



Template-free hydrothermal derived cobalt oxide nanopowders: Synthesis, characterization, and removal of organic dyes

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ABSTRACT

Pure spinel cobalt oxide nanoparticles were prepared through hydrothermal approach using different counter ions. First, the pure and uniform cobalt carbonate (with particle size of 21.8–29.8 nm) were prepared in high yield (94%) in an autoclave in absence unfriendly organic surfactants or solvents by adjusting different experimental parameters such as: pH, reaction time, temperature, counter ions, and ($\text{Co}^{2+}:\text{CO}_3^{2-}$) molar ratios. Thence, the spinel Co_3O_4 (with mean particle size of 30.5–47.35 nm) was produced by thermal decomposition of cobalt carbonate in air at 500 °C for 3 h. The products were characterized by powder X-ray diffraction (XRD), Fourier transform infrared (FTIR), transmission electron microscope (TEM), scanning electron microscope (SEM), and thermal analysis (TA). Also, the optical characteristics of the as-prepared Co_3O_4 nanoparticles revealed the presence of two band gaps (1.45–1.47, and 1.83–1.93 eV). Additionally, adsorption of methylene blue dye on Co_3O_4 nanoparticles was investigated and the uptake% was found to be >99% in 24 h.

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