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Experimental, kinetic, equilibrium and regeneration studies for adsorption of Cr(VI) from aqueous solutions using low cost adsorbent (activated flyash)

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ABSTRACT

In the present study, activated flyash — a low-cost adsorbent, is used as for Cr(VI) removal from aqueous solutions. Flyash is activated by giving heat treatment and with the use of concentrated sulfuric acid (98% w/w). Batch adsorption experiments are carried out to investigate the effect of influencing process parameters such as initial pH, change in pH during adsorption, contact time, adsorbent amount, and initial Cr(VI) concentration. The maximum adsorption of Cr(VI) on activated flyash is found at an initial pH value of 1. The value of pH increases with increase in adsorption of Cr(VI). The equilibrium data for adsorption of Cr(VI) on activated flyash is tested with different adsorption isotherm models such as Langmuir, Freundlich, Redlich–Peterson, Koble–Corrigan, Tempkin, Dubinin–Radushkevich and generalized isotherm models. The Koble–Corrigon isotherm model is found to be the most suitable one for Cr(VI) adsorption using activated flyash. The maximum adsorption capacity obtained is 21.9 mg g^{-1} at a pH value of 1. The adsorption process follows the second order kinetics and the corresponding rate constants are obtained at different initial Cr(VI) concentrations. Desorption of Cr(VI) from activated flyash using acid and base treatment shows a higher desorption efficiency by more than 85%. A feasible methodic solution for the disposal of contaminant (acid and base solutions) containing high concentration of Cr(VI) obtained during the desorption process is proposed.

Keywords: Adsorption; Cr(VI); Activated fly ash; Heavy metal removal; Batch studies; Water pollution; Adsorption isotherm; Kinetics; Regeneration

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