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OPTIMIZATION OF Pb (II) REMOVAL FROM AQUEOUS SOLUTIONS BY FLY ASH USING BOX-BEHNKEN DESIGN

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Abstract

This article explores the possibility of the use of fly ash, a byproduct of coal-fired thermal power plants, as a low-cost adsorbent for adsorption of Pb (II) from an aqueous solution. A 3-factor, 3-level Box Behnken design (BBD) technique was used to investigate the interactive effects of fly ash dosage (5-25 g/L), initial concentration of Pb (II) (10-20 mg/L), and pH (2.5-5.5) on Pb (II) removal efficiency. The interactive effects of process parameters were examined using a second-order quadratic equation. The analysis of variance (ANOVA) implies that the quadratic model developed in this study is very significant. The proposed model possesses a high correlation coefficient R^2 equals to 0.9964, indicating that all of the terms represented were extremely significant. At optimal conditions, 97.6% removal efficiency was achieved using an initial Pb (II) concentration of 10 mg/L, a pH of 5.3, and a fly ash dosage of 18g/L. The second-order kinetic model has a coefficient of correlation that is closer to unity ($R^2 = 0.98$) than the other kinetic models. The adsorption data was fitted to different isotherm models, and it was found that the adsorption process follows both the Langmuir and Freundlich isotherms. This research shows that fly ash may be utilized as an unconventional low-cost material to adsorb Pb (II) from aqueous solutions.

Key words: fly ash, kinetic study, optimization, RSM, thermodynamics

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