Desalination and Water Treatment
www.deswater.com
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doi: 10.5004/dwt.2009.251

2 (2009) 139–147
February

Utilization of walnut shells (*Juglans regia*) as an adsorbent for the removal of acid dyes

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Received 18 December 2006; Accepted 26 January 2009

ABSTRACT

The removal of acid red 183 and acid green 25 onto walnut shells (*Juglans regia*) (WS) from aqueous solutions was investigated by using parameters such as contact time, temperature, pH, adsorbent doses and initial dye concentration. Adsorption equilibrium was reached within 30 min. The adsorption isotherms were described by means of the Langmuir and Freundlich isotherms. It was found that the Langmuir isotherm appears to fit the isotherm data better than the Freundlich isotherm. The maximum adsorption capacities for acid red 183 and acid green 25 on WS at 308, 313, and 318 K were found to be 45, 37, and 37; 21, 14, and 7 mg g^{-1}, respectively. The data obtained from adsorption isotherms at different temperatures were used to calculate some thermodynamic quantities such as free energy of adsorption (ΔG^0), enthalpy (ΔH^0), and entropy (ΔS^0). That G^o is negative, indicating that the nature of adsorption process for dyes is spontaneous. The positive value of H^o indicates that the adsorption of dyes onto WS is an endothermic process. The positive value of S^o reflects the affinity of the adsorbent for dyes. The kinetics and the factors controlling the adsorption process were also studied. The adsorption process followed a second-order model. WS, being a cheap, and easily available material, can be an alternative for more costly adsorbents used for dye removal in wastewater treatment processes.

Keywords: Adsorption; Adsorption isotherms; Adsorption of dyes; Walnut shells; Acid dyes

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