

REMOVAL OF PHOSPHATE BY FELDSPAR-FLY ASH-ALGINATE COMPOSITE

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Phosphate enters water-ways from fertilizer run-offs, human and animal waste, and industrial effluents. It can stimulate the growth of aquatic plants and algae in water bodies leading to eutrophication. The objective of this study is to investigate the potential use of an environmentally friendly silicate polymer composite for phosphate removal from aqueous medium. To prepare the composite, feldspar and fly ash were added in 1:1 ratio to a freshly prepared solution of sodium alginate (5% w/v) at 80 °C and stirred for 18 h. This mixture was added drop-wise to a 5% (w/v) Cu²⁺ solution. The beads formed were allowed to stand for 48 h, filtered and washed with distilled water. Phosphate concentration was determined using UV-Vis spectrophotometer. Kinetic study was conducted with an adsorbent dosage of 20.0 g L⁻¹ and 25.0 mL of 5.0 mg L⁻¹ phosphate solution at pH 6.5 at 27 °C and the data were fitted to pseudo 1st and 2nd order kinetic models. The adsorption was further studied by varying the initial pH values (pH 1.0-12.0) and initial phosphate concentrations (1.0-15.0 mg L⁻¹). The adsorption data were fitted to Langmuir and Freundlich isotherm models. In this study, the equilibrium was reached after 330 min with a maximum phosphate adsorption of 82.5%. Pseudo 2nd order kinetic model ($R^2 = 0.9417$) was accepted with a rate constant of 0.122 L mg⁻¹ min⁻¹. The optimum pH range for the adsorption process was 3-7 with more than 80.0% adsorption. In this pH range, the predominant ion is H₂PO₄⁻, and therefore, it is more attracted towards the composite. Adsorption isotherm data agreed well with Freundlich isotherm model with high R^2 , which indicates that the adsorption process is reversible and it is a multilayer adsorption onto heterogeneous surface. This study indicates that feldspar-fly ash-alginate composite can be used as an environmentally-friendly, and a green adsorbent to remove phosphate from a contaminated aqueous environment.

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