Loading of Tin sulfide over Metal Organic Framework for boosting visible-light photocatalytic degradation of Norfloxacin

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Highlights

- MIL-88A(Fe)/SnS_2 composite as photocatalyst is employed for Norfloxacin degradation in a suitable photochemical reactor.
- Photoelectrochemical studies have been utilised.
- LCMS analysis has been done to find out intermediate products.

1. Introduction

Over the past few decades, the release of pharmaceuticals into aquatic environments has become a cause for growing concern among the public. These pharmaceutical residues in water originate from sources such as hospitals, domestic wastewater, and pharmaceutical industries, encompassing both excreted and unused medications. Recent research indicates that the onset of the COVID-19 pandemic led to a substantial 102.2% increase in the average waste production in both private and government healthcare facilities. Norfloxacin (NOR) belongs to the fluoroquinolone class of antibiotics and has found extensive usage in both human and animal applications. Nevertheless, due to its incomplete metabolism within the body, a significant portion of NOR is excreted, ultimately entering the environment through wastewater effluents. Hence, it is crucial to eliminate NOR from wastewater prior to its release into the environment.

2. Methods

This study involved the synthesis of MIL-88A(Fe), SnS_2, and their composites. Norfloxacin degradation experiments using MIL-88A(Fe), SnS_2, and their composites were carried out in 300 mL cylindrical flasks equipped with 250-watt mercury lamps and magnetic stirrers, maintaining a speed of 550 rpm under ambient conditions.

3. Results and discussion

Thorough examinations employing FESEM, EDX, XRD, Raman, FTIR, and XPS techniques have been conducted, and the results robustly affirm the successful production of the synthesized photocatalysts. The optical characteristics of the created sample were assessed through UV-VIS diffuse reflectance spectroscopy (DRS), unveiling a band gap conducive to effective absorption of visible light. The determination of semiconductor type, exploration of charge transfer kinetics, and examination of charge separation and transfer within the on and off zones have been accomplished using the Mott-Schottky plot, Electrochemical Impedance Spectroscopy (EIS) analysis, and photocurrent investigation, respectively.

4. Conclusions

The degradation of Norfloxacin (NOR) was conducted in a suitable photochemical reactor, and the reaction rate constant was determined. After a duration of 60 minutes under optimal conditions, the residual concentration of NOR decreased to an undetectable level.

References

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Keywords
Norfloxacin, Visible-light degradation, MOF