SORPTION-DESORPTION OF PB(II) BY MODEL ASSOCIATIONS OF SOIL COLLOIDS

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Natural colloids are organomineral associations of multiple soil constituents, which are the main contributors to sorption and transport processes affecting contaminants in soil and water. The importance of individual soil constituents on contaminants sorption is usually evaluated by studying the sorption behaviour on selected soil fractions or by investigating changes in sorption after removing soil constituents, such as Fe oxides or organic matter. An alternative approach is the use of model sorbents.

In this work, we have studied the sorption of Pb(II) by binary and ternary sorbents containing montmorillonite (SWy), ferrihydrite (Ferrih) and humic acid (HA), and the results were compared with the sorption behaviour of the individual model sorbents. The model particles were prepared in the laboratory and characterised by elemental analysis, X-ray diffraction, infrared spectroscopy and specific surface area measurements. Pb(II) adsorption isotherms were obtained using the batch equilibration technique and fitted to the Langmuir equation. The corresponding Langmuir parameters, Cm and L, were calculated. Results obtained were discussed to establish the interaction mechanism.

With regard to single sorbents, sorption of Pb(II) was high on humic acid, moderate on montmorillonite, and zero on ferrihydrite. Accordingly, ferrihydrite coatings on SWy reduced the sorption of lead by the resulting SW-Ferrih systems. HA coatings on SW increased the sorption of lead, whereas this effect was not observed for the Ferrih-HA systems. This was attributed to blockage of the functional groups of HA responsible for Pb(II) sorption (carboxylates and phenolates) as a result of their interaction with the ferrihydrite surface. A similar behaviour was observed when HA was associated with Ferrih-coated montmorillonite.

Pb(II) desorption isotherms showed that sorption by the model associations was reversible. Spectroscopic studies revealed the role of carboxylate groups in the retention of lead and the presence of Pb(II) in the clay interlayers.

The results of this study confirmed that the sorptive behaviour of colloidal particles is not the simple sum of the sorption on single components, illustrating the usefulness of considering the behaviour of binary and ternary model systems as sorbents in order to give a more realistic interpretation of the adsorption process in soil.

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