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**Effect of Time and Reaction Conditions on the
Formation/Dissolution of Ni Surface Precipitates on the Clay
Fraction of a Soil using EXAFS Spectroscopy**
**Effet du temps et des conditions de réaction sur la formation et la
dissolution des précipités du Ni sur la surface de la fraction
argileuse d'un sol utilisant l'EXAFS**

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Several anthropogenic inputs have resulted in excessive amounts of heavy metals such as Cu, Cr, Pb and Ni in the soil environment. Assessment of the mechanism(s) by which these metals sorb to soil mineral surfaces has traditionally involved standard clay minerals and metal oxides, several of which are rarely found in the natural environment in pure forms or without the presence of several other mineral phases. Additionally, metal sorption studies have involved the use of purely macroscopic techniques, often using an equilibrium approach. It is necessary to understand metal sorption mechanisms on natural, mixed systems and what effects time and reaction conditions have on such reactions. Some recent studies on standard soil components have revealed that both adsorption and nucleation of metals occurs, often simultaneously. However, studies are lacking on the importance of metal nucleation phenomena in soils. Accordingly, this study examines the sorption and desorption mechanisms/kinetics of Ni(II) on the well characterized clay fraction (<0.002 mm) of a Matapeake silt loam soil at pH 6.0, 6.8, and 7.5. The clay fraction is primarily composed of chloritized vermiculite and kaolinite as indicated by X-ray diffraction and thermogravimetric analysis. X-ray absorption fine structure (XAFS) spectroscopic analysis indicates the formation of polynuclear Ni surface complexes over rapid time scales (minutes) often at low surface loading levels (5%). The rate at which these precipitates form is additionally dictated by the solution pH, with formation occurring in several minutes at pH values in excess of 7 and taking several hours at pH values less than 7. The desorption of Ni from the soil clay fraction is strongly affected by the formation of these complexes, with less nickel being released into solution when the reaction time and pH levels are increased. The data suggests that it is possible to propose sorption mechanisms on soil clay fractions based on XAFS and kinetic analysis and on a complete characterization of the clay fraction. Furthermore, this study indicates the need to incorporate surface precipitate formation as a possible reaction mechanism in 24 hour equilibrium based sorption models.

Keywords : Nickel, surface, soil clay, EXAFS

Mots clés : Nickel, surface, argile de sol, EXAFS