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Solar photocatalytic degradation of amoxicillin using Ni:TiO_2 nanocatalyst stabilized on ceramic plates

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ABSTRACT

The main aim of this study was to investigate the photocatalytic degradation of amoxicillin in an aqueous medium using Ni:TiO_2 nanoparticles stabilized on ceramic surfaces under natural sunlight irradiation. Ni:TiO_2 nanoparticles were synthesized using a hydrothermal method and characterized using X-ray diffraction, scanning electron microscope, and Fourier-transform infrared spectroscopy techniques. The nanoparticles were then stabilized on the ceramic surface in a furnace. The effects of operational parameters such as the doping percentage (doping ratio), initial pH, contact time, and initial amoxicillin concentration on the photocatalytic degradation efficiency (PDE) of amoxicillin were examined in the presence of natural sunlight irradiation. The reusability of the stabilized nanoparticles was also studied. Based on these results, the amoxicillin PDE under natural sunlight irradiation was enhanced by increasing the doping percentage of synthesized nanoparticles and the contact time, while increasing the initial pH and the initial concentration of amoxicillin led to a reduction in the amoxicillin PDE. The results revealed that 78.4% PDE was obtained for amoxicillin using Ni:TiO_2 nanoparticles under optimal conditions for the photocatalytic process. This efficiency rate was higher than the PDE of TiO_2 nanoparticles and the degradation efficiency of solar irradiation by 22.97% and 66.1%, respectively. Moreover, the amoxicillin PDE was reduced after each reuse of the Ni:TiO_2 nanoparticles stabilized on the ceramic.

Keywords: Antibiotic; Stabilization; Photocatalyst; Ni:TiO_2; Hydrothermal; Sunlight

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