Water

89273
oral

Effect of water chemistry and time on the sustainable reuse of recovered iron oxides as phosphate sorbents
D.M. Dorman* and R.W. Nairn, *University of Oklahoma*, *Norman, OK, USA*.
dayton.m.dorman-1@ou.edu

Sustainable treatment of mine drainage must consider the economic and environmental impact of treatment processes including the fate of the mine drainage (MD) treatment residual solids. Disposition and disposal of these solids can be costly and have a large environmental footprint. Thus, finding ways to reuse these solids can help improve the economic and environmental sustainability of treatment systems. The surface chemistry and large surface area per unit mass of iron oxide (FeOOH) solids make these materials an ideal sorbent for phosphate (PO_4), possibly giving these treatment residuals a beneficial reuse. These materials and similar industrial byproducts (e.g., fly ash) have been evaluated for this purpose by several authors. However, limited research has been performed to analyze 1) how different MD water chemistries affect the resulting FeOOH mineralogy and PO_4 sorption capacity and 2) how these FeOOH solids change in situ over time and any resulting effects on PO_4 sorption capacity and possible metals desorption. This research analyzed FeOOH from net-alkaline hard-rock MD passive treatment systems (PTS) (Tar Creek Superfund Site) and from net-acidic coal MD discharges and net-alkaline coal MD PTS (Arkoma Basin). Preliminary data shows that more amorphous forms of FeOOH (ferrihydrite and poorly-ordered goethite) are found near discharges where precipitates were the freshest while more mature materials found in PTS demonstrated greater crystallinity. All samples have a large sorption capacity for PO_4 (≈90 mg/g). Although the FeOOH from hard-rock MD PTS had higher metals concentrations than FeOOH formed in coal MD discharges, minimal desorption of metals was found over time in all samples. Management and disposal of these solids can be costly, however reuse of these solids as a PO_4 sorbent may be an economically and environmentally sustainable alternative.