Lead Speciation in Single and Mixed Mineral Systems Using X-ray Absorption Fine Structure Spectroscopy (XAFS)

T. E. Alcacio and G. M. Lamble

In this study, X-ray Absorption Fine Structure Spectroscopy was used to study the local chemical environment of individually Pb treated gibbsite, pyrophyllite and of mixtures. Our results show that the surface speciation in the two systems are quite different. For instance, Pb on pyrophyllite was found to be coordinated to three oxygen atoms, all with equal bond distances of 2.30 Å. This distance is too short for an outer-sphere complex and suggests that a monodentate, inner-sphere, adsorption complex is present. In contrast, the individually treated gibbsite shows two Pb-O bond distances of 2.30 Å and 2.58 Å and Pb-Pb bond distance 3.88 Å. All of the revealed bond distances indicate that a Pb complex is present as a distorted tetrahedral involved in corner sharing with surface oxygens in gibbsite. When individual gibbsite and pyrophyllite samples (3.47 and 1.73 μmol m^{-2} respectively) were dried and mixed, the spectrum of the mixed component system agrees well with the prominent features displayed by the two individual spectra components. These results suggest that XAFS can be used to differentiate sorption modes in heterogeneous systems.