

Synthesis of Visible-light-Induced Sulfanilic-based composites for the degradation of Azo dyes

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Abstract

The effluent discharge from the textile industry contains dyes that are harmful to the environment and human beings. This effluent requires a effective treatment method before release into the environment. Photocatalytic degradation of dyes emerges as an alternate option to replace conventional methods such as coagulation, oxidation, etc. Keeping in view, the current study is designed to study the photodegradation of Congo Red and Malachite Green. For this purpose, three sulfanilic-based composites were synthesized i.e., sulfanilic-based composite with graphitic carbon nitride, sulfanilic-based composite with manganese, and sulfanilic-based composite with cobalt using the solvothermal method. FTIR spectrum of sulfanilic acid showed different absorption bands at 2703cm⁻¹ and 2858cm⁻¹ was assigned to -CH (symmetric and antisymmetric vibration) of sulfanilic acid. The absorption band at 1497cm⁻¹ represented the benzene ring of the compound. FTIR spectrum of sulfanilic base composite with graphitic carbon nitride showed an absorption band at 3190 cm⁻¹ assigned to the NH₂ group of graphitic carbon nitride. The absorption bands at 1753cm⁻¹ and 1361cm⁻¹ are assigned to -C=N, C-N confirming the composite formation. The bands at 980cm⁻¹ are assigned to the vibration of the metal-oxygen bond (Co-O and Mn-O) and these bands are very sharp and prominent. XRD pattern showed peaks at 8° and 26° assigned to 100 and 002 planes of g-C₃N₄. SMn showed sharp peaks from 30° to 60° assigned to manganese nanoparticles and SC showed peaks at 31°, 33°, 38°, 48° and 54°, between 30° to 60° indicating the cobalt nanoparticles. The synthesized sulfanilic-based composites with manganese showed a good 98% photocatalytic degradation of Congo red at 1mg/L and pH 10 within 180 minutes. Meanwhile, sulfanilic-based composites with graphitic carbon nitride showed 91% photocatalytic properties for Malachite green at 1mg/ L, pH 8, and 100mg catalyst dosage within 220 minutes.

Key Words: Malachite Green, Congo Red, Photodegradation, Sulfanilic acid, composites

