Biocomposition based on humic acids and oil-degrading microorganisms in the relation to petroleum products

Gertsen M.M.¹, Dmitrieva E.D.²

¹Tula State University, Tula, Russia, mani.gertcen@gmail.com

²Tula State University, Tula, Russia

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Humic acids are the nutrient substrates for oil-degrading microorganisms involved in the decomposition of petroleum hydrocarbons, which, after applying them to the surface being cleaned, are attached to the oil film at the oil-natural phase section and are involved in the petroleum biodegradation. The purpose of this work is to study the detoxifying ability of biocompositions based on humic acids and oil-degrading microorganisms of the genus *Rhodococcus* in the relation to petroleum products.

The objects of this study were peats humic acids (HAs) of the Tula region: red fen peat (RFP), black alder fen peat (BFP), sphagnum high-moor peat (SHP) and sphagnum transition peat (STP) [1]. Bacterial strains of *Rhodococcus erythropolis* S67, *Rhodococcus erythropolis* X5 [2]. The remediation efficiency of biocompositions was analyzed on two samples of oil-contaminated soils from the territories of an oil refinery and a metallurgical enterprise with a high (3321 ± 1162 mg / kg) and very high (9180 ± 2300 mg / kg) levels of contamination. The initial and residual content of oil products at the end of the remediation measures was determined on a fluid analyzer "Fluorat 02-3M" according to the method of PND F 16.1: 2.21-98. The effectiveness of biocompositions was assessed by vegetation experiments with a watercress test object according to a complex of biological indicators before and after remediation. The treatment of oil-contaminated soil samples from the territories of industrial enterprises with biocompositions can significantly reduce the content of oil products in the soil system, which was confirmed by chemical analysis. Maximum oil recovery efficiency of biocompositions "HAs of RFP + *Rh. erythropolis* S67" and "HAs of RFP + *Rh. erythropolis* X5": the amount of petroleum products in the soil sample with a very high level of contamination is reduced to a low level (1160 ± 290 mg/kg). As a result of exposure to the soil sample with a high level of contamination of the biocomposition "HAs of RFP + *Rh. erythropolis* S67", the content of oil products corresponds to the permissible level of pollution (948 ± 102 mg/kg); "HAs of SHP + *Rh. erythropolis* X5" reduces the amount of petroleum products in the soil by 2 times. An increase in the level of biodegradation of soils oil pollution is due to the complex action of humic acids, which consists both in the stimulating effect of humic acids on microorganisms of the genus *Rhodococcus* - components of biocompositions and the native microflora of the soil, and the detoxifying effect of HAs in the relation to soils oil pollution.

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