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Ag_3BiO_3/AgBr heterojunction formation for dye degradation under visible light and its photocatalytic mechanism

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Highlights

- Ag_3BiO_3/AgBr composite photocatalyst was fabricated by combined a facile co-precipitation and ion-exchange methods.
- The catalytic photodegradation was improved in the rhodamine B (RhB) and methyl blue (MB) dyes under visible light.
- Cooperative effects on heterostructure inhibit the self-recombination of photoelectrons-holes pairs.
- Taking into account the more suitable band alignment, a Z-scheme carrier migration mechanism was proposed in the composite.

Abstract

This work investigates the photocatalytic properties of a nanostructured Ag_3BiO_3/AgBr composite prepared by the co-precipitation method followed by ion exchange for the degradation of rhodamine B (RhB) and methyl blue (MB) dyes under visible light. The structural, morphological, surface chemical composition and optical characterization of the nanocomposite obtained was studied by X-ray diffraction (XRD), scanning electron microscopy (SEM), X-ray photoelectron spectroscopy(XPS) and UV–Vis diffuse reflectance spectroscopy (DRS) analyses. The Ag_3BiO_3/AgBr heterojunction showed superior photocatalytic performance in comparison with Ag_3BiO_3. The exceptional degradation of RhB and MB dyes (96% and 100%, respectively, at 80 min) was mainly attributed to the formation of a heterojunction with excellent surface properties capable of enhancing the efficiency of photogenerated electron-hole separation. The possible band alignment and photocatalytic mechanism of the composite were revealed by DRS and XPS and Mott–Schottky analysis by electrochemical measurements and were related to the efficient