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Application of humic substances for biological remediation of oil polluted soil

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Russia annually produces 300 millions tons of oil 7 % of which is discharged in the environment as a result of an emergency oil spills at extraction and transportation. It is clear that at the current stage of development of oil industry it is impossible to exclude its a environmental effects in this connection their arises a demand for development of new technology and improvement of existing ones of soil clean up.

Application of humic substances (HS) or HS-based sorbents is one of the methods for cleaning of oil polluted soils.

On the one hand these substances physiologically active towards plants and certain microorganisms by that providing for indigenous microflora stimulation of soils. On the other hand availability hydrophobic frame in the structure of HM determines their capacity to interact with oil hydrocarbons.

In view of the above the objective of the work was study of effects of different humic substances in the presence of biopreparation "Rhoder" on biodegradation of oil polluted soils. This biopreparation consists of two non-pathogenic bacteria (Rhodococcus ruber and Rhodococcus erythropolis isolated from oil polluted soils).

The following preparations were used as HS: Irkytsk humate (IH) widely used as fertilizer, highly hydrophobic humic acids (HA) and gimatomelanic acids (GMA) extracted from the IH and also iron humate (HA-Fe) known as a catalyst of chemical oxidation of oil hydrocarbons.

Doses of application of HS were 0.2, 2, 20 g/l. Oil heated to 272 degree was used as a model pollutant. Thus heated oil characterizes old oil pollution of soil.

As the study showed preparation GMA in concentration of 20 and 2 g/l had a positive effect on oil biodegradation. For this preparation 23±3% and 19±3% the reduction of

biodegradation was observed accordingly. The preparation HA-Fe in concentration of 2 g/l had a positive effect on oil biodegradation too. For this preparation 22±3% the reduction of biodegradation was observed. It is likely that the observed reduction of soil pollution is determined either hydrophobic interaction of HS with oil hydrocarbons or simulating effect of HS towards microorganisms of biopreparation "Rhoder".

Experiments were made to study effects of HS on biodegradation of different chemical oil fractions. The results showed that maximum degradation of 29±3% and 27±3% respectively was observed for heavy aromatic oil fractions with introduction of HA and GMA in concentration of 20 g/l.

Degradation of light and medium aromatic oil fractions was effected by preparations IH and HA in concentrations of 2 g/l.

Aliphatic fraction biodegradation was negligible and amounted to 10% in the presence of IH and HA-Fe in concentrations 0.2 and 2 g/l, respectively.

Comparative Study of Humics of Different Origin by Method Infrared spectroscopy

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The method infrared spectroscopy (IRS) is one of the most effective in the investigation of qualitative composition of nature humic acids (HA), organic substances (OS) similar to humus and commercial humics. This method for a long time is used with a great success for the investigation of soil matter structure, for the estimation of fertilisers quality, for the determination of fertilises transformation.

The samples of HA were isolated using the standard method and purificated by means of dialysis. A number of commercial HA from different Russian companies and some OS of nonhumic origin was taken: biohumus "Terra vita" (BTV), "Humics" (H), purificated and unpurificated chemical reagent "Humic acids" (HA_{cp} and HA_{cu}), lignin (Lig), organic rock "mumie" from Mountain Altai (M) and dropping-lignin complex (DLC). Besides them, the HA from soddy-podzolic soil (HA_s), deep sedge peat (HA_p), "Humate" from brown coal (HA_h) and "mumie" (HA_m) were isolated and purificated.

The results of investigation show several common functional groups presence for all HA: hydrocarbon chains, fragments of aromatic compounds, complex ethers, spirits and carboxilic groups. Besides, in almost all HA OH-groups, are bound by intermolecular hydrogen compound, occur.

Also, a number of structure fragments is determined, which are character for different HA. Thus, free OH-groups, present in HA_p. The connections which are conjugated with C=C, C=O, including aromatic, present in HA_p, M, HA_h and DLC. The presence of nitrogen