Simulated Typha Wetlands Applied to Removal of Iron and Manganese from Acid Mine Drainage

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Biological neutralization of acid mine drainage (AMD) in natural and man-made cattail (Typha) wetlands offers an alternative to chemical treatments. Mechanisms within wetlands which remove iron and manganese from AMD are not completely understood. Such information is vital for predicting impacts of long term use of Typha wetlands for treatment of AMD. In this study, simulated Typha wetlands were constructed in a controlled greenhouse environment. Four wooden troughs measuring 480 x 60 x 60 cm, (L x W x D) were lined with 40 mil thick plastic liners. Substrate consisted of a bottom layer of limestone (15 cm) covered by a peat moss/soil mixture (45 cm). Two ecotypes of Typha latifolia, designated A and B, were collected from non-AMD impacted field sites. Troughs contained 32 plants arranged in 16 rows of alternating ecotypes. Within 60 days, cattail root systems were fully established both on surface and subsurface and plants averaged 200 to 250 cm in height. Control systems were constructed in which no T latifolia was planted. All wetlands received inoculation with a mixed sediment slurry collected from a natural Typha wetland currently treating AMD in order to introduce both aerobic and anaerobic microorganisms. Preliminary addition of tap water to all troughs (300 ml/min) allowed establishment of microflora prior to addition of AMD: Interstitial water samplers were installed prior to AMD addition at the input and output points of the simulated wetland and allowed to equilibrate for 14 days. Pore water collected from the samplers show a pronounced decrease in Eh and increase in pH with depth, indicating oxygen consumption by microorganisms and buffering by the added limestone, respectively. Sulfate concentrations decreased with depth, probably due to establishment of active sulfate-reducing bacterial populations. Chemical analyses were performed on all troughs containing T latifolia to obtain base line data on Fe, Mn, and SO_4^{-2}levels at various depths. Total Fe levels showed an overall increase with increasing depth and consisted primarily of ferric (Fe^{+3}) iron. Similar patterns were observed with Mn levels. Data indicate that the greenhouse systems are sufficient to study microbial biotransformations of Fe, Mn, and S. Several isolation procedures are currently being evaluated for their ability to recover Fe and Mn-oxidizing and -reducing, as well as S-oxidizing and SO_4^{-2} reducing bacteria. Data will be

presented on bacterial populations and activities before and after AMD additions to simulated Typha wetlands.