**Abstract**

*Prosopis juliflora* bark activated carbon -cobalt ferrite magnetic composite (PJBAC-CFC) was synthesized by the auto-combustion method and employed for the removal of direct brown 2 (DB2) from aqueous solutions. The prepared composite was characterized by powder XRD, SEM, EDAX, AFM, N2 adsorption desorption isotherm and magnetization measurement. Operating factors influencing the rate adsorption, namely initial dye concentrations, doses of sorbent materials, preset time intervals, variable pH and temperature environments are substantiated by batch equilibration method. Adsorption is observed to be more pronounced at pH 2. The magnetized composite material exhibited enhanced sorption characteristics. The isothermal adsorption data fit well with Freundlich isotherms. Kinetic studies favour the system to follow the second-order. The outcome of the present work indicates that *Prosopis juliflora* bark activated carbon -cobalt ferrite magnetic composite can be effectively used as a cost-effective potential adsorbent for trapping the dye molecules