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Synthetic humic substances and their use for remediation of contaminated environments

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Soils are increasingly subjected to different chemical stresses, because of increasing industrialization process and other factors. Different anthropogenic compounds (organic or inorganic in nature) upon entering the soil, may not only influence its productivity potential, but may also affect the quality of groundwater and food chain. Consequently, soils of different environments contain a complex mixture of contaminants, such as oil products, metals, organic solvents, acids, bases and radionuclides. Thereby greater focus should be paid to risk assessment and evaluation of remedial techniques in order to restore the quality of the soil and groundwater. The treatment technologies presently used to remove contaminants are physical, chemical and biological technologies.
Many functional groups in the structure of humic substances determine their ability to interact with metal ions forming stable complexes and influencing speciation of metal ions in the environment, as well mobility, behaviour and speciation forms in the environment. Humic substances are suggested for use in the remediation of environments contaminated with metals, owing to complex forming properties. Several efforts have been undertaken with respect to synthesize humic substances for their structural studies. At the same time the real number of methods suggested for synthesis of humic substances is highly limited and their synthesis in general has been used mostly for their structural analysis.
The present study deals with development of approaches for synthesis of humic substances with increased complex forming ability in respect to metal ions. Industrially produced humic substances (TEHUM) were used for comparison and after their modification their properties were analyzed for their elemental composition; functional group content changes in spectral characteristics. Synthetic humic substances showed significant differences in the number of functional groups and in ability to interact with the metal ions, which were reflected in their complexation properties towards metal ions. FTIR spectra gave evidence of the presence of metal ions, strongly bound and protected in inner sphere complexes. Considering a large scale of production of humic substances, the obtained synthetic humic substances with modified properties are perspective and sustainable areas of use. The obtained results of this study showed that synthetic humic substances can be used for remediation of environments contaminated with heavy metal ions.