

## Equilibrium sorption of methylene blue using mansonia wood sawdust as biosorbent

Augustine E. Ofomaja

Department of Chemistry, Faculty of Physical Science, University of Benin, Ugbowo-Lagos Road, Benin City, Edo State, Nigeria  
Tel. +234 802 871 5034; email: aus\_ofomaja@yahoo.com

Received 20 July 2006; Accepted 11 August 2008

---

### ABSTRACT

The potential use of mansonia wood sawdust as low-cost adsorbent for the sorptive removal of basic dye, methylene blue, from aqueous solution has been studied. The effect of sawdust particle size on the equilibrium methylene blue uptake was examined using batch sorption technique. Adsorption isotherm was determined using various particle sizes (150, 250, 350, 450 and 550  $\mu\text{m}$ ) of mansonia sawdust at 26°C and the experimental data obtained were modeled using the Langmuir, Freundlich, Tempkin and Dubinin–Radushkevich isotherms. The results revealed that the sawdust particle size has a strong influence on the percentage dye removal and on the amount of dye adsorbed per gram of sawdust from a 120 mg/dm<sup>3</sup> dye solution. Increasing sawdust particle size from 150 to 550  $\mu\text{m}$  reduced the percentage dye uptake from 93.57% to 29.50% and amount of dye adsorbed per gram of sawdust from 28.07 to 8.85 mg/g. The isotherm data were found to be well described by the Langmuir, Tempkin and Dubinin–Radushkevich isotherm models. The monolayer capacity calculated from the Langmuir equation is given as 33.44 mg/g using sawdust of particle size 150  $\mu\text{m}$ . The equilibrium binding constant  $K_i$  calculated from the Tempkins was reduced with increasing sawdust particle size from 150 to 550  $\mu\text{m}$ , while the mean free energy of sorption per mole of sorbate calculated from the Dubinin–Radushkevich isotherm was in the range 12.91 to 13.89 mol<sup>2</sup>kJ<sup>-2</sup>, suggesting that the sorption mechanism was by ion exchange. A mathematical relationship was also drawn between the equilibrium sorption capacity and the change in pH ( $\Delta H^+$ ) at the end of the isotherm experiments with varying initial dye concentration, supporting the fact that sorption of methylene blue dye on mansonia sawdust is by ion exchange. Desorption of sorbed dye molecules into solution was achieved at low pH conditions.

**Keywords:** Mansonia sawdust; Sorption isotherm; Methylene blue dye; Ion exchange; Monolayer capacity

---