Zinc and Nickel Sorption and Desorption Using a Mixed Algae Community Collected from a Mine Drainage Passive Treatment System[1]

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Abstract: Algae communities populate ponds in passive treatment systems (PTS) naturally, but their role in water quality dynamics is not well understood. Algae are capable of sorbing metals from contaminated waters, but it is uncertain how much of the sorbed metals will remain after the death and decomposition of the algal detritus. If algae are capable of retaining some of the sorbed metals even after decomposition, then the naturally growing communities may benefit overall PTS performance. Algae and water from the final polishing unit of the Mayer Ranch PTS at the Tar Creek Superfund Site of the Tri-State Lead-Zinc Mining District (Oklahoma, Kansas and Missouri) was collected for a sorption and desorption experiment. Concentrations of both zinc and nickel (0.5 mg/L, 2.0 mg/L, 5.0 mg/L, 10 mg/L, and 20 mg/L) were added to the PTS water to determine the magnitude and extent of possible sorption. Algae and the solution were tested for metal concentrations after a five-day period. Light was then removed by covering the vessels and they were placed at 0°C to promote algal death. Immediately after return to room temperature, and after a period of time provided for decomposition, both the algae and solution were tested for metal concentrations. All samples were centrifuged at 3000 rpm for five minutes to separate the algae from the supernatant for testing purposes. The algae were dried at 50°C for 15 hours, then powdered. Analyses were completed using acid digestion and Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES). It was hypothesized that sorption of both zinc and nickel by the naturally occurring mixed-algae community will occur and algal metal concentrations will decrease after decomposition of the detritus.

Additional Key Words: Langmuir and Freundlich isotherms, absorption, adsorption

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