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PHOSPHATE REMOVAL FROM WATER AND RECOVERY USING IRON (Fe^{+3})OXIDE/HYDROXIDE NANOPARTICLES-BASED AGGLOMERATES SUSPENSION (AggFe) AS ADSORBENT

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Abstract

An iron(Fe^{+3}) oxide/hydroxide nanoparticles-based agglomerates (AggFe) suspension adsorbent was synthesized for efficient, cost-effective phosphate removal. A strong effect of AggFe concentration and pH level of water containing phosphate on removal efficiency was shown. It was found that phosphate adsorption onto the AggFe suspension may be described by pseudo-second-order reaction kinetics and the Langmuir isotherm model. The unique adsorption properties of synthesized AggFe adsorbent are demonstrated. This technique achieved a residual phosphate concentration of less than 0.05ppm as PO_4 (<20 ppb as P), which is acceptable by water quality regulations, and at least 95-99% regeneration efficiency of the phosphate with the proposed adsorbent. The phosphate adsorption capacity on the AggFe at an equilibrium concentration of 0.1ppm as P in the solution is about 1.5-1.9 times higher than these values for granulated ferric hydroxide (fraction <63 μm) and more than one order of magnitude higher than other values reported in the literature. This technique enables recovery of the adsorbent while producing a concentrated phosphate solution that may be treated further to obtain phosphate crystals while recovering the cleaning solution.

Key words: adsorption, agglomerates, iron(Fe^{+3}) oxide-hydroxide, phosphate, recovery, suspension, water purification

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