










CdIn₂Se₄@chitosan heterojunction nanocomposite with ultrahigh photocatalytic activity under sunlight driven photodegradation of organic pollutants

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Abstract

This research focused on synthesizing a CdIn₂Se₄@Ch nanocomposite by doping CdIn₂Se₄ into chitosan using a photolysis assisted ultrasonic process. The aim was to enhance the photodegradation efficiency of ofloxacin and 2,4-dichlorophenoxyacetic acid under sunlight. The synthesized CdIn₂Se₄@Ch nanocomposite was investigated via different techniques, including XRD, XPS, FTIR, TEM, DSC, TGA, UV-Vis and PL. The study also investigated the influence of various reaction parameters, including the effects of inorganic and organic ions. The synthesized nanocomposite demonstrated exceptional efficiency, achieving 86% and 95% removal rates, with corresponding rate constants of 0.025 and 0.047 min⁻¹. This performance surpasses that of CdIn₂Se₄ by approximately 1.35 and 2.25 times, respectively. The values of COD were decreased to 78 and 86% for ofloxacin and 2,4-dichlorophenoxyacetic, while the TOC values decreased to 71 and 84%, respectively, from their premier values. The improvement in performance is associated with the introduction of CdIn₂Se₄ into chitosan, resulting in the self-integration of Cd into the catalyst. This creates a localized accumulation point for electrons, enhancing the efficiency of charge separation and further reducing the surface charge of chitosan. Experimental evidence suggests that superoxide and hydroxyl radicals play a significant role in the photodegradation of pollutants. Additionally, the nanocomposite exhibits excellent stability and can be reused up to five times, indicating remarkable stability and reusability of the developed photocatalyst.