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Enhanced photoactivity of cerium tungstate-modified graphitic carbon nitride heterojunction photocatalyst for the photodegradation of moxifloxacin(Article)

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Abstract

Design and optimization of visible-light-driven photocatalysts for degradation of organic pollutants is an important step towards environmental decontamination. In this study, wolframite cerium tungstate ($\text{Ce}_2(\text{WO}_4)_3$, (CW)) hybridized with g- C_3N_4 (CN) nanosheets was synthesized via a simple hydrothermal route followed by an ultrasound-assisted synthesis method. The prepared $\text{Ce}_2(\text{WO}_4)_3@ \text{g-C}_3\text{N}_4$ (CW@CN) heterojunction was investigated for photocatalytic degradation of the antibiotic moxifloxacin (MXF) under visible light irradiation. Structural, morphological, and optical properties as well as chemical composition of the as-synthesized heterojunction were investigated by transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD), UV-Vis diffuse reflectance spectroscopy (UV-Vis DRS) and photoluminescence (PL). MXF photocatalytic degradation by the binary nanostructure ($\text{Ce}_2(\text{WO}_4)_3@ \text{g-C}_3\text{N}_4$) (94.1%) was the highest compared to g- C_3N_4 (53.6%) and $\text{Ce}_2(\text{WO}_4)_3$ (46.4%). Such enhanced activity could be ascribed to efficient suppression of the charge carriers' recombination, leading to adequate formation of the reactive species responsible for MXF degradation. Furthermore, the $\text{Ce}_2(\text{WO}_4)_3@ \text{g-C}_3\text{N}_4$ heterojunction showed remarkable stability over five consecutive cycles, with only 11.5% reduction after the 5th cycle. This work established the potential applicability of $\text{Ce}_2(\text{WO}_4)_3@ \text{g-C}_3\text{N}_4$ nanostructures towards photocatalytic removal of MXF. © 2020, Springer Science+Business Media, LLC, part of Springer Nature.

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Engineering controlled terms:

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High resolution transmission electron microscopy Hydrothermal synthesis Light
Nanostructures Optical properties Organic pollutants Photocatalytic activity
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Engineering uncontrolled terms

Chemical compositions Design and optimization Diffuse reflectance spectroscopy
Hydrothermal routes Photo catalytic degradation Photo-catalytic removal
Visible light driven photocatalysts Visible-light irradiation

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