THE EFFECT OF CARBON AND pH ON THE REDUCTION OF SULFATE BY SULFATE REDUCING BACTERIA AND THE SUBSEQUENT PRECIPITATION OF Fe AND Mn IN SIMULATED WETLAND MESOCOSMS

by

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Abstract: Experiments were conducted to determine the role that sulfate reducing bacteria (SRB) play in constructed wetlands to treat acid mine drainage (AMD). Simulated wetland mesocosms measuring 6" x 6" x 24" were constructed of plexiglass sheets, filled with 4 inches limestone gravel, 17 inches weathered mulch and fed synthesized AMD by gravity flow. In order to determine the effect of (1) carbon and (2) pH on the reduction of sulfate and the precipitation of Fe and Mn, densities of SRB, inlet and outlet pH and concentrations of SO_4 Fe, Mn and dissolved $S^=$ were measured over time. Prepared AMD contained sulfate ranging from 1500 to 375mg/L. With weathered mulch as the only available carbon source, sulfate concentrations decreased only 15% at all sulfate levels tested as AMD passed through the mesocosms. An average population of 10^4 SRB/g dry soil was detected. Sulfate decreased up to 100% after the addition of 300mg/L carbon as lactate at a rate of 0.1L/h. Iron and Mn decreased up to 95% and the population of SRB increased to 10^6. Dissolved $S^=$ was only detected after the addition of lactate. When AMD sulfate was maintained at 750mg/L and pH adjusted to 6.0, 4.5, and 3.0, sulfate was reduced 100%, 75%, and 55% respectively. Iron decreased 94% and Mn decreased 87.5%, 72.5% and 35% respectively. Our results suggest that carbon may be a limiting factor in wetlands developed to treat AMD and that low pH adversely affects the precipitation of Mn and the reduction of sulfate.

Key Words: acid mine drainage, sulfate reduction, wetlands

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