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Laboratory Scale Purification of Water from Copper Waste

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Abstract : Heavy metals presence in water streams is a big danger for aquatic life and ultimately effects human health. Removal of copper (Cu) by ispaghula husk, maize fibre, and maize oil cake from synthetic solution in batch conditions was studied. Different experimental parameters such as contact time, initial solution pH, agitation rate, initial Cu concentration, biosorbent concentration, and biosorbent particle size has been studied to quantify the Cu biosorption. The rate of adsorption of metal ions was very fast at the beginning and became slow after reaching the saturation point, followed by a slower active metabolic uptake of metal ions into the cells. Up to a certain point, (pH=4, concentration of Cu = ~ 640 mg/l, agitation rate = ~ 400 rpm, biosorbent concentration = ~ 0.5g, 3g, 3g for ispaghula husk, maize fiber and maize oil cake, respectively) increasing the pH, concentration of Cu, agitation rate, and biosorbent concentration, increased the biosorption rate; however the sorption capacity increased by decreasing the particle size. At optimized experimental parameters, the maximum Cu biosorption by ispaghula husk, maize fibre and maize oil cake were 86.7%, 59.6% and 71.3%, respectively. Moreover, the results of the kinetics studies demonstrated that the biosorption of copper on ispaghula husk, maize fibre, and maize oil cake followed pseudo-second order kinetics. The results of adsorption were fitted to both the Langmuir and Freundlich models. The Langmuir model represented the sorption process better than Freundlich, and R^2 value ~ 0.978. Optimizations of physical and environmental parameters revealed, ispaghula husk as more potent copper biosorbent than maize fibre, and maize oil cake. The sorbent is cheap and available easily, so this study can be applied to remove Cu impurities on pilot and industrial scale after certain modifications.

Keywords : biosorption, copper, ispaghula husk, maize fibre, maize oil cake, purification
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