

## Enhancement of Adsorption Efficiency of Methylene Blue on Co<sub>3</sub>O<sub>4</sub>/SiO<sub>2</sub> Nanocomposite

*Hany H. Abdel Ghafar<sup>a,b\*</sup>, Gomaa A.M. Ali<sup>c,d</sup>, Osama A. Fouad<sup>e</sup>, Salah A. Makhlouf<sup>f,g</sup>*

<sup>a</sup>Faculty of Science and Arts, Department of Chemistry, King Abdulaziz University, Khulais, Saudi Arabia

<sup>b</sup>Water Pollution Research Department, National Research Center, Cairo 12311, Egypt

<sup>c</sup>Faculty of Science, Chemistry Department, Al-Azhar University, Assiut branch, Assiut 71524, Egypt

<sup>d</sup>Faculty of Industrial Science and Technology, University Malaysia Pahang (UMP), Kuantan 26300, Pahang, Malaysia

<sup>e</sup>Central Metallurgical Research and Development Institute, CMRDI, P.O. Box 87, Helwan 11421, Egypt

<sup>f</sup>Faculty of Science, Physics Department, Assiut University, Assiut 71516, Egypt

<sup>g</sup>Deanship of Scientific Research, Al Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh 11463, Saudi Arabia

### ABSTRACT

Single and well-crystalline Co<sub>3</sub>O<sub>4</sub> phase imbedded in an amorphous SiO<sub>2</sub> 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 N<sub>2</sub> adsorption–desorption techniques. The apparent crystallite size for Co<sub>3</sub>O<sub>4</sub> was found to be about 13.5 nm, which elucidates the rule of poly ethylene glycol in preventing particle's agglomeration; moreover, the porous structure of the composite enhances its adsorption ability. Co<sub>3</sub>O<sub>4</sub>/SiO<sub>2</sub> has a high ability to absorb methylene blue from an aqueous solution. The removal percent of Methylene blue (MB) by Co<sub>3</sub>O<sub>4</sub>/SiO<sub>2</sub> has reached 95.7%. The effect of various experimental parameters, such as initial dye concentration, contact time, and dose were investigated. Co<sub>3</sub>O<sub>4</sub>/SiO<sub>2</sub> nanocomposite shows high adsorption capacity of 53.87 mg g<sup>-1</sup>, 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. Co<sub>3</sub>O<sub>4</sub>/SiO<sub>2</sub> nanocomposite material is proposed as a potential adsorbent for water treatment.

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

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