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FINAL YEAR PROJECT 2 – RESEARCH PROJECT

PREPARATION AND CHARACTERIZATION OF Ag-TiO_2/g-C_3N_4 AND ITS APPLICATION UNDER METHYLENE BLUE AND REACTIVE RED 4 DYE

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PREPARATION AND CHARACTERIZATION OF Ag-TiO_2/g-C_3N_4 AND ITS APPLICATION UNDER VARIOUS DYE

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ABSTRACT

PREPARATION AND CHARACTERIZATION OF Ag-TiO_2/g-C_3N_4 AND ITS APPLICATION UNDER METHYLENE BLUE AND REACTIVE RED 4 DYE

The photodegradation process with a photocatalyst is a novel green technology for responding to the remediation of dye-contaminated wastewater. Conventional photocatalysts like TiO_2 are limited by their large band gap and weak responsiveness to visible light, greatly reducing their effectiveness in environmental applications. This study aims to overcome these limitations with the design of a new Ag-TiO_2/g-C_3N_4 photocatalyst combining the merits of graphitic carbon nitride (g-C_3N_4) and silver (Ag) to improve the absorption of visible light, promote charge separation, and increase photocatalytic efficiency by using a Z-scheme heterojunction and the localized surface plasmon resonance (LSPR) effect. The study investigates the synergistic effects of these improvements, compares the photocatalytic degradation of cationic (Methylene Blue) and anionic (Reactive Red 4) dyes, and determines the recyclability and stability of the composite material. Synthesis of the Ag-TiO_2/g-C_3N_4 photocatalyst was performed using chemical reduction accompanied by in-situ calcination procedures, followed by characterization through FTIR, XRD, and UV-Vis DRS. Photodegradation experiments were performed under fluorescent lighting with consideration of dye concentrations and varying pH levels. The results showed significantly enhanced photocatalytic activity, with the photocatalyst exhibiting higher efficiency toward Reactive Red 4, especially under acidic pH, compared to Methylene Blue, which showed moderate degradation under alkaline conditions. Reusability tests indicated that the catalyst maintained its performance over multiple cycles without noticeable decline in activity. In summary, the Ag-TiO_2/g-C_3N_4 photocatalyst effectively overcomes the drawbacks of pure TiO_2 and demonstrates excellent degradation performance, particularly for Reactive Red 4, along with recyclability, making it a highly promising solution for sustainable wastewater remediation in alignment with Sustainable Development Goal #6 (Clean Water and Sanitation).

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