

Synthesis and Characterization of Tb-Doped TiO₂ Nanocatalysts for Ponceau 4R Photodegradation

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Titanium dioxide (TiO₂) is a widely studied photocatalyst due to its stability, low cost, and strong oxidative capacity. However, its application is restricted by its wide bandgap (3.2 eV), limiting its absorption to the ultraviolet region. Among the strategies to extend its photoactivity to visible light, doping with rare earth (RE) elements has shown promising results. RE ions can modify surface interactions, improve charge separation, and introduce intermediate energy states, enhancing photocatalytic performance [1,2]. This work investigates the synthesis of terbium-doped TiO₂ (Tb/TiO₂) nanocatalysts via a modified sol-gel route. The synthesis conditions were systematically varied, including pH adjustment and thermal treatment parameters, to evaluate their influence on the structural and optical properties of the materials. Characterization techniques such as XRD, Raman spectroscopy, UV-Vis DRS, and photoluminescence were employed. The photocatalytic activity was assessed through the degradation of Ponceau 4R dye (P4R) under simulated solar irradiation [3]. Preliminary results indicate that different synthesis parameters lead to distinct morphological characteristics and variations in photocatalytic efficiency. These findings suggest that tuning the synthesis conditions plays a crucial role in optimizing the material's properties for enhanced photocatalytic performance. This study contributes to the development of more effective nanocatalysts for environmental applications.

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References

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