Magnetic porous controlled Fe3O4?chitosan nanostructure: An ecofriendly adsorbent for efficient removal of azo dyes

Freire T.M.

Fechine L.M.U.D.

Queiroz D.C.

Freire R.M.

Denardin J.C.

Ricardo N.M.P.S.

Rodrigues T.N.B.

Gondim D.R.

Junior I.J.S.

Fechine P.B.A.

In this work, chitosan/magnetite nanoparticles (ChM) were quickly synthesized according to our previous report based on co-precipitation reaction under ultrasound (US) irradiation. Besides ChM was in-depth structurally characterized, showing a crystalline phase corresponding to magnetite and presenting a spheric morphology, a ?nanorod?-type morphology was also obtained after increasing reaction time for eight minutes. Successfully, both morphologies presented a nanoscale range with an average particle size of approximately 5?30 nm, providing a superparamagnetic behavior with saturation magnetization ranging from 44 to 57 emu·g?1 . As ChM nanocomposites have shown great versatility considering their properties, we proposed a comparative study using three different amine-based nanoparticles, non-surface-modified and surface-modified, for removal of azo dyes from aqueous solutions. From nitrogen adsorption?desorption isotherm results, the surface-modified ChMs increased the specific surface area and pore size. Additionally, the adsorption of anionic azo dyes (reactive black 5 (RB5) and methyl orange (MO)) on nanocomposites surface was pH-dependent, where surface-modified samples presented a better response under pH 4 and non-modified one under pH 8. Indeed, adsorption capacity results also showed different adsorption

mechanisms, molecular size effect and electrostatic attraction, for unmodified and modified ChMs, respectively. Herein, considering all results and nanocomposite-type structure, ChM nanoparticles seem to be a suitable potential alternative for conventional anionic dyes adsorbents, as well as both primary materials source, chitosan and magnetite, are costless and easily supplied.

Azo dyes

Chitosan

Magnetite

Superparamagnetic nanocomposite