



Kinetics and quantitative modelling of coupled dissolution/precipitation reactions of lead bearing solutions interacting with aragonitic shells.

M. Bucca (1), P. Cubillas (2), M. Dietzel (1), and S.J. Köhler (1)

(1) TU Graz, Applied Geosciences, Graz, Austria (maurizio.bucca@tugraz.at), (2) Centre for Nanoporous Materials, School of Chemistry The University of Manchester (pablo.cubillas-gonzales@manchester.ac.uk)

Elevated lead concentrations in surface and groundwater may cause serious health problems for aquatic biota and humans. Several processes are known for the removal of lead (Pb) from the aqueous solutions. In a previous study carried out by Cubillas et al. (2005) cadmium uptake using aragonite surfaces has been studied. The mechanism involved was a dissolution-precipitation happening concurrently and demonstrated aragonite's potential as metal sorbent. Further studies demonstrated a similar efficiency of aragonite surfaces in presence of other selected metals as lead (Pb), zinc (Zn) and cobalt (Co) (Köhler et al., 2007). Before optimizing such a process more a detailed study of the kinetic effects is necessary. In the present study we focused on the kinetics of the coupled precipitation/dissolution process for lead removal from polluted soils and waters by biogenic aragonitic carbonate (CaCO_3) shell surfaces according to the following Eq. 1:



This reaction has been investigated at fixed experimental conditions using synthetic model systems in batch and single pass flow through and fluidized bed reactors that allowed quantifying the kinetics of the process of metal carbonate formation. The chemical parameters pH, alkalinity, temperature, pCO_2 , and total ion concentration were followed during several hours. The reaction kinetics was successfully modelled using the geochemical code PHREEQC (Parkhurst, 1998) using the Plummer-Wigley-Parkhurst equation for both the dissolution and precipitation process. The precipitated lead bearing solid phases were characterized mineralogically. Potential applications of this study will be discussed.

Cubillas, P., Köhler, S. J., Prieto, M., Causserand, C., Oelkers, E.H., 2005. How do mineral coatings affect dissolution rates? An experimental study of coupled CaCO_3 dissolution- CdCO_3 precipitation. *Geochimica et Cosmochimica Acta* 69, Issue 23, 5459-5476.

Köhler, S.J., Cubillas, P., Rodriguez-Blanco, J.D., Bauer, C., Prieto, M., 2007. Removal of cadmium from wastewaters by aragonite shells and the influence of other divalent cations. *Environmental Science & Technology* 41, Issue 1, 112-118.

Parkhurst, D.L., 1998. PHREEQC (Version 2) - A computer program for speciation, batch-reaction, one-dimensional transport and inverse geochemical calculations. U.S. Geological Survey Water-Resources Investigations Report, pp 99-4259.