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Technogenic transformation of ecosystems in the karst area during oil production

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Oil production in karst areas often leads to negative consequences for ecosystems, including aquatic ones, since karst creates favorable conditions for the migration of oil mining pollution.

The study area is located in the oil and gas bearing zone of the Western Urals, the territory is assigned to the area of gypsum and carbonate-gypsum karst. The site (river basin) of one of the old-developed fields of the Perm Region was studied, which is characterized by a large number of oil mining infrastructure facilities.

The purpose of this study is to identify the features of technogenic transformation of ecosystems in karst conditions. For this, a field survey of the territory, sampling of surface and underground waters, grounds, bottom sediments and soils, measurements of the concentrations of pollutants in the air, the presence of the main ecological and trophic groups of microorganisms in water samples were carried out.

The process of hydrocarbons input (bitumization) covered karst cavities, springs, streams of the study area. In time, the concentration of hydrocarbons increased during periods of high water. Spatially, the hydrocarbon content gradually decreased from the polluted springs in the direction of the river mouth.

The increased content of hydrocarbons in bottom sediments (up to 54,872 mg/kg) was observed at almost all sample plots.

Areas with a tendency to accumulation of hydrocarbons were identified within the boundaries of the study area (soil pollution near the well cluster in the upper part of the river basin exceeds 100,000 mg/kg). Bottom sediments and soils are a deposit medium for pollutants, they can become secondary sources of pollution.

Microorganisms are an integral part of ecosystems, which serve as indicators of pollution. Quantitative changes in the group of heterotrophic and oil-oxidizing microorganisms of the spring microbocenosis are multidirectional. An increase in the number of heterotrophs and a decrease in the number of oil-oxidizing microorganisms are observed.

Technogenic salinization during oil production is an accumulation of salts (chlorides, sulfates, carbonates), which are contained in large quantities in high-mineralized stratal waters extracted

along the way. The maximum values of chloride concentrations were recorded in the upper part of the river basin.

The karst region is composed of sulfate rocks, which have greater solubility compared to carbonate rocks, we believe that this primarily explains the high content of sulfate ion in water samples.

The increased salinity of the aquatic environment can be judged by the presence of halophilic microorganisms. At the points where halophilic organisms were detected, chloride concentrations exceeding background values were recorded. It should be noted that the number of halophiles is low.

Excess concentrations of benzene, hexane, toluene, hydrogen sulfide, and methane were recorded in the atmospheric air at certain points.

The transformation of ecosystems in the study area has a pronounced degradation orientation. Hydrocarbons make the greatest contribution to environmental pollution, and the presence of karst forms only aggravates the situation.

Measures to localize pollution and organizational recommendations to improve the environmental situation were proposed for each problem area.

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