Electrochemical Photocatalytic Degradation of Rhodamine B Dye by Sm³⁺ doped Titanium Dioxide (Sm-TiO₂) in Natural Sunlight Exposure

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Nanoparticles Sm-TiO₂ is successfully synthesized by photolysis method for degrading Rhodamine B (RhB) dye under direct sunlight. The prepared nanoparticles were characterized by X-photoelectron spectrum (XPS), X-ray diffraction (XRD), Raman spectrum, field emission scanning electron microscope-energy dispersive x-ray (FESEM-EDX) and UV-Visible spectrum (UV-Vis). The XPS spectrum revealed that 1% Sm-TiO₂ was successfully doped. The results from XRD and Raman showed the formation of anatase phase for prepared and doped TiO₂. According to the Debye Scherrer equation, particle size decreased as Sm³⁺ concentration increased, reaching 4.56 nm at 5% Sm-TiO₂. For the synthesized material, FE-SEM revealed a spherical agglomeration. The UV-Vis spectrum revealed that the energy gap decreased as the concentration of dopant (Sm³⁺) increased. Cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and chronopotentiometry (CP) were used to examine the electrochemical characteristics of pure and Sm-TiO₂ under dark and light conditions. The results show that the catalyst behaves as a pseudocapacitor when the Sm³⁺ ratio rises, as does the conductivity.

Keywords: electrochemical; rare earth, photolysis, cyclic voltammetry; impedance; chronopotentiometry.

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