

## Adsorption of Phosphate from Aqueous Solution Using Filter Cake for Urban Wastewater Treatment

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**Abstract :** Adsorption of phosphorus (P as PO<sub>4</sub><sup>3-</sup>) in filter cake was studied to assess the media's capability in removing phosphorous from wastewaters. The composition of the filter cake that was generated from alum manufacturing process as waste residue has high amount of silicate from the complete silicate analysis of the experiment. Series of batches adsorption experiments were carried out to evaluate parameters that influence the adsorption capacity of PO<sub>4</sub><sup>3-</sup>. The factors studied include the effect of contact time, adsorbent dose, thermal pretreatment of the adsorbent, neutralization of the adsorbent, initial PO<sub>4</sub><sup>3-</sup> concentration, pH of the solution and effect of co-existing anions. Results showed that adsorption of PO<sub>4</sub><sup>3-</sup> is fairly rapid in first 5 min and after that it increases slowly to reach the equilibrium in about 1 h. The treatment efficiency of PO<sub>4</sub><sup>3-</sup> was increased with adsorbent extent. About 90% removal efficiency was increased within 1 h at an optimum adsorbent dose of 10 g/L for initial PO<sub>4</sub><sup>3-</sup> concentration of 10 mg/L. The amount of PO<sub>4</sub><sup>3-</sup> adsorbed increased with increasing initial PO<sub>4</sub><sup>3-</sup> concentration. Heat treatment and surface neutralization of the adsorbent did not improve the PO<sub>4</sub><sup>3-</sup> removal capacity and efficiency. The percentage of PO<sub>4</sub><sup>3-</sup> removal remains nearly constant within the pH range of 3-8. The adsorption data at ambient pH were well fitted to the Langmuir Isotherm and Dubinin-Radushkevick (D-R) isotherm model with a capacity of 25.84 and 157.55 mg/g of the adsorbent respectively. The adsorption kinetic was found to follow a pseudo-second-order rate equation with an average rate constant of 3.76 g.min<sup>-1</sup>.mg<sup>-1</sup>. The presence of bicarbonate or carbonate at higher concentrations (10-1000 mg/L) decreased the PO<sub>4</sub><sup>3-</sup> removal efficiency slightly while other anions (Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, and NO<sub>3</sub><sup>-</sup>) have no significant effect within the concentration range tested. The overall result shows that the filter cake is an efficient PO<sub>4</sub><sup>3-</sup>-removing adsorbent against many parameters.

**Keywords :** wastewater, filter cake, adsorption capacity, phosphate (PO<sub>4</sub><sup>3-</sup>)

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