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Environmental Situation in the Schuchinsk-Borovskoy Resort Zone of the Republic of Kazakhstan

[1]Maikanov Balgabai Sadepovich, [2]Auteleeva Laura Tulegenovna and [3]Shershen Elena Andreevna,
[1]Doctor of Biological Sciences, Professor, [2]PhD, [3]Master's Degree Student,
[1,2,3]Kazakh Agrotechnical University named after S. Seifullin, Republic of Kazakhstan, Nur-Sultan

Abstract: The article presents the results of monitoring studies on the sanitary – ecological situation of water bodies and air pollution in the Shchuchinsko-Borovskoy resort area. It was determined an excess of pH, manganese iron and trace amounts of heavy metals' salts in water bodies. An excess of sulfur dioxide and carbon dioxide were registered in the atmospheric air of the resort area was marked by. These changes linked with seasonal increase in the passenger traffic of tourists, leading to the accumulation of emissions and smog formation substances in the environment.

Keywords — *Resort Area, Lake, Heavy Metals', Atmospheric Air*

I. INTRODUCTION

The flow of domestic tourism in the Republic of Kazakhstan in creasese very year, thus, there are a lot of resort areas, where people relax and get healthy. Among these places, the most attractive and important one is the resort "Burabai", whch is called as the "Kazakhstani Switzerland". According to the analytical agency "Turstat", this resort ranked 1st place in the Top- 5 resorts of the CIS. [2]. This rating was based on an analysis of the attendance of resorts by Russian tourists. As a result, every year millions of tourists from Kazakhstan and neighboring countries come to relax in the Shchuchinsk-Borovoe resort area. Thus, it is of high importance to monitor and maintain the ecofriendly condition in this area. However, ecological-sanitary characteristics of resort "Burabai" is worsening every year and mainly it is dueto negative anthropogenic impact, which leads to the pollution of air, water and soil thus, people's health are under high risk.

II. MATERIALS AND METHODS

Water sampling from the reservoirs of the resort area was carried out according to SD RK GOST-R 51592-2003 "Water. General requirements for sampling". Obtaining of organoleptic and physio-chemical parameters was carried out according to theMarch 16, 2015 No. 209 Sanitary Rules "Sanitary and epidemiological requirements for water sources, water intake sites for household and drinking purposes, household water supply and places of cultural and community water use and safety of water bodies". Obtaining trace elements of heavy metal salts were carried out according to GOST 31866-2012 "Drinking water. Determination of the content of elements by the method of inversion voltammetry ". Overall, 63 water samples were investigated in total. MVI KZ 07.00.01612 / 1-2013 "Measuring methodology of the mass concentration of harmful substances in the atmospheric air with the GANK-4 gas analyzer".

III. RESULTS AND DISCUSSION

Monitoring of sanitary – ecological conditions of lakes and rivers in the territory of the Shchuchinsko-Borovskoy resort area was carried out at 7 water bodies (lakes) - Burabai, UlkenShabakty, KishiShabakty, Shortan, BalpashSor, Maybalik, Katarkol (Figures 1-7).

Conserning lake UlkenShabykty, in terms of pH there is a slight excess of the norm (7.0–8.0) by 0.24 (8.24). The average value of the mineral composition is 854 ± 12.84 mg / dm^3 and of dissolved oxygen is 4.5 ± 0.05 mg / dm^3. The total BOD was 3.4 ± 0.08 mg O2 / dm^3 and COD 24 ± 0.08 mg O2 / dm^3. The content of iron, zinc, copper and manganese are within the normal range.

The residual amount of heavy metals in the lake UlkenShabakty is within the normal range, but there has been found trace amounts of arsenic 0.002 mg / dm3 and cadmium 0.006 mg / dm3. The average content of radionuclides in the lake for cesium was 137 - 0 ± 4.17 Bq / kg and for strontium 90 - 14.75 ± 7.46 Bq / kg.

In water samples from Lake Kishi Shabakty, the pH value has an excess of the norm (7.0–8.0) as it is 8.3. The average value of the mineral composition is 799 ± 5.62 mg / dm^3 and of dissolved oxygen is 4.3 ± 0.03 mg / dm^3. The total amount of BOD was 3.1 ± 0.05 mg O2 / dm3 and COD 24 ± 1.15 mg O2 / dm^3.

Water samples from Lake Balpash Sor had organoleptic abnormalities. Floating impurities in the form of salt crystals of suspended dirt were found and a color change was observed, which was pink, the smell of water was 0 degrees, the pH was 7.31

According to the physicochemical parameters, water samples from the Maybalyk Lake had the following changes: pH equals 8.47 (7.0–8.0), the average mineral composition is 870 ± 3.60 mg / dm^3 and of dissolved oxygen is 5.4. ± 0.04 mg / dm^3, complete BOD amounted to 4.9 ± 0.01 mg O2 / dm^3 and COD to 24.5 ± 0.72 mg O2 / dm^3. There is a slight excess in the content of manganese at a standard of 0.1 mg / dm^3 as in the lake it was 0.114 ± 0.07.

According to the physicochemical parameters, water samples from the Katarkol lake had deviations in pH values , which was 8.6. The average value of the mineral composition is

780 ± 2.16 mg / dm^3 and of dissolved oxygen is 5.2 ± 0.1 mg / dm^3. The total BOD was 5.3 ± 0.2 mg O2 / dm^3 and COD 17.5 ± 0.14 mg O2 / dm^3. The excess of iron content was 0.5 ± 0.02 mg / dm^3.

According to the results of our research, it was revealed that there were no changes in the organoleptic indicators of water samples from reservoirs of cultural and domestic use of the resort area, however, Lake Balpash Sor has a pink color of water and had impurities in the form of salt crystals. According to Government Decision no. 106 of February 4, 2005, Lake Balpash Sor is not part of the Shchuchinsk-Borovoe resort area even though local residents use the mud of the lake for medicinal purposes. According to physico-chemical parameters water samples of the lakes Ulken Shabakty, Kishi Shabakty, Maybalyk, Katarkol exceeded the pH value (pH) from 8.24 to 8.6. According to some authors, it is associated with trace amounts of salts of heavy metals [2]. This is confirmed by the results of our research above. The main danger of heavy metals is that, unlike organic toxicants, which decompose to varying degrees in natural waters, heavy metal ions remain unchanged. They are not subjected to the process of self-destroying or self-purification, thus, they only travel within the water and interact with living organisms [3]. The main reasons for the deterioration of water quality are water pollution by sewage and uncontrolled water abstraction, especially during the tourist season. Contamination of soil, air and water is also due to the increasing flow of road transport [4].

Studies of the atmospheric air conducted during the seasonal tourist visit (warm period) of the Schunchinsk-Borovoe resort area showed that the indicators of harmful substances in the composition of the atmospheric air are within the normal range except for sulfur dioxide, the concentration of which exceeds the maximum permissible concentration.

Figure 1 presents the results of the study of atmospheric air at checkpoints of the resort area during the warm period (June, July, August).

As can be seen from chart 1, the concentration of sulfur dioxide index at all sampling points exceeds the maximum permissible concentration by 6-6.5 times and amounts to 2.95 ± 0.0262 mg / m^3 at checkpoint number 2, and 3,17 ± 0.015 mg / m^3, at checkpoint number 3, on the Abylaykhan glade it was 2.3 ± 0.0067 mg / m^3. Generally, sulfur dioxide is a toxic substance that has a negative effect on the human body and animals.

The content of sulfur dioxide at checkpoint 1 is 0.0233 ± 0.0017 mg / m3, at checkpoint 2 - 0.05 ± 0 mg / m3, at checkpoint 3 - 0.063 ± 0.0017 mg / m3, at checkpoint 4 - 0.07 ± 0 mg / m3, and on the Abylaykhan glade - 0.02 ± 0.003 mg / m3. The content of carbon dioxide at checkpoint No. 1 was 69.67 ± 0.2455 mg / m^3, at checkpoint No. 2 - 62.63 ± 1.44 mg / m3, at checkpoint No. 3 - 78.37 ± 0.1764 mg / m3, at checkpoint No. 4 - 55.53 ± 0.7585 mg / m3, and on the Abylaykhan glade - 80.4 ± 0.0577 mg / m3.

Research results for August show that the indicators of harmful substances in the composition of atmospheric air of Schunchinsk-Borovoe resort area are within the normal range except for sulfur dioxide, the concentration of this substance exceeds the norm by 2-6 times and amounts to 3.1967 ± 0.006 mg / m^3 at checkpoint №1, at checkpoint number 2 - 1.12 ± 0.0029 mg / m^3, at checkpoint number 3 - 2.2267 ± 0.0083 mg / m^3, at checkpoint 4 - 1.6 ± 0.00221 mg / m^3, on the Abylaykhan glade - 0.9967 ± 0.006 mg / m^3.

As a result, we have established a standard index for sulfur dioxide at chechpoint 1, checkpoint 2 and checkpoint 3 amounting to 6.4, which refers to a high level of atmospheric pollution. The standard index at checkpoint 4 was 3.38 and it also indicates an increased level of pollution.

Table 14 –StandardIndex (SI) and Highest Frequency (HF)of sulfur dioxide impurity concentrations.

PlaceIndicators	Checkpoint 1	Checkpoint 2	Checkpoint 3	Checkpoint 4	Abylaykhan grade
SI	6,4	6,4	6,4	3,38	4,62
HF	50%	66%	100%	50%	66%

The highest frequency of sulfur dioxide at checkpoint 1and checkpoint4 was 50%. At checkpoint number 2, and at checkpoint number 3 it was equal to 100%. It indicates that all of these places have a very high level of air pollution. Thus, in terms of sulfur dioxide the territory of the Schunchinsk-Borovoe resort areais characterized by a very high level of pollution. It is determined by the average value of the SI equalling to 5.4 ± 0.5657 and the average value of the HF equalling to 66.4 ± 8.3347%.

The main reasons for the deterioration of water quality are water pollution by sewage and uncontrolled water abstraction, especially during the tourist season. Contamination of soil, air and water is also due to the increasing flow of road transport [5].

Combustion processesis the main source of air pollution, which are highly integrated into to the lives of everyone. In the combustion processes, hydrogen and carbon of the fuel are combined with atmospheric oxygen, generating heat and light and releases of carbon dioxide and water vapor. The impurities contained in the fuel, the lean fuel / air mixture during combustion, and the too high or too low burning temperature lead to the formation of by-products such as carbon monoxide, sulfur and nitrogen oxides, soot, and unburned hydrocarbons — all of them are considered as air pollutants.

When assessing the level of atmospheric air pollution by sulfur dioxide, a standard index was calculated ranging from 3.38 to 6.4, which indicates an increased level of air pollution by this element. The highest frequency was calculated for the same concentration and it ranged from 50% at checkpoint 1 and checkpoint 4, and 66% and 100% on the Abylaykhanglade and at checkpoint 3, respectively. That also indicates a high content of harmful substances in the atmospheric air. This level of air pollution has a negative effect on human health, leading to noticeable morphological changes in the central nervous system, respiratory organs, gastrointestinal tract and cardiovascular system [6].

Also, during the study of atmospheric air, the maximum permissible concentration for sulfur dioxide was noted to be in the range from 0.9967 ± 0.006 to 2.3 ± 0.0067 mg / m3, which is due to a high automobile load on this section of the resort area and the location of parking lots in this area. Numerous walks to the sights begin from the glade of Abylay Khan, and as a result,

tourists park private cars and buses in the adjacent parking lots. According to the TASS news agency, similar concentration of sulfur dioxide is observed in megacities such as Berlin, Prague, New York, Moscow [7]. Also, based on the indicators of our research and RGP "Kazgidromet", we can note the high content of a carbon dioxide. There is no standard maximum allowable concentration of carbon dioxide (CO2) in the atmospheric air indicated in domestic and foreign documents. Actually, it is obvious that the content of CO2 in the air will be different in rural areasand in small and large cities. This difference in concentrations is caused the amount of motor vehicle emissions, fuel combustion at thermal power plants and the work of industrial enterprises. In many foreign countries carbon dioxide along with oxides of nitrogen, carbon monoxide, sulfur dioxide and volatile organic compounds, is a typical pollutant that must be taken into account when assessing outdoor air for designing ventilation and air conditioning systems. The European Standard EN 13779 "Ventilation for non-residential buildings - as a general basic guideline" suggests to take a carbon dioxide concentration in rural areas as 350 ppm, in small towns as 400 ppm, and in urban centers as 450 ppm. [8-9]. According to this the flow of fuel based transport in Shuchinks-Borovoe resort area should be decreased or even eliminated, and one of the possible ways is to use electric transport.

CONCLUSION

Thus, after conducting the monitoring studies on the sanitary – ecological situation of lakes and rivers in Shuchinsk-Borovoe resort area, the following information was found:

- the organoleptic characteristics of water samples from the lakes of the resort area had no deviations, with the exception of Lake BalpashSor, where salt crystals and suspended matter were found;

- pH excess in lakes water samples: UlkenShabakty- 8.24; KishiShabakty - 8.3; Maybalyk - 8.47; Katarkol - 8.6; Tekkekol - 8.35;

- the excess of iron in Lake BalpashSor is 3.2 mg / dm^3, in Lake Katarkol and is 0.5 mg / dm^3 and a slight excess of the MPC for manganese in Maybalyk Lake.

- the presence of trace amounts of salts of heavy metals: arsenic (As) from 0.002 to 0.008 mg / dm^3; cadmium (Cd) 0.0002 to 0.002 mg / dm^3 and lead (Pb) from 0.002 to 0.03 mg / dm^3

- the standard index (SI) for sulfur dioxide at checkpoint 1, checkpoint 2 and checkpoint 3 was equal to 6.4, which refers to a high level of atmospheric pollution, at checkpoint 4 it was 3.38, thus, indicating an increased level of pollution;

- the highest frequency (HF) for sulfur dioxide at checkpoint 1 and checkpoint 4 was 50%, at checkpoint 2 and on the glade named after. Abylaykhan accounted for 66%, and at checkpoint 3 it was 100%, which refers to a very high level of air pollution.

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