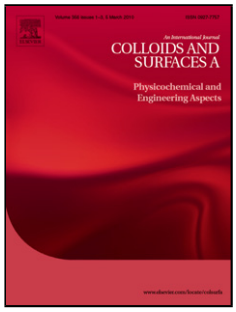

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Analysis of metal speciation dynamics in clay minerals dispersion by Stripping Chronopotentiometry techniques

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Abstract

In aqueous systems, interactions of metal ions with colloidal interphases are considered as a key feature for analyzing trace metal speciation, mobility, lability and bioavailability. Among colloidal matters of interests, clay minerals play a major role in metal complexes formation and sorption. The aim of this study is to analyze the dynamic speciation of metal in the presence of clay as colloidal ligand. This work is achieved by means of two complementary electroanalytical techniques: Absence of Gradients and Nernstian Equilibrium Stripping (AGNES) is used for the direct determination of the free metal in solution and Stripping Chronopotentiometry at Scanned deposition Potential (SSCP) is applied for the dynamic speciation analysis. The measured response of SSCP reflects the flux properties (limiting transport or kinetic fluxes) of metallic species and allows the determination of thermodynamic constants and analytical lability features of metal complexes. In addition to that, one of the main interests of using such a technique lies in the fact that analyses are achieved in metal concentrations of environmental relevance (from millimolar to nanomolar). For anisotropic and chemically heterogeneous particles such as clay particles, this study demonstrates the possibility to obtain useful information as the determination of diffusion coefficients of particles as well as the description of dynamic behavior of metal species as a function of physicochemical conditions of the suspension. In this regard, this study shows that the sorption of cadmium by clays can be described as a chemically homogeneous and labile system along a large range of pH whereas lead sorption shows some heterogeneity aspects, while remaining SSCP-labile.