

Hybrid TiO₂/Nb₂O₅ photocatalysts synthed via sol-gel for ponceau 4r dye degradation: effect of molar ratio

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Azo dyes, such as Ponceau 4R, are widely used in the food and pharmaceutical industries due to their vibrant colors and low cost[1]. However, their environmental persistence and toxicity pose significant concerns. Advanced oxidation processes (AOPs)[2], particularly heterogeneous photocatalysis, have emerged as effective strategies for pollutant degradation[3]. This study reports the synthesis of hybrid TiO₂/Nb₂O₅ photocatalysts via the sol-gel method followed by hydrothermal treatment, systematically varying the molar ratios (50% TiO₂:100% Nb₂O₅ and 50% Nb₂O₅:100% TiO₂) to optimize photocatalytic performance. The TiO₂/Nb₂O₅ heterojunction was designed to enhance light absorption and suppress electron-hole recombination, key factors in improving photocatalytic efficiency. The materials were characterized by XRD, FTIR, diffuse reflectance spectroscopy, and TEM, while their photocatalytic activity was assessed under UV irradiation (120 min) using Ponceau 4R as a model pollutant. Preliminary results indicate that molar ratio variation significantly influences the structural and electronic properties of the catalysts, directly affecting degradation efficiency. This approach not only utilizes sustainable reactants (water and oxygen) but also demonstrates high efficiency in degrading recalcitrant compounds, underscoring its potential for industrial wastewater treatment.

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References

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