Novel Adsorbent-Reactants for Treatment of Ash and Scrubber Pond Effluents

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Objectives: The overall goal of this project will be to evaluate the ability of novel adsorbent/reactants to remove arsenic, selenium and mercury from ash and scrubber pond effluents while producing stable residuals for ultimate disposal. The adsorbent/reactants to be evaluated include micro- and nano-sized iron sulfides (FeS) and disulfides (FeS_2). These compounds have the ability to remove arsenic, selenium and mercury from solution as well as react with them to produce solid phases that are stable when disposed in landfills, so that removal of these compounds from wastewaters will not result in contamination of soils and groundwaters. Methods for reliably and economically producing these materials will be developed.

Accomplishments: As of the date of preparation of this abstract, the project had not been initiated, so no progress has been made.

Future Work: Batch reactor systems will be employed in an anaerobic chamber to conduct experiments to characterize removal of arsenic, selenium and mercury from solution and their subsequent reactions. Experimental variables to be evaluated include concentrations of reactants (Fe^{2+}, Fe^{3+}, HS^-); temperature; energy input (microwave, ultrasound); inert nuclei. Experimental variables for removal experiments (short reaction time) will include: contaminant valence state (As(V), As(III), Se(VI), Se(IV), Hg(II)); adsorbent/reactant type (FeS, FeS_2); adsorbent/reactant concentration; pH (7, 8, 9, 10); competing ion (SO_4^{2-}) concentration (0, 10^{-3}, 10^{-2} M). Measured variables will be the soluble concentration of the contaminant. This data will be used to determine adsorption isotherms for each contaminant on each adsorbent/reactant. Experimental variables for reaction experiments (longer reaction time) will include: reaction time; pH (7, 8, 9, 10), and reductant type (none, Sn(II), borohydride). Measured variables will be soluble concentration of contaminant, identity of surface compounds (XRD) and leachability of surface compounds (equilibrium extraction test at various pH). Techniques will be developed to efficiently and economically produce adsorbent/reactants of different particle sizes.

Successful completion of this project is expected to demonstrate the ability of novel adsorbent/reactants to remove arsenic, selenium and mercury from ash and scrubber pond effluents and to produce residuals that are stable when disposed in landfills. This will provide

the fundamental data needed to develop an economical and environmentally sound method for managing these wastewaters at power plants. It is expected that techniques will be developed that allow the particle size of the adsorbent/reactants to be controlled during synthesis, which will allow small particles to be used that have greater capacity for removal of contaminants. The solid phases ultimately produced after removal from solution are expected to be low solubility solids that are compatible with anoxic conditions in landfills. Conventional methods for removal of these contaminants (sorption/coprecipitation with iron oxyhydroxides) produce residuals that are not stable under anoxic conditions.

Publications: No papers have been published or presentations made. No students have yet been supported.