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High-efficient capture of C.I. Basic Blue 3 by carboxymethyl-β-cyclodextrin conjugated magnetic composite

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ABSTRACT

In the present study, carboxymethyl-β-cyclodextrin (CM-CD) molecules were introduced onto the surfaces of Fe_3O_4 nanoparticles via chemical co-precipitation approach. The synthesized Fe_3O_4/CM-CD composite exhibited high magnetism and could be easily separated from the aqueous phase by exposing to an external magnetic field. In addition, the composite was stable in solution over a wide pH range. The effects of contact time, solution pH, ionic strength, solid dosage and temperature on the removal performance of Fe_3O_4/CM-CD toward a cationic dye named C.I. Basic Blue 3 (BB3) were evaluated by using the batch technique. The sorption kinetic process achieved equilibrium within a contact time of 90 min. The sorption isotherm data were simulated by the Langmuir model well and the maximum sorption capacity was calculated to be 203.54 mg/g at 298 K. The Fe_3O_4/CM-CD composite exhibited favorable removal performance toward BB3 in both the single-solute system and the simulation effluent. After sorption equilibrium, the BB3-loaded composite could be easily regenerated and reused for multiple sorption/desorption cycles. The experimental findings herein proposed the feasibility of adopting Fe_3O_4/CM-CD composite for the decontamination of BB3 from the polluted water systems.

Keywords: Fe_3O_4/CM-CD composite; C.I. Basic Blue 3; Simulation effluent; Magnetic separation; Renewable performance

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