



Scale-up of a dye adsorption process using chemically modified rice husk: optimization using response surface methodology

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ABSTRACT

This article extends our previous study on malachite green (MG) adsorption using chemically modified rice husk at shake flask level, by investigating the scale up of the dye adsorption process to a laboratory level stirred batch reactor. Response surface methodology (RSM) was employed to investigate the effect of different operating conditions on the uptake of MG. A two level three factor (2^3) full factorial central composite design (CCD) with the help of Design Expert Version 7.1.6 (Stat Ease, USA) was used for the optimization of the adsorption process and to evaluate the effects and interactions of process variables: initial solution pH (4.0–10.0), initial dye concentration (100–500 mg/l), and adsorbent dose (10–50 g/l). Multiple response optimization was applied to the experimental data to discover the optimal conditions for a set of response, simultaneously, by using a desirability function. The optimum conditions for MG adsorption were found to be 8.30, 500 mg/l and 29.31 g/l respectively, for initial solution pH, initial dye concentration and adsorbent dose. Under these conditions, the removal efficiency was found to be 90.83%.

Keywords: Adsorption; Rice husk; Malachite green; Stirred batch reactor; Central composite design; Response surface methodology

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