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Biosorption of Manganese Mine Effluents Using Crude Chitin from Philippine Bivalves

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Abstract : The area around the Ajuy river in Iloilo, Philippines, is currently being mined for manganese ore, and river water samples exceed the maximum manganese contaminant level set by US-EPA. At the same time, the surplus of local bivalve waste is another environmental concern. Synthetic chemical treatment compromises water quality, leaving toxic residues. Therefore, an alternative treatment process is biosorption or using the physical and chemical properties of biomass to adsorb heavy metals in contaminated water. The study aims to extract crude chitin from shell wastes of Bractechlamys vexillum, Perna viridis, and Placuna placenta and determine its adsorption capacity on manganese in simulated and actual mine water. Crude chitin was obtained by pulverization, deproteinization, demineralization, and decolorization of shells. Biosorption by flocculation followed 5 g: 50 mL chitin-to-water ratio. Filtrates were analyzed using MP-AES after 24 hours. In both actual and simulated mine water, respectively, B. vexillum yielded the highest adsorption percentage of 91.43% and 99.58%, comparable to P. placenta of 91.43% and 99.37%, while significantly different to P. viridis of -57.14% and 31.53%, ($p < 0.05$). FT-IR validated the presence of chitin in shells based on carbonyl-containing functional groups at peaks 1530-1560 cm^{-1} and 1660-1680 cm^{-1}. SEM micrographs showed the amorphous and non-homogenous structure of chitin. Thus, crude chitin from B. vexillum and P. placenta can be bio-sorbents for water treatment of manganese-impacted effluents, and promote appropriate waste management of local bivalves.

Keywords : biosorption, chitin, FT-IR, mine effluents, SEM
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