

## **Removal and Recovery of Phosphate using Sorption from Wastewater: Effect of Process Parameters and Modeling**

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Wastewater contains P (Phosphorus) from human excreta, household detergents and some industrial and trade effluents in the form of orthophosphates, organic compounds and polyphosphates. Out of these, phosphate is the most available form of P. Thus, the need for the removal of excess phosphate is a necessity. Since P is a nutrient, release of wastewater containing excess P could lead to create problems of eutrophication. Apart from that, P is a finite resource, therefore, recovery of P from wastewater is also of interest. Sorption has been given importance in this regard mainly by using Activated Carbon (AC). However, use of kinetics and adsorption isotherm models to describe this P sorption process on to AC is limited in the literature. Therefore, this study is sought at describing adsorption kinetics and equilibrium adsorption isotherms of P on to AC and the desorption process to enhance the recovery of phosphate. Different reaction parameter impacts on the adsorption process were tested. Experiments were conducted with synthetic solutions having an initial P concentration of 25 ppm prepared by using  $\text{KH}_2\text{PO}_4$ . Results of the kinetic study done in triplicate showed that the phosphate removal reached its maximum value (38.37%) after four hours and thirty minutes. The Elovich model fit well with the kinetic study experimental data explaining that the rate of adsorption of P on to AC gets decreased exponentially as the amount of adsorbed P on to AC increases. Equilibrium isotherm study results suggested that this adsorption process could be well explained by the Langmuir model with the maximum adsorption capacity of  $-0.5488 \text{ mg g}^{-1}$ . The results also revealed that the pH of the solution significantly influences the adsorption process as P removal efficiency is considerably decreased from lower pH to higher pH. Desorption study w results showed that the phosphate adsorbed by AC could be successfully desorbed using 1 M NaOH solution up to 84.17% after 1.6 hrs.

**Keywords:** Phosphorus; Adsorption; Elovich model; Langmuir model; Desorption