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INVESTIGATION OF COPPER(II), ZINC(II) AND LEAD(II) REMOVAL ONTO EXPANDED PERLITE BY ADSORPTION FROM THE WASTES OF METAL CASTING INDUSTRY: STATISTICAL MODELING AND OPTIMIZATION

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Abstract

In this work, the feasibility of expanded perlite as an adsorbent for copper(II), zinc(II) and lead(II) removal from the industrial waste was investigated. Batch adsorption method was used to evaluate the feasibility. Kinetic and isotherm models were studied to investigate the adsorption mechanisms. The results indicated that the adsorption of all heavy metals onto expanded perlite followed well Langmuir isotherm and pseudo-second order kinetic models. Box Behnken experimental design was also used to determine the effects of the independent variables on the response and to maximize the optimum conditions for the removal of these heavy metals. The independent variables selected for study were pH, adsorbent concentration and contact time. These independent variables were studied at three different levels 2, 5 and 8 for pH, 10 g/L, 50 g/L and 100 g/L for adsorbent concentration, and 5 min, 30 min and 120 min for contact time. The adsorption capacities were found as 0.9997 mg/g, 34.2466 mg/g, and 40.3226 mg/g for copper(II), zinc(II), and lead(II) ions, respectively. ANOVA test was used to specify the model performance. The predicted values from the model agreed with the observed responses. The results encouraged the using of Box–Behnken experimental design in order to optimize critical variables and an adsorption process onto expanded perlite.

Key words: Box-Behnken design, expanded perlite, heavy metal, industrial waste, removal

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