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Fish Scale Derived Bio Sorbents for the Removal of Organics from Greywater

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Abstract

Utilization of greywater can reduce water scarcity if, it is used as an alternative source of water for non-potable use. Fish scales, a low-cost waste product from the seafood industry, have gained attention as a potential bio sorbent for greywater treatment. Fish scales are natural biopolymers rich in minerals, aligned type I collagen fibrils with two layers which forms a plywood structure for fish scales. This makes the fish scales a good adsorbent to remove contaminants from wastewater. Previous studies used fish scales to treat different types of wastewaters, however the literature on the use of fish scale to treat greywater is lacking. This study emphasizes to use fish scale derived bio sorbent, to treat the grey water produced from a student hostel. The fish scales were collected from a local market, then it was thoroughly washed and dried under shade. The scales were cut into small pieces to enhance the surface area. Batch adsorption experiments were conducted through adsorption isotherm and kinetics to determine optimum dosage and the optimum contact time of the bio sorbent respectively. Isotherm and kinetics were conducted respectively for varying doses of bio sorbent (1 g/L to 12 g/L) and varying contact time (30 min to 24 hours). Results revealed the 4 g/L dosage of fish scale exhibited maximum reduction in COD (64%), turbidity (98%) and EC (43%) at contact time of 300 mins from raw wastewater (COD 449 mg/L; turbidity172 NTU; EC 4.20 ms/cm). This corresponds to the adsorption capacity(q_e) of 161.0 mg/g for COD. Optimum dosage (4 g/L) and optimum contact time (300 mins) were determined based on adsorption capacity of the adsorbents to the respective dosage and time. The proposed kinetic models for COD were predicted well with R^2 value 0.988 for Pseudo-second-order kinetic model which assumes that this adsorption is chemisorption, which involves covalent bonding through sharing or exchanging electrons between the adsorbent and the adsorbate. Elovich isotherm model well explains the experimental data on adsorption equilibrium with R^2 value 0.806, which based on a chemisorption kinematic principle in heterogenous surfaces. The wasted fish scales could be potentially incorporated into constructed wetlands, sand filters or other alternative natural treatment systems, enhancing their ability to effectively remove contaminants from greywater. The utilization of fish scales as a bio sorbent not only addresses waste management concerns but also aligns with the principles of circular economy by repurposing waste into valuable resources and fostering sustainability through innovative, eco-friendly solutions.

***Keywords**:* Greywater, Adsorption, Fish scales, Reuse, Chemical Oxygen Demand