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Title

Kinetics and Mechanisms of Nickel Sorption to a Goethite- Coated Kaolinite

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abstract

Recent research has shown that most of the first row transition elements are incorporated into stable surface precipitates, which form on aluminum containing clay minerals and oxides and at pHs above 6.5. In soils, clay minerals are often coated with iron oxides, which mask the clay mineral surface from the bathing soil solution. Since clay minerals have been shown to have a strong affinity for metals such as Ni, it is important to understand how metal oxide coatings affect sorption mechanisms, especially the formation of metal surface precipitates that can significantly sequester metals. Therefore, the objective of this research is to elucidate the mechanisms by which Ni is sorbed to clay minerals coated with goethite. Kaolinite was coated with increasing amounts of goethite and characterized via SEM, XRD, and XPS and CEC, pnzc and surface area measurements. Nickel sorption experiments were conducted at constant pH (7.5) [using a HEPES buffer] and ionic strength in batch reactors, and for several months to elucidate the effects of aging. Solid samples were periodically collected and the sorption products characterized using EXAFS, XPS and XRD. Preliminary findings indicate the formation of a surface precipitate (alpha-NiOH) at the kaolinite surface. Over time Ni is partially replaced by Fe. These findings have large implications for the long-term bioavailability of Ni.

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