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PREPARATION, CHARACTERIZATION AND ADSORPTION PROPERTIES OF MFe_2O_4 (M = Ni, Co, Cu) NANOPOWDERS

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Abstract

MFe_2O_4 nanopowders (M = Ni, Co, Cu) were prepared using the precursor technique, starting from the corresponding metal nitrates and poly(vinyl alcohol)-PVA. During the heating of metal nitrates- PVA solution, a redox reaction takes place around 150 °C, leading to the formation of M(II) and Fe(III) carboxylates. These compounds were used as precursors for the ferrites nanopowders. The desired ferrites were obtained by thermal decomposition of the carboxylates; the obtained powders were characterized by means of Fourier Transform Infrared spectroscopy (FT-IR), X-ray diffractometry (XRD), scanning electron microscopy (SEM) and Brunauer-Emmett-Teller (BET) specific surface area measurements. According to the results, $CoFe_2O_4$ and $NiFe_2O_4$ were obtained at 500 °C, while $CuFe_2O_4$ was contaminated with simple oxides. All powders consisted in micrometric aggregates of nanometric particles. Magnetic measurements evidenced that all powders obtained at 500 °C exhibited ferrimagnetic behavior. MFe_2O_4 nanopowders were used as adsorbents for Congo red removal from aqueous solutions. The influence of various experimental parameters (pH value, amount of adsorbent, initial concentration and contact time) was evaluated in batch experiments. The experimental data were analyzed using the pseudo-first-order, the pseudo-second-order and the intra-particle diffusion kinetic models. The pseudo-second-order model best described the kinetics of the adsorption process. The equilibrium adsorption data were fitted to Langmuir, Freundlich and Sips isotherm models. The experimental data were well described by the Sips model.

Key words: adsorption, Congo red, kinetic, nanocrystalline ferrite, poly(vinyl alcohol)

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