Biogeosorbents for solving environmental problems

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The pollution of land and water objects by hydrocarbons during exploration, production, transportation, storage and processing remains an important environmental problem. The problem of restoring land and water objects, polluted after accidental spills, is especially relevant for the Northern and Arctic territories, which are char-

acterized by low regeneration. The most common waste is phenol and its derivatives, which belong to the group of dangerous pollutants. The input of phenols into waters has a negative effect on the hydrochemical mode of the water object: the oxygen content decreases, the color and oxidizability increase.

The work is aimed at the creation of biogeosorbents and testing of their sorption and destructive properties in relation to oil products and phenols.

Mineral carriers were natural sorbents based on mineral raw from the European North-East of Russia: analcime-containing rocks of the Veslyana occurrence of the Kainskaya zeolite area [1], clinoptilolite-containing clays and glauconite-containing rocks of the Chim-Loptyuga oil shale field [2].

The strains, included in the Biotrin biological product [3], were used as oil destruction organisms: bacteria *Pseudomonas yamanorum* VKM B-3033D [4]; yeast *Rhodotorula glutinis*, VKM Y-2998D [5]; microalgae *Chlorella vulgaris* Beijer. f. *globosa* V. Andr. As organisms of phenol destructors, microalgae *Chlorella vulgaris* Beijer f. *globosa* V. Andr. were used.

The sorption and destructive properties of the initial sorbents and simulated biogeosorbents in relation to oil products are evaluated. We determined that the samples of the initial sorbents exhibited a high adsorption activity with respect to oil products, reducing the oil product content by 2.5—5 times (standard or significantly lower than MAC standard).

During the immobilization of microorganism cells on the surface of mineral carriers we revealed decreasing sorption properties, but at the same time, the microorganisms provided biodegradation of hydrocarbons, which during 4 days was 60 to 77 % [6, 7]. The ratio of normal alkanes changes, lighter alkanes degrade faster. Samples of calcite-containing rocks and clinoptilolite-containing clay can retain low molecular alkanes, which are usually subject to weathering.

We evaluated sorption and destructive properties of the initial sorbents, a suspension of microalgae, and simulated biogeosorbents in relation to phenols. The advantage of the synergetic complex of the biogeosorbent from its individual components was revealed: decreasing period of water purification from phenols. Biodegradation of 83 % of phenols in the model water occurs in 3 days.

We showed that the mineral carrier ensured safety and increases the growth of microalgae cells under stress conditions. Microalgae *Chlorella vulgaris* immobilized on analcime-containing rocks showed tolerance to increased salinity (34 ‰) and organic pollutants (phenolic water with a concentration of 10 µg/dm³) [8].

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