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Comparison of the removal efficiencies of Basic red 46 from aqueous solutions using Aşkale lignite with and without ultrasound assisted processes

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ABSTRACT

This study compared the removal efficiencies of Basic red 46 from aqueous solutions with and without ultrasound-assisted processes using lignite as a low-cost adsorbent. The effects of various experimental parameters such as contact time, adsorbent dosage, initial solution, pH, initial dye concentration and temperature on the dye removal efficiency were investigated. The experimental results were modelled by the kinetic and isotherm models. Both of processes fitted well to pseudo-second-order kinetics and the Langmuir model with highest correlation coefficients for all of three temperatures. The results showed that the influence parameters have a different effect on the removal efficiency in the presence and absence of ultrasonic irradiation. When the results obtained for both processes are compared, it is seen that the removal efficiency obtained with the ultrasound assisted process is much higher than that obtained with non-ultrasound assisted process at high dye concentrations. The removal efficiency of ultrasound-assisted and unassisted processes was found to be 81.5% and 54.6%, respectively, at 80 mg/L dye concentration and 60 min. Thermodynamic parameters showed that the adsorption process was spontaneous and exothermic. The enthalpy and entropy changes for the ultrasound-assisted process were –9.35 kJ/mol and –0.03 kJ/K·mol, respectively.

Keywords: Basic red 46; Lignite; Adsorption; Ultrasound assisted process; Dye removal efficiency

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