

## Adsorption, kinetic and equilibrium studies on removal of basic dye from aqueous solutions using hydrolyzed oak sawdust

M.M. Abd El-Latif\*, Amal M. Ibrahim

*Mubarak City for Scientific Research and Technology Applications, Institute of Advanced Technologies and New Materials, Fabrication Technology Department, Alexandria, Egypt  
Tel./Fax +20 34593414; email: amona1911@yahoo.com*

Received 22 June 2008; Accepted 2 April 2009

---

### ABSTRACT

Oak sawdust (SD), which is the main waste from furniture industry in Egypt, has been used as an adsorbent without treatment or it was treated with 0.1 N sodium hydroxide (SD1) and 0.1 N sulphuric acid (SD2). Different adsorbents were characterized by SEM, TGA and FTIR to clarify the effect of treatment on the adsorption process. Oak sawdust and different treated oak sawdust have been used for the removal of methylene blue dye from aqueous solutions. Batch adsorption experiments were performed as a function of pH, adsorbent dose, agitation speed, contact time and initial dye concentration. The optimum pH required for maximum adsorption was found to be 8. The experimental equilibrium adsorption data are tested for Langmuir, Freundlich and Temkin isotherms. Results indicate the following order to fit the isotherms: Langmuir > Temkin >>> Freundlich adsorption. Kinetics data were modeled using the pseudo-first and pseudo-second order, Elovich equations and intra-particle diffusion models. The results indicate that the second-order model best describes adsorption kinetic data with regard to the intra-particle diffusion rate. Thermodynamic parameters  $\Delta H$ ,  $\Delta S$  and  $\Delta G$  have been calculated for each type of adsorbents. Positive value of  $\Delta H$  and negative value of  $\Delta G$  show endothermic and spontaneous nature of adsorption respectively, also activation energy  $E_a$  has been calculated.

*Keywords:* Adsorption; Isotherms; Kinetics; Cationic dye; Sawdust

---

\* Corresponding author.