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Preparation of CS-Fe@Fe_3O_4 nanocomposite as an efficient and recyclable adsorbent for azo dyes removal

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ABSTRACT

As an effective and in situ purification strategy, adsorption technology has drawn much attention and recently the utilization of biomass substrate has been regarded as a promising way to enhance the adsorption performance and reduce cost. In this study, chitosan was applied as matrix and the magnetic Fe-crosslinked chitosan (CS-Fe@Fe_3O_4) composite was obtained through a chelation procedure with cheap and environmentally friendly chitosan and iron salts. Then, the resultant CS-Fe@Fe_3O_4 composites were characterized by scanning electron microscopy, transmission electron microscopy, Fourier-transform infrared spectroscopy, X-ray photoelectron spectroscopy, X-ray diffraction, and thermogravimetric analysis. The sorption and desorption of methyl orange (MO), a common type of azo dye, on CS-Fe@Fe_3O_4 composite was systematically studied to understand its availability for dyeing wastewater. The results revealed that CS-Fe@Fe_3O_4 composites could efficiently remove MO in a wide pH range. The mixed Fe_3O_4 particles were physically mixed and almost had no negative effect on its adsorption. Moreover, the dye adsorption process was found to be controlled by the pseudo-second-order rate model and the adsorption isotherm behavior could be described by the Langmuir model. The repeatability test showed that the CS-Fe@Fe_3O_4 composites could retain its high efficiency after desorption and regeneration. In summary, the results presented herein indicated that the resultant CS-Fe@Fe_3O_4 nanocomposite with high adsorption efficiency and strong magnetic property could serve as a potential adsorbent for remediating industrial dyeing wastewater.

Keywords: Fe-crosslinked chitosan; Magnetic adsorbent; Azo dyes; Adsorption kinetics

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