

Malachite green adsorption by mango (*Mangifera indica* L.) seed husks: Kinetic, equilibrium and thermodynamic studies

Adriana S. Franca*, Leandro S. Oliveira, Silvanio A. Saldanha, Pedro I.A. Santos, Samantha S. Salum

*Departamento de Engenharia Mecânica/Universidade Federal de Minas Gerais, Av. Antônio Carlos, 6627, 31270-901, Belo Horizonte, MG, Brazil
Tel. +55 (31) 34093512; Fax +55 (31) 34433783; email: adriana@demec.ufmg.br*

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ABSTRACT

Mango seed husks (MSH), an agricultural waste, was evaluated as an adsorbent for removal of malachite green (MG) from aqueous solutions. Batch adsorption tests were performed at room temperature and the effects of contact time and initial solution pH were investigated. Equilibrium was attained after 2 h for all the tested initial MG concentrations (100–500 mg L⁻¹). Adsorption kinetics was determined by fitting pseudo first and second-order kinetic models to the experimental data, with the pseudo second-order model providing the best description of MG adsorption by MSH. The experimental adsorption equilibrium data were fitted to Langmuir and Freundlich adsorption models, with Freundlich providing the best fit. Evaluation of thermodynamics parameters indicated that the adsorption is spontaneous ($\Delta G^\circ = -4190 \text{ J mol}^{-1}$ at 30°C) and exothermic ($\Delta H^\circ = -66.2 \text{ KJ mol}^{-1}$). Maximum adsorption capacity was 47.9 mg g⁻¹, comparable to other untreated agricultural residues such as rattan sawdust and lemon peel. The experimental data obtained in the present study indicate that this type of waste material is a suitable candidate for use as a biosorbent in the removal of cationic dyes.

Keywords: Adsorption; Agri-food waste; Toxic pollutants

* Corresponding author.