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SYNTHESIS AND SURFACE MODIFICATION OF Fe_3O_4 AND γ- Fe_2O_3 NANOPARTICLES AND APPLICATION IN REMOVAL OF CHLOROPHENOLS

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Magnetite, Fe_3O_4 and maghemite, γ-Fe_2O_3 magnetic nanoparticles (MNP) have attracted profound attention in research as they impart superior chemical and physical properties leading to many applications. In the present study, above mentioned MNPs were synthesized by co-precipitation method and the surface modification was carried out by casein in order to make the particles more stable preventing aggregation. Most of the synthesized Fe_3O_4 nanoparticles were found to be super-paramagnetic while γ-Fe_2O_3 showed mixed ferri- and super-paramagnetism. Synthesized nanoparticles were characterized by XRD and FTIR; XRD peak analysis revealed the approximate particle size of about 8 nm for the bare particles and the bare particles were found to be stable for about two weeks and undergo aggregation thereafter. A protein of casein was then used as a stabilizer to prevent particle aggregation and incorporation of casein lead the formation of core-shell particles which were found to be stable for several months. These core-shell particles were utilized to test the interaction of chloro phenols in aqueous medium and that the studies were compared with bare particles. Adsorption of ortho(o) and para (p)-chlorophenols showed different pH dependence behavior on both bare and modified particles. The amount adsorbed on the modified particles was about 15% higher than that of bare particles. FTIR spectral data indicated the different adsorbed configurations for chloro phenols in which o-chloro phenol has the ability to adsorb via catechol type intermediate while the p-chlorophenol adsorbed as a mono-dentate configuration. Fe_3O_4 nanoparticles showed high efficiency for the removal of chlorophenols over γ-Fe_2O_3 probably attributed to their structural and differences in magnetic properties.