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Ecological assessment of groundwater at the airport zone

In complex natural, technogenic and anthropogenic conditions, when at the same time the quality of water directly in the underground part of the Hydrosphere or through other components of the environment is affected by various factors of pollution, the assessment of the quality of underground water takes on a specific character. Carrying out constant monitoring of the state of the groundwater, comparing and assessing the compliance of pollutant concentrations with established standards makes it possible to assess the actual state of groundwater in the airport area and adjacent territories for the content of pollutants. The main sources of groundwater pollution as a result of the operation of aviation equipment are rainwater and meltwater, emergency discharges of petrochemicals, fuel and lubricant storage farms [1-2]. The purpose of the work: to carry out an ecological assessment of the quality of groundwater at the area of the International Airport Kyiv (Zhulyany) according to the main hydro-ecological indicators. The water quality of five drinking wells at different distances from the runway of the Kyiv airport zone was analyzed.

Since there is no single indicator that would describe the entire complex of water characteristics, water quality assessment is carried out on the basis of a system of indicators. Since the studied groundwaters are located within the city limits, they belong to water bodies for economic, drinking and cultural and domestic purposes, and therefore the results of the experiments were compared with the drinking water quality standards. The assessment of the quality of groundwater due to its specific location in the environment should have a deeper and meaningful essence, therefore, in addition to hydrochemical analysis of the main indicators, the study of selected water samples was supplemented with a series of additional control methods: microbiological, biotesting methods, and genotoxicity analysis. The results show that the pH value in all the tested samples does not exceed the permissible limits. According to the current standard, the hardness of drinking water should be within 1.5-7 mg-eq/l. Although Ca and Mg salts are not harmful to the body, their presence in water in large quantities is undesirable, because the water becomes unsuitable for drinking needs and industrial water consumption. On the other hand, the toxic effect of many heavy metal salts is reduced in hard water. This phenomenon is explained by the fact that highly mineralized waters, which contain calcium, magnesium, potassium, sodium, barium salts, reduce the solubility of toxic substances, forming insoluble sediments with them, and their toxicity is reduced tenfold. The degree of hardness of ground water exceeds drinking water quality standards by 6.7-3.8 times. Thus, the water sampled at a distance of 20 m from the runway can be characterized as water of medium hardness (4-8 mg-eq/l), that is, satisfactory for drinking and poor for household use. Water sampled at a distance of 250 m is very hard (10.5-14.4 mg-eq/l), but acceptable for drinking purposes. The water sampled at a distance of 500 m, 1000 m and 1500 m is hard (8-10.5 mg-eq/l), satisfactory for drinking and poor for household use. For drinking, the use of relatively hard water is allowed, since the presence of Ca and Mg salts is harmless to health and does not impair the taste of water. The use of hard water for economic purposes will cause a number of inconveniences. It is advisable to use water from a well located at a distance of 250 m for economic and drinking purposes in agreement with the sanitary supervision authorities (hardness higher than 10 mg-eq/l). According to the oxidizability indicators, the water of all the selected samples cannot be considered suitable for drinking, because the oxidizability indicator exceeds the MPC, which is established for groundwater, by 3.7–6.8 times.Increased oxidizability may indicate the presence of organic substances, some humic substances, sulfides, nitrites, ferrous iron in the tested water and requires the use of appropriate protective measures when using it. According to the MPC for drinking water, the content of N/NH_4 in water is not regulated, N/NO_3 (according to the nitrogen index) is not higher than 9.2 mg/l, and N/NO_2 should not be present. As a result of the analysis of the obtained results, we can draw the following conclusions about the ecological state of the airport groundwater. An excess of ammonium and nitrite nitrogen content was found in all investigated water samples. An increase in the concentration of ammonium nitrogen in water can be an indicator of the deteriorating condition of a water body. The presence of N/NH_4 indicates water pollution by sewage and fecal effluents. Nitrites are an intermediate link in the chain of bacterial processes of ammonium oxidation to nitrates. A high content of nitrites indicates an increase in the processes of decomposition of organic substances under conditions of slower oxidation of NO_2 to NO_3. This indicates pollution of the water environment. Elevated concentrations of both nitrogen compounds may indicate the presence of a permanent source of pollution. Any elevated nitrate content is observed in the tested water. That is, the nitrification process of ammonium ions under the action of nitrifying bacteria does not occur in the studied water. The drinking water is hard – it is satisfactorily drinkable, it is contaminated with ammonium nitrogen and nitrites in all wells. According to the oxidizability index, it is determined as unfit for consumption.

References

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