PASSIVE REMEDIATION OF "HIGH RISK" ACID MINE DRAINAGE: MICROCOSM STUDIES USING CRAB-SHELL CHITIN AS A FRACTIONAL SUBSTRATE AMENDMENT[1]

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Abstract: Although passive treatment wetlands offer a low cost alternative for treating acid mine drainage (AMD), recent guidelines from the Pennsylvania Department of Environmental Protection indicate that they often fail when treating "high risk" AMD, containing net acidity and high metal loading, due to clogging with metal precipitate. Traditionally, spent mushroom compost (SMC) is the chosen substrate in these systems; however, recent laboratory and field studies indicate that the sustainable waste product, crab shell chitin, is highly effective at increasing pH, providing alkalinity and nutrients, maintaining reducing conditions, and inducing metals removal through precipitation and biosorption. In side-by-side field trials treating moderately strong AMD, crab shell chitin has not clogged with yellow boy (ferric hydroxide, ($Fe(OH)_3$), while other substrates have.

This study evaluated the performance of crab shell chitin for treating "high risk" water both on its own, and as a lower cost fractional amendment to SMC. Five substrate mixtures ranging from 10% to 100% chitin (with the balance SMC) were compared to the traditional vertical flow wetland (VFW) substrate (90% SMC/10% limestone) in laboratory microcosms containing AMD collected from a "high risk"mine discharge. Over fifty days, microcosms containing greater than 30% chitin outperformed microcosms containing traditional VFW substrate in increasing pH, adding alkalinity, and removing acidity. Metal removal was also strongly correlated with the substrate's chitin content, with higher percentages giving more rapid and complete remediation.

Based on these data, substrate ratios containing <30% chitin are not recommended for "high risk" water. All other tested ratios perform equal to or better than the traditional SMC and limestone, regarding alkalinity addition and metals removal. Continuous flow column studies (in progress) will further evaluate chitin amendments greater than 30% for treating "high risk" water in an attempt to estimate the longevity and cost of this promising substrate.

Additional Key Words: High risk, bioremediation, passive treatment.

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