Environmental Engineering and Management Journal xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
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SPOTTED GOLDEN THISTLE STALKS AS A NOVEL LOW-COST SORBENT FOR METHYLENE BLUE SORPTION FROM SYNTHETIC AQUEOUS SOLUTIONS: EQUILIBRIUM AND KINETICS STUDIES

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Abstract

The present study explores the potential use of plant waste i.e. spotted golden thistle (*Scolymus maculatus L.*) stalks, as an inexpensive sorbent for the removal of methylene blue from synthetic aqueous solutions. Firstly, the waste material was characterized using different analysis methods then kinetics and equilibrium studies of dye sorption were investigated using a batch sorption technique. The influence of contact time, initial dye concentration, sorbent dose, particle size and agitation speed on the dye sorption kinetics has been studied. The amount of dye sorbed at equilibrium increased with initial dye concentration, and with decreasing of particle size and sorbent dose. Agitation speed of 400 rpm afforded immersion of sorbent at earlier contact time and enhanced sorbed dye equilibrium amount. The necessary time to achieve equilibrium was increasing in the range of 12-19 h with initial dye concentration. Five models including first order, pseudo-second order, Elovich, Avrami and Tobin ones, were selected to describe the dye sorption kinetics. The best fitting model was the Avrami one. A multiple-stage diffusion of methylene blue onto thistle stalks particles was observed. Equilibrium data of methylene blue sorption by thistle stalks were fitted to six models namely Freundlich, Langmuir, Temkin, Sips, Toth and Redlich-Peterson models; Sips model best fitted the data. Maximum monolayer sorption capacity of sorbent was found to be 74 mg/g towards methylene blue. These first results obtained under the investigated experimental conditions, show that this sorbent is promising material for methylene blue removal from aqueous solutions.

Key words: equilibrium, kinetics, methylene blue, sorption, spotted golden thistle

Received: January, 2016; Revised final: August, 2016; Accepted: August, 2016

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