Synthesis of Iron Magnetic Nanoparticles Coated by Octadecylsilane as an Adsorbent of Organic Compounds

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Todays, magnetite nanoparticles (Fe3O4 MNPs) are widely used in various fields such as, biomedical, drug delivery, catalysis and magnetic separations. They showed broad applications for isolation and pre-concentration of some target analytes. However, naked Fe3O4 MNPs are very likely to be oxidized and aggregate and are not suitable for extraction or removal of chemicals. Therefore, it is necessary to protect these MNPs with proper organic or inorganic groups to improve their surface as a ive and applicable adsorbent. Normally, coating with silica is viewed to improve the stability and prevent oxidation of the Fe3O4 MNPs. In the present study, Fe3O4@SiO2 MNPs functionalized with octadecyl groups (Fe3O4@SiO2-C18) were synthesized, characterized and employed as powerful nano sorbent for removal of bis (2-ethylhexyl) phthalate (DEHP) and dicyclohexyl phthalate (DCHP) aqueous solutions. For this purpose, after chemical synthesis of Fe3O4 MNPs via co-precipitation method, a silica layer was coated on the surface of MNPs to form Fe3O4@SiO2 NPs and subsequently, ocatdecyl silane groups were chemically synthesized on the Fe3O4@SiO2 surface using octadecyl trichlorosilane. The structure, magnetic property and morphology of the prepared NPs were investigated by FT-IR, DRS, VSM, XRD and FESEM instruments. The results showed the good functionalization with a nanometric size of synthesized particles. The experimental factors affecting the DEHP and DCHP adsorptions including solution pH, ionic strength, adsorbent amount and contact time were studied via taguchi experimental design. In order to study the kinetic and isotherm of adsorption, four kinetic models (pseudo-first-order, pseudo-second-order, intra-particle diffusion and Elovich) and three well-known isotherm models (Langmuir, Freundlich and Temkin) were studied in the optimized conditions. The results showed the high adsorption efficiency (>97%) in

a short time. Finally, the applicability of the proposed adsorbent for removal of DEHP and DCHP real water samples was examined and satisfactory results were obtained.

Keywords : Bis (2-ethylhexyl) phthalate, Dicyclohexyl phthalate, Adsorption, Removal, Octadecylsilane, Magnetite nanoparticles