Enhancement of Adsorption Efficiency of Methylene Blue on Co_3O_4/Sio_2 Nanocomposite

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ABSTRACT

Single and well-crystalline Co3O4 phase imbedded in an amorphous SiO2 matrix has been obtained by novel aqueous solution method. The structural and morphological properties are investigated using X-ray diffraction, Fourier transform infrared spectrometer, and N2 adsorption–desorption techniques. The apparent crystallite size for Co3O4 was found to be about 13.5 nm, which elucidates the rule of poly ethylene glycol in preventing particle's agglomeration; moreover, the pours structure of the composite enhances its adsorption ability. Co3O4/SiO2 has a high ability to absorb methylene blue from an aqueous solution. The removal percent of Methelene blue (MB) by Co3O4/SiO2 has reached 95.7%. The effect of various experimental parameters, such as initial dye concentration, contact time, and dose were investigated. Co3O4/SiO2 nanocomposite shows high adsorption capacity of 53.87 mg g−1, which is larger than the adsorption capacity of MB on other materials. Both of Langmuir and Freundlich models were used to analyze the equilibrium adsorption data. The pseudo-second-order model was found to be the most appropriate model to represent the present data. Co3O4/SiO2 nanocomposite material is proposed as a potential adsorbent for water treatment.

KEYWORDS: Cobalt Oxide/Silica; Nanocomposite; Adsorption; Methylene blue

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