Title : Enhancing the Photocatalytic Activity of BiOBr Supported by Graphene Oxide for Antibiotic Degradation in Wastewater

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ABSTRACT

The development of bismuth-based photocatalysts offers a promising approach for wastewater treatment. In this work, bismuth oxybromide (BiOBr) was synthesized using a hydrothermal method and modified with graphene oxide (GO) at various loadings (0.5, 0.75, 1, 1.5, 2, and 3 wt%) to improve its photocatalytic performance. The photocatalytic activity of the BiOBr/GO composites was evaluated through the degradation of three antibi-otics: ciprofloxacin (CIP), tetracycline (TC), and amoxicillin (AMX) under visible-light irradiation from a 100 W LED lamp. The residual concentrations of the antibiotics after reaction were quantified using UV-Vis spectrophotometry. X-ray diffraction (XRD) analysis confirmed that BiOBr and all BiOBr/GO composite catalysts was a tetragonal phase. Scanning electron microscopy (SEM) and transmission electron microscopy (TEM) analyses revealed that GO sheets were uniformly distributed on the square-like BiOBr microplates. UV-Vis DRS analysis showed that all synthesized material responded in the visible-light region, indicating their ability to utilize visible irradiation. Moreover, the GO/BiOBr composites demonstrated stronger visible-light absorption with increasing GO content. Among all compositions, the 2%wt-GO/BiOBr photocatalyst exhibited the highest activity, achieved degradation efficiencies of 60% for CIP, 68% for TC, and nearly complete removal of AMX within 210 minutes. Reactive species trapping experiments were carried out to identify the dominant species which is superoxide radical act as the dominant reactive species. Electrochemical measurements, photoluminescene (PL) and time-

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resolve photoluminescence (TRPL) analyses indicated that the incorporation of GO facilitated charge carrier separation and suppress electron-hole recombination. To confirm the reactive species that occurred during photocatalysis reaction was carried through electron paramagnetic resonance (EPR). This work demonstrates that incorporating an appropriate amount of GO into BiOBr improves its photocatalytic performance toward antibiotic degradation, demonstrating the potential of BiOBr/GO composites for wastewater treatment.

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