Environmental Engineering and Management Journal *May 2015, Vol.14, No. 5, 1067-1078*
http://omicron.ch.tuiasi.ro/EEMJ/

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ADSORPTIVE REMOVAL OF METHYLENE BLUE FROM AQUEOUS SOLUTIONS BY PUMICE POWDER: PROCESS MODELLING AND KINETIC EVALUATION

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Abstract

This study was carried out to investigate the adsorption of methylene blue (MB) onto pumice powder, as a low-cost adsorbent for the removal of dyes. The experiments were designed based on a central composite design (CCD) and the process was analyzed and modeled using response surface methodology (RSM). In order to study the adsorption process, three important factors viz. pumice dosage (20- 50 mg/50mL), MB concentration (20-40 mg/l) and contact times (5- 35 min) were chosen as variables and MB removal was studied as the process response. Three dimensional plots demonstrate relationships between the MB removal efficiency with the paired factors (when other factor was kept at its optimal level), describing the adsorption of pumice powder in a batch process. The model showed that MB removal efficiency in aqueous solution affected by three factors studied. A maximum MB removal efficiency of more than 90% was achieved at the optimum conditions (pumice dosage of 50mg/50 mL, MB concentration of 20 mg/l and contact time of 35 min). Process kinetic parameters were also investigated and modeled using five kinetic models including the pseudo-first-order equation, second-order equation, the modified Freundlich, the pore diffusion model and the Elovich equation. The best fit of experimental adsorption data was obtained by means of the pseudo-second-order models. Equilibrium data were fitted to the Freundlich and Langmuir isotherm equations, and the equilibrium data were found to be well represented by the Langmuir equation.

Key words: adsorption isotherms, methylene blue (MB) removal, pumice powder, response surface methodology

Received: January, 2012; Revised final: September, 2012; Accepted: September, 2012

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