2.1.P15

Surface speciation of mine tailings after sterilization treatment

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In order to compare abiotic and microbial sulfide oxidation rates in mine tailings, sterilization techniques are required. However, the methods must not alter the mineralogical, chemical, and physical properties of the treated material. It is essential that the surface reactivity of the tailings remains unaltered during sterilization treatment, or a comparison of oxidation rates will not be valid. This study uses X-ray photoelectron spectroscopy (XPS) to investigate the effect of a number of sterilization techniques (autoclaving, repeated heating, ethanol treatment, antibiotic treatment, γ-irradiation, and washing with deionized water) on the surface chemistry of mine tailings.

The results of the XPS study indicate that the methods involving heating produce the greatest changes in tailings surface chemistry, as demonstrated in the S(2*p*) spectra (see e.g. Figure 1). There is a much greater accumulation of oxidized sulfur species (e.g. sulfate, elemental sulfur and polysulfides) at the surfaces of these samples, relative to control samples. Weathering studies conducted with the treated tailings indicate little difference in metal release rates [1], which suggests that the changes in surface reactivity were not sufficiently great to effect the rate of weathering processes in the tailings.

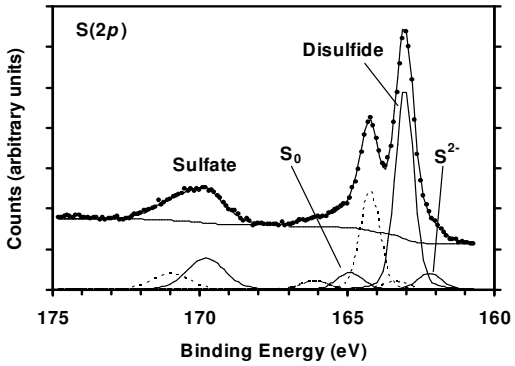

Figure 1: S(2*p*) XPS spectrum of mine tailings after treatment with 25 kGy γ – irradiation.

References

[1] Herbert R.B., Malmström M., Ebenå G., Salmon U., Ferrow E., Fuchs M. (2004) Sterilization of mine tailings for the quantification of abiotic oxidation rates (*manuscript*).

2.1.P16

Kinetics of cadmium fixation onto bone meal measured by Isotopic Dilution

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Over the past 15 years, extensive research has been carried out to identify new and economically priced sorbents for heavy metal removal from contaminated sites. Bonemeal (calcium hydroxyapatite) has been suggested as an effective low cost amendment to remediate heavy metal contaminated soil by decreasing metal bioavailabilty.

Understanding of the kinetics and mechanisms of metal adsorption onto mineral surfaces is fundamental if accurate predictions are to be made about metal fate and mobility.

Although still unclear, it is believed that due to the heterogeneous properties of bone meal, the mechanisms of metal sorption and phosphate formation comprises physical sorption, ion exchange and chemisorption (nucleation, precipitation).

The present study was undertaken to further elucidate the adsorption mechanism of cadmium onto bone meal and to investigate the effect of time on the lability of cadmium and the reversibility of the process.

After characterization of the bone meal by X-ray diffraction analysis and scanning electron microscopy, the adsorption of cadmium onto bonemeal was investigated in batch experiments using isotopic dilution techniques.

A binary experimental set up at different equilibration periods was used. The isotope was introduce with a specific loading in one experimental subset to measure the total adsorbed Cd, while it was introduce at the end of the reaction time in the other subset to measure the labile adsorbed Cd (isotopically exchangeable).

Results so far demonstrate instantaneous fixation of Cd as well as time-dependent transfer to non-labile pools. Further studies will examine the reversibility of the adsorption process and the effects of metal competition for surface sites.