Bioaccessibility of As(V) and Pb(II) from mimetite

A. WOJNAR, M. MANECKI AND T. BAJDA

Department of Geology, Geophysics and Environmental Protection, AGH-University of Science and Technology, al.Mickiewicza 30, 30-059 Krakow, Poland (wojalicja@interia.pl, gpmmanec@cyf-kr.edu.pl, bajda@geol.agh.edu.pl)

Arsenic and lead contamination is prevalent problem throughout the world. One of the method suggested for their removal from wastewaters is based on precipitation of lead chloroarsenate - mimetite $Pb_5(AsO_4)_3Cl$ (Twidwell at all., 1994). In this process, mimetite quickly forms crystalline precipitate of relatively low solubility, suitable for separation and storage.

In this study, a bath equilibrium technique was adopted to quantitatively evaluate bioaccessibility of As(V) and Pb(II) released by dissolution of synthetic mimetite. EDTA (pH 7), acetate buffer (pH 5), and H_2SO_4 (pH 2 and 4) leaching fluids were used to simulate the presence of organic materials in soils and landfills and the effects of acid rains.

The highest solubility of mimetite was observed in the presence of EDTA. Dissolution in both, EDTA and acetate buffer is congruent and results in stoichiometric Pb/As ratio. Mimetite dissolves relatively fast and within first week the solution becomes saturated. In contrast, dissolution of mimetite in H_2SO_4 is incongruent and results in formation of anglesite $PbSO_4$ while As(V) remains in solution.

Reference

Twidwell, L.G., Pressas, K.O., Comba, P.G., and Dahnke, D.R., 1994. J. Hazardous Matter, 36, 68-80

Interaction between arsenic oxyanions and iron-sulfide minerals

P. YADAV AND D. WALLSCHLÄGER

Environmental & Resource Studies Program,Trent University, Peterborough, Canada (prabhasyadav@trentu.ca)

Introduction

Elevated arsenic (As) concentrations are frequently encountered in groundwater extracted from 30-50 m depth on the Indian sub-continent. Mineralogical studies in these aquifer strata suggest the importance of Fe-S minerals in this As mobilization process. In this project, we study the molecular mechanisms of As interaction with Fe-S minerals (both natural and synthetic pyrite FeS_2 and pyrrhotite FeS) under different redox conditions.

Methods

Fe-S minerals were equilibrated in batch experiments with solutions containing various concentrations of either As(III) or As(V). The redox state in solution was controlled by purging with N_2 , air or H_2S, and anoxic experiments were conducted in a glove box. Subsamples were withdrawn at different time intervals, filtered and analyzed for pH, total Fe, S and As by ICP-MS and for As speciation by AEC-ICP-MS.

First results

Arsenate adsorbed stronger to the Fe-S minerals than arsenite, and FeS adsorbed the As species stronger than FeS_2. Surprisingly, results suggest that sub-stochiometric levels of As species influence the solubility of the Fe-S minerals. Also, the mobility of the As species increased as the Fe-S mineral began to dissolve slightly (Fig. 1), i.e. As adsorption was reduced by Fe and/or S released from the mineral.

Figure1: As concentration in solution with and without pre-equilibration between Fe-S mineral and solution