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Abstract

Metal–Oxide Photocatalysts with Heterojunctions for Ceftriaxone Removal from Water Matrices †

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Abstract: The aggressive progress of global industry has led to environmental pollution, particularly to the development of wastewater containing non-biodegradable compounds, which has affected the ecosystem and human health. Advanced oxidation processes can solve this problem by creating reactive species following solar irradiation, which is an efficient and sustainable technology for removing non-biodegradable contaminants from aqueous effluents. Our group developed photocatalysts with apatite-based metal–oxide heterojunctions to assess the removal of a well-known organic pollutant.

Keywords: photocatalysis; heterojunctions; organic pollutants; antibiotics; depollution

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1. Introduction

Ceftriaxone, part of the third-generation cephalosporin class of antibiotics, is frequently detected in surface water, groundwater, and even drinking water due to uncontrolled administration. Unfortunately, due to its resistance to treatments, poor biodegradability and high toxicity, ceftriaxone could not be effectively removed via various conventional wastewater treatment techniques [1].

2. Materials and Methods

To address this matter, we synthesized four apatite-based metal–oxide photocatalysts, using metal–oxide precursors of cadmium, lead and manganese, in a Discover 2.0 Microwave Flow Reactor (CEM Corporation, Matthews, NC, USA), at the temperature of around 160 °C, 300 W power, for 10 min. We characterized the obtained photocatalysts using modern analytical methods to ensure that they had appropriate properties. Also, we determined the photocatalytic activity by separately mixing the metal–oxide photocatalysts with a styrene–acrylic film-forming material [2]. For photocatalytic degradation, we used a xenon arc lamp (Figure 1) and the capacity was assessed by UV-vis absorption spectroscopy.

Figure 1. Xenotest 150 S+ device used for photocatalytic degradation.

3. Results

The obtained materials presented adequate properties and showed good results regarding the photocatalytic activity.

4. Conclusions

Based on the results obtained using ceftriaxone containing water matrix, the synthesized nanomaterials can be used in water depollution via photocatalytic processes. However, although compared to other synthesized photocatalysts, these ones showed a lower capacity to decompose antibiotic products.

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