



Sorption of Cr(III) on mixed montmorillonite Al-Fe humic acid complexes

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Soil pollution by chromium(III) presents only a low health risk, there was a significant toxicological hazard from Cr(III) taking into account its potential oxidation to Cr(VI) by different oxidant agent in soil. Hydroxy precipitates of Cr(III) are particularly important because appreciable mobilisation of hydrolysed Cr from montmorillonite occur only via intercalation into interlamellar space. Although these specific adsorption sites have important implications with respect to environmental quality (e.g. bioavailability, mobility, and the fate of Cr in soils and waters), little information is available in the literature on adsorption of Cr(III) polynuclear species on organo-mineral matrix. In our study we used organo-mineral complexes formed by montmorillonites in which we intercalated aluminium and iron polymers and complexed with humic acid in such a way as to provide specific adsorption sites capable of interacting with heavy metals more strongly. These research aim on the effect of the Cr(III) ion concentration on the micromorphological and surface properties of mixed montmorillonite Al-Fe humic acid complexes. Batch adsorption studies were carried out for the assessment of the Cr(III) adsorption interactions on mixed Fe-Al-Cr-montmorillonite and humic samples. The complexes were prepared with 3 mmol of Al or Fe per g of clay. Na-montmorillonite (Mt) and humic acids (HA) were added at pH 5,0 and 7,0, respectively. The adsorption of Cr(III) from aqueous solution of CrCl₃, from 10 a 2038 μmol l⁻¹ was studied and the metal amounts in the complexes were analyzed by FAAS and were interpreted in terms of Langmuir equation. The organo-mineral complexes have been characterized by X-ray diffractometry (DRX), FTIR, TEM and SEM-EDS for elementary analysis and surface area determination. The adsorption trends of Cr(III) on organo-mineral complexes were investigated separately and in all combinations in order to distinguish the effects based on the interactions of the components. Significant alteration of surface characteristic was observed with TEM and SEM observation indi-

cating the different influence of Fe and Al on the organo-minerals complexes surface properties. The presence of Al or Fe precipitation products cause important changes in the adsorption capacity values of Cr(III). The coprecipitated Al or Fe markedly decreased the sorption of Cr(III) in binary systems whereas the strength of chromium intercalation increases in Mt-Al-HA complexes. After Cr(III) adsorption an alteration of complexes surface were observed by SEM and also a significative increasing of $d(001)$ spacing on XRD patterns was detected. The basal spacing of montmorillonite Al-Fe humic acid complexes was increased after Cr(III) adsorption, showing its intercalation. The SEM images of the complexes after Cr(III) adsorption points out some important micromorphologic modifications. In particular SEM observation show that the Mt-Fe-HA complexes behaved as a non-oriented network, the ferrihydrite suspension was formed from particles of various shapes and dimensions, and the humic acid exhibited a sponge-like structure. The micromorphology of the ferrihydrite-humic acid association was close to that of pure ferrihydrite, while the Mt-Al-HA associations recalled the basic network of the smectite. Significant correlation was observed with SEM-EDS in the organo-minerals complexes between iron and chromium adsorbed indicating the presence of specific sorption site for this heavy metal. Data presented here, however, show that appreciable immobilisation of adsorbed hydrolysed Cr occur in the organo-mineral complexes. High molecular weight humic acids are effective chelators of sorbed Cr and these ligands may therefore play an important role in the mobilisation and cycling of this metal in soils and sediments. The full potential of native organic ligands to mobilise sorbed Cr can therefore be assessed only once a greater number and variety of organic compounds have been examined.