Exploring Microbial-Driven Carbonate Precipitation for Mine Waste Treatment

E. LAUCHNOR[1*], E. STOICK[2,] W. KIEFFER[3]

[1]Montana State University, Bozeman, MT 59715 USA (*ellen.lauchnor@montana.edu)

[2] Montana State University, Bozeman, MT 59715 USA (emily.stoick@montana.edu)

[3] Montana State University, Bozeman, MT 59715 USA (whitney.kieffer@montana.edu)

Microbially induced $CaCO_3$ precipitation (MICP) has been successfully used in many applications and has the potential to be used for immobilization of heavy metals in mine waste materials. In this work, MICP is investigated for mining remediation applications, including precipitation of heavy metals from mine influenced water and stabilization of mine tailings.

During MICP, bacterially catalyzed ureolysis produces carbonate and increases pH to promote precipitation of $CaCO_3$. Heavy metal cations can be co-precipitated in $CaCO_3$ or other minerals. MICP is being used in this research to drive co-precipitation of heavy metals from alkaline mine influenced water in batch reactors and porous media columns, utilizing a model bacterium, *Sporosarcina pasteurii*, and a ureolytic bacterium enriched from contaminated sediments. The native bacterium reduced concentrations of the heavy metals zinc, copper, cadmium, nickel and manganese during both batch and continuous flow column studies.

MICP is also investigated for stabilization of mine tailings by formation of a coating and "cement", to minimize heavy metal leaching from the tailings. Small scale column tests with re-application of MICP bacteria were able to promote MICP on the tailings surface. Permeability reduction was measured by increased infiltration time of water through the tailings and heavy metal mobilization will be evaluated with leaching tests.

In this research, we demonstrate that MICP can be promoted in mine-contaminated environments. However, implications of by-products from MICP must also be considered before field application.