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Metallic particles to stimulate sulfate reduction: A new approach for Bioremediation in low pH streams

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Extensive research has been carried out on efficiency of ZVI (Zero Valent Iron) and SRB (Sulfate Reducing Bacteria) for treatment of inorganics in contaminated groundwaters. ZVI is proved as a potential remediation agent due to multiple ZVI-metal interactions such as surface complexation, reduction and (co) precipitation. But little information is available till date on stability of precipitates, which is very important while dealing subsurface processes. SRB's are well known for metal removal and stable precipitates, but most of the time, the pH in mining areas are significantly low, which either restrict the stimulation of SRB or requires extra substrate and time. During anaerobic corrosion, ZVI deplete O2 and produce water derived H2, resulting an increase in pH and decrease in redox potential which makes it very efficient in low pH plumes. Moreover, SRB can potentially use this hydrogen as an electron donor to raise biomass yield significantly to accelerate reductive sulfate removal. The main objective of this research was to determine whether the combination of SRB and ZVI can improve the rate of contaminant removal and stability of precipitates.
Within the framework of this study, we tested experimentally different parameters: concentration and particle size (ranging from 70 nm to 300 mm) of ZVI to stimulate sulfate reduction for subsequent removal of metals such as As, Cd and Zn in groundwaters and sediments with low pH ($\sim$3). Stability of precipitates was studied as well in flowthrough columns by changing pH and redox conditions. In our experiment, we find that ZVI is very efficient in stimulating sulfate reduction, fast removal of contaminants and more stable precipitates

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