Magnetically modified multiwalled carbon nanotubes for the adsorption of bismarck brown R and Cd(II) from aqueous solution: batch and column studies

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ABSTRACT

In this study, ferrofluid-modified multiwalled carbon nanotubes (MMWCNT) was used as an efficient adsorbent for the removal of bismarck brown R (BBR) and Cd(II) ions from aqueous solution using batch and column operations. An adsorption capacity \((q_m)\) of 76.92 and 38.17 mg/g was achieved for BBR and Cd(II), respectively. A maximum column adsorption capacity was 98.16 and 39.15 mg/g for BBR and Cd(II), respectively. The column experimental data conformed to Thomas model. The experimental data were best fitted into Langmuir isotherm suggesting homogenous, monolayer adsorption of both the dye and metal on MMWCNT surface. The energy obtained from DKR isotherm for BBR (2.24 kJ/mol) and Cd(II) (1.58–7.07 kJ/mol) indicated physical adsorption. The adsorption of both dye and metal followed pseudo-second-order kinetics and the mechanism was both liquid film and intraparticle diffusion controlled. The adsorption process was thermodynamically spontaneous and endothermic in nature.

Keywords: Adsorption; Modified MWCNT; Bismarck brown R; Cd(II); Isotherms; Kinetics; Column studies

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