the protected zone of the Dzungarian Alatau and Altyn-Emelsky according to the research contract dated February 4, 2018, within the framework of the budget program on the topic "Comparative analysis and monitoring of air, soil and water pollution in the anthropogenic disturbed buffer zone in the protected mode of the national natural parks of Zhongar-Alatau, Altynemel", experimental studies were conducted research in these specially protected natural areas to determine the quality of natural water. The components of Lake Alakol were also studied. The purpose of the study was to determine the quality and level of contamination of water and soil of the protected areas "Zhongar Alatau" and "Altyn Emel".

Within the framework of the study, the following tasks were solved:

- determination of physical and chemical indicators of natural water quality;
- analysis of the level of contamination of the studied water.

According to the research data, the following conclusion can be made: according to the basic physico-chemical quality indicators, natural water meets the requirements [6].

This study revealed contamination of the Alakol lakes with heavy metals. Anthropogenic factors may contribute to this. And according to the findings of the research, we can say that a full study of this problem is still required.

5 Conclusion

During the research work, the level of heavy metal pollution of the main components of Lake Alakol (air, water, soil) was studied. Analysis of the values of heavy metal concentrations in surface water samples from Lake Alakol showed that among the studied ingredients, cadmium is 7-12 times higher than the MPC. It turned out that the analysis of the concentrations of heavy metals in soil samples taken from the shores of Lake Alakol is twice as high as the MPC for cobalt, and 1.75 - 3.67 times higher than the MPC for manganese. Analysis of the values of heavy metal concentrations in soil samples taken from the Yrgaity River showed that among the studied ingredients, only the cobalt value is 2.9 times higher than the MPC. And for the rest of the heavy metals, the values obtained do not exceed their MPC.

In conclusion, the level of heavy metal contamination of surface waters, soils taken for research from Lake Alakol, and other objects was studied. The values obtained in the course of the study necessitated further study of the state of the main components of the biosphere.

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