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Photodegradation of ciprofloxacin in water by magnetite, silicon dioxide, and titanium dioxide composites

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Highlights

Composites Fe_3O_4@SiO_2@TiO_2 were synthesized
The photocatalytic degradation of ciprofloxacin was optimized.
The composite combined photocatalytic efficiency with magnetic recoverability.

Resumo/Abstract

Antibiotics in aquatic environments, such as ciprofloxacin (CIP), are an environmental challenge due to the potential development of bacterial resistance and impacts on aquatic ecosystems[1]. Considering conventional water treatment systems cannot remove emerging contaminants (ECs), it is important to develop more effective approaches[2]. In this study, Fe_3O_4 was prepared, coated with SiO_2, and deposit with TiO_2. The materials were characterized by Fourier-transform infrared spectroscopy (FTIR), determination of the point of zero charge (pH_{pzc}), and X-ray diffraction (XRD). The composites were evaluated as photocatalysts in the degradation of ciprofloxacin in aqueous media, and the experiments were conducted in a batch reactor under UV-C radiation at pH 5. Fe_3O_4@SiO_2@TiO_2 exhibited the highest performance, with 80% removal of CIP, while Fe_3O_4 and Fe_3O_4@SiO_2 showed lower efficiency. Kinetic data were best fit by the pseudo-second-order model, indicating rapid degradation during the initial phase followed by deceleration. The results suggest that the Fe_3O_4@SiO_2@TiO_2 combines photocatalytic and magnetic recovery properties, representing a possible alternative for the treatment of drug-contaminated waters.

References:

[1] LI, M. et al. **Occurrence, risk, and treatment of ciprofloxacin and clarithromycin in drainage**. v. 469, p. 142968, 2023.

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