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Photodegradation of phenazopyridine in an aqueous solution by CdS-WO_3 nanocomposite

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ABSTRACT

The as-synthesized CdS-WO_3 nanocomposite and its individual components were characterized by X-ray diffraction, scanning electron microscope, diffuse reflectance spectroscopy, Fourier transformation infra-red spectroscopy and photoluminescence (PL) spectroscopy. The composite was then used in photodegradation of phenazopyridine aqueous solution and it showed a synergistic photocatalytic activity with respect to the individual CdS and WO_3 semiconductors. The composite showed also a lower PL intensity than the single semiconductors. Optimal conditions in photodegradation experiments were C_{PhP}: 10 mg L^{-1}, pH 4, irradiation time: 45 min and 0.9 g L^{-1} of the CdS-WO_3 catalyst when the moles of WO_3 were twice greater than CdS in the composite. The kinetics of the photodegradation process obeyed the Hinshelwood equation and a rate constant of 6.96×10^{-3} min^{-1} with a half-life time of 99.6 min was obtained by UV-Vis spectroscopy. Also, the mineralization extent of the PhP molecules was followed by the COD technique and a rate constant of 0.052 min^{-1} with a $t_{1/2}$ of 13 min was obtained. HPLC analysis of the PhP solution showed that about 90% of PhP molecules were degraded for 45 min.

Keywords: Phenazopyridine; Pseudo-first order kinetic; Heterogeneous photodegradation; Antibiotics; CdS-WO_3 composite

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