Chemical treatment of orange tree sawdust for a cationic dye enhancement removal from aqueous solutions: kinetic, equilibrium and thermodynamic studies

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**ABSTRACT**

In order to assess the potential use of low-cost materials for dye removal from aqueous solutions, the adsorption of cationic dye methylene blue (MB) onto orange tree sawdust was studied under static mode using raw sawdust (ROS) and chemically modified sawdust (MOS). The effect of several parameters such as contact time, initial dye concentrations, initial pH, adsorbent dose, and temperature were also investigated. Results showed that the adsorption kinetic data of MB onto both materials were well fitted by the second-order model and the equilibrium state was reached after 180 min of contact time. For both ROS and MOS, MB removal efficiency was improved by the increase in the initial aqueous concentrations, adsorbent dose, and aqueous pH. Moreover, MB adsorption data at equilibrium were well fitted by Langmuir model suggesting a probable monolayer adsorption process. The chemical treatment of the orange tree sawdust with sodium hydroxide (1 M) significantly increased the density of sorption sites and lead to the appearance of new functional groups. Therefore, MB removal capacity increased from about 40 mg/g for ROS to 111 mg/g for MOS at an initial pH value 6.0. The thermodynamic study demonstrated that MB adsorption was endothermic for ROS and spontaneous and exothermic for MOS, respectively. Desorption experiments with HNO\textsubscript{3} acidic solutions proved that MB was significantly desorbed from the tested adsorbents, which offers a possible reusability. All these findings indicate that alkaline-treated orange tree sawdust could be employed as an efficient low-cost and eco-friendly adsorbent for cationic dye removal from industrial wastewaters.

**Keywords:** Orange tree sawdust; Chemical pretreatment; Methylene Blue; Adsorption; Thermodynamics

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