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CHARACTERIZATION OF NATURAL CLAY FROM BOGOVINA (SERBIA) AND POSSIBLE UTILIZATION IN SORPTION OF THE HERBICIDES

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Content: The mineralogical composition of the soil clay fraction, along with soil organic matter, plays an important role in the sorption process of the soil. However, natural clay minerals are much better sorbents of inorganic than organic contaminants, such as nonionic pesticides. On the other hand, due to the high solubility, pesticides are mobile and could be detected in groundwater. Changing the surface nature of montmorillonite from hydrophilic to hydrophobic is crucial for enhancing the sorption of pesticides. This change in the surface characteristics of montmorillonite can be accomplished using different procedures. In this paper, montmorillonite samples from Bogovina (Serbia) were pretreated with 1M NaCl, and then with different concentrations of two organic complexes (HDTMA, PTMA). Chemical analysis of the sample showed that natural montmorillonite from Bogovina (Serbia) was Ca montmorillonite.
The whole modification process was monitored using several methods. The batch adsorption method was used to measure the efficiency of inorganic and organic modified montmorillonites for the sorption of the S-metolachlor. Mineralogical characterization of natural clay samples was performed using the X-ray diffraction method. This method was also used in order to track structural changes in montmorillonites during the modification treatment and adsorption process.
Based on the X-ray diffraction diagrams, it was concluded that, after saturation with the HDTMA complex, there was an expansion of the interlayer space. Depending on the degree of saturation, the long-chain organic complex can exhibit different arrangements in the interlayer space, from monolayer to paraffin orientation. On the other hand, montmorillonite modified with PTMA complex exhibited monolayer arrangement of cations on the surface of montmorillonite in such a manner that the cations acted as pillars in interlayer space.
Batch adsorption results were presented as L type isotherms, which mean that the pesticide sorption decreased with increasing pesticide concentration. This means that the adsorption of pesticide molecules occurs on the high-energy sorption centers at lower pesticide concentrations (specific adsorption), and low-energy sorption centers at higher pesticide concentrations (non-specific adsorption). In the case of montmorillonites modified both by the HDTMA and PTMA complexes, Freundlich coefficients showed an increment in S-metolachlor sorption with increasing the content of the organic complex used in the montmorillonite modification. Positive relationship between the parameter K_f and the content of the organic complex was found. A general trend of sorption can be presented in the following sequence: Natural clay < Na-montmorillonite < PTMA-montmorillonites < HDTMA-montmorillonites. The adsorption of S-metolachlor was highest for HDTMA-montmorillonite with 1CEC saturation.
High sorption of examined herbicides on some organically modified montmorillonites creates an opportunity for application of these substrates as potentially useful material for removal of S-metolachlor and clomazone from the environment. The efficiency of the sorption of S-metolachlor by montmorillonite depends on the size of the interlayer space, the type of interchangeable cation, and also on the characteristics of the montmorillonite surface.

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