Utilization of Brachystegia Spiciformis Leaf Powder in the Removal of Nitrates from Wastewaters: An Equilibrium Study

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Abstract : High levels of nitrates in drinking water present a potential risk to human health for it is responsible for methemoglobinemia in infants. It also gives rise to eutrophication of dams and rivers. It is, therefore, important to find ways of compating the increasing amount of nitrates in the environment. This study explored the bioremediation of nitrates from aqueous solution using Brachystegia spiciformis leaf powder (BSLP). The acid treated leaf powder was characterized using FTIR and SEM before and after nitrate biosorption and desorption experiments. Critical biosorption factors, pH, contact time and biomass dosage were optimized as 4, 30 minutes and 10 g/L respectively. The equilibrium data generated from the investigation of the effect of initial nitrate ion concentration fitted the isotherm models in the order Dudinin-Radushkevich < Halsey=Freundlich < Langmuir < Temkin model based on the correlation of determination (R^2). The Freundlich's adsorption intensity and Langmuir's separation factors revealed the favorability of nitrate ion sorption onto BSLP biomass with maximum sorption capacity of 87.297 mg/g. About 95% of the adsorbed nitrate was removed from the biomass under alkaline conditions (pH 11) proving that the regeration of the biomass, critical in sorption-desorption cycles, was possible. It was concluded that the BSLP was a multifunctional group material characterised by both micropores and macropores that could be effectively utilised in nitrate ion removal from aqueous solutions.

Keywords : adsorption, brachystegia spiciformis, methemoglobinemia, nitrates

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