ISOLATION AND CULTURE OF A MANGANESE-OXIDIZING BACTERIUM FROM A MAN-MADE CATTAIL WETLAND

Vail, W. J. (1), Wilson, S. (2), and Riley, R. K. (3). ((1) Professor and Chairman, (2) Student, and (3) Professor, Department of Biology, Frostburg State University, Frostburg, MD). A manganese-oxidizing bacterium was isolated and cultured in association with a fungus from a cattail wetland. Sediment and water samples were collected from a man-made cattail wetland in Somerset County, PA during the summer of 1987. Winogradsky columns were prepared, and the columns were sampled and transferred to tubes containing a medium composed of manganese sulfate and yeast extract at pH 4. After 3 days incubation a fungus mycelium appeared, and after 3 additional days incubation the mycelium began to turn dark. Microscopic examination showed many regions associated with the hyphae containing dark brown crystalline deposits which are assumed to be manganese dioxide. The fungus grown on the control medium, which lacked manganese sulfate, produced a cream-colored mycelium, but did not exhibit these brown deposits. Using standard microbiological techniques, a fungus-bacterium association was isolated, and observed and confirmed with SEM. The oxidization of Mn occurred at pH 4 and above. When this association is inoculated into a medium of manganese sulfate and yeast extract, there is a reduction of [Mn] in the supernatant fluid of between 18 to 26 percent over a 12-day period. The bacterium was tentatively identified as Metallogenium, and attempts are underway to grow both the fungus and bacterium in separate cultures.

Additional Key Words: Metallogenium.

SCREENING OF MOSSES AND ALGAE IN GREENHOUSE EXPERIMENTS FOR THEIR ABILITY TO REMOVE IRON FROM WATER.

Webster, H. J. (1), Stark, L. R. (2), and Stevens, S. E., Jr. (3). ((1) Assistant Professor, Biology Department, Dubois Campus, The Pennsylvania State University, DuBois, PA 15801, (2) Research Associate, Biology Department, The Pennsylvania State University, University Park, PA 16801 and (3) Professor, Molecular and Cell Biology, The Pennsylvania State University, University Park, PA 16802). Greenhouse experiments were conducted to screen the potential of five moss species, one algal species, and sawdust for their effectiveness in lowering the concentration of iron in acidified water. The initial iron concentrations of the reservoir water were 37-45 mg/L, using $FeSO_4$ as the source of iron. The pH for each species was adjusted to the pH of the water at the collection sites as follows: Sphagnum recurvum (5.2), S. fimbriatum (5.5), Drepanocladus fluitans (5.2), Pohlia nutans (2.8), Aulacomnium palustre (5.5), and Ulothrix subtilissima (3.1), while the red oak (Quercus borealis) sawdust was screened at a pH of 5.5. Water flow rates were 60 mL/min through each system. The percent change in iron concentrations of the water varied with species, although direct comparisons among species should be made with caution. After 13 to 14 hours, the dissolved iron in outlet water had been lowered relative to inlet water as follows: Spagnum recurvum (92%), S. fimbriatum (78%), Drepanocladus (86%), Pohlia (50%), Aulacomnium (98%), Ulothrix (27%), and sawdust (49%). Iron-oxidizing microbes were associated with the plant species although no correlation was found between bacterial counts and the lowering of iron concentrations. The iron content of plant tissue was greatest near the inlet of each lane, and brown tissues had more iron than green tissues. These results suggest that certain mosses and algae may be effective in treating acid mine drainage.

Additional Key Words: wetlands, Sphanum recurvum, S. fimbriatum, Drepanocladus fluitans, Pohlia nutans, Aulacomnium palustre, Ulothrix subtilissima.

ECOLOGICAL ENGINEERING AND BIOLOGICAL POLISHING: ITS APPLICATION IN CLOSE-OUT OF ACID GENERATING WASTE MANAGEMENT AREAS

Kalin, M. (Ecologist, Boojum Research Limited, Toronto, Canada). Methods for establishing cattail stands on pyritic wastes are being developed as part of Ecological Engineering. Cattails reduce infiltration of precipitation and provide organic matter. Hand-transplanted, mature Typha latifolia L. developed into stands with significantly higher growth potentials when transplanted in groups comprised of >3 plants. Mechanical transplanting was more suitable in physically exposed locations, but was limited by machinery access. Although hydroponic transplanting failed in waters with high Zn and Cu concentrations (250 and 35 mg/L), growth was achieved in waters with 3 and 0.5 mg/L Zn and Cu. Effective metal removal by aquatic biota (biological polishing) from acidic waste water is a function of the annual biomass production and their adsorption/uptake characteristics. Biomass production of Drepanocladus fluitans (C. Muell.) Roth, transplanted in mesh bags into an acidified lake (pH 4.0) was seasonally dependent (maximum, 100 g [dry weight]/m^2 moss; July, August), but not affected by location within the lake. Its polishing capacity ranges between 0.05 to 0.1, and 0.01 to 0.03 g/m^2 Zn and Cu. The biomass production of a gelatinous algal community, primarily Muogeotia Agardh spp., colonizing a substrate of submerged woody debris in the same lake, was dependent on location, but not on season. Biomass production in the first year of substrate introduction ranged from 9 to 42 g [dry weight]/100 g branch, while the polishing capacity of this periphytic algae-branch complex after 6 months of growth was 0.1 and 0.03 g /100 g branch Zn and Cu. Effective methods curtailing environmental degradation due to acid-generating base metal mining wastes can be developed through combining different polishing agents.

Additional Key Words: base metal mining, mine waste water, copper contamination, zinc contamination, Typha latifolia, Drepanocladus fluitans, Muogeotia spp.