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Removal of phosphate from aqueous solutions using granular ferric hydroxide process optimization by response surface methodology

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ABSTRACT

Granular ferric hydroxide was used in the present study to evaluate the efficiency of phosphate removal from aqueous solutions using central composite design and optimization by response surface methodology (RSM). The interaction of important parameters including pH, contact time, adsorbent dose and initial concentration of phosphate was used on the phosphate removal process and optimization of the removal process. The design of this research was based on central composite, which is one of the methods of RSM. The number of standard samples in this study was 35. The results of optimization of the variables derived by solver command in the initial phosphate concentration were 1.78 mg L^{-1}, pH = 5.81, contact time = 82 min, and adsorbent dosage = 4.03 g, maximum removal efficiency of 92.14%. Experimental results of phosphate removal with three repetitions indicated that maximum removal efficiency of phosphate in optimal conditions was 91.6%. Also, the experimental adsorption data indicated that the data follow the pseudo-second-order kinetic model (R^2 = 0.979) and Freundlich isotherm model (R^2 = 0.997). Based on the Langmuir model, the maximum phosphate adsorption (Q_{max}) was 6.541 mg g^{-1}. In general, it can be concluded that granular ferric hydroxide with a good quality and low operating cost has high efficiency in removal of phosphate from various aqueous solutions.

Keywords: Adsorption; Phosphate; Aqueous solutions; Granular ferric hydroxide; RSM

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