Title : Synthesis and characterize Titanium dioxide and Tin oxide nanocomposite for dye waste water treatment by photocatalysis process

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ABSTRACT

Nowadays, dye-containing wastewater from the textile industry is considered a major environmental problem. Most dyes are chemically stable and possess complex molecular structures that are difficult to degrade using conventional wastewater treatment processes. As a result, they persist in water sources and adversely affect aquatic ecosystems. This research therefore focuses on the development of materials for wastewater treatment using photocatalysis, an advanced oxidation process that is highly effective in degrading organic pollutants. The objective of this study was to synthesize and characterize a nanocomposite material composed of titanium dioxide (TiO_2) and tin oxide (SnO_2) for use as a photocatalyst in wastewater treatment. Titanium dioxide particles were synthesized via a hydrothermal process and subsequently calcined at 500, 700, and 900 °C for 2 hours to obtain mixed crystalline structures. SnO_2 was then introduced onto the TiO_2 particles through a reflux process. Since tin oxide has a lower conduction band level than titanium dioxide, the photogenerated electrons can be transferred from TiO_2 to SnO_2. Therefore, the incorporation of SnO_2 is expected to reduce electron–hole recombination and enhance photocatalytic efficiency.

In this study, factors affecting dye degradation were investigated, including the calcination temperature of TiO_2 (500, 700, and 900 °C) and the weight ratios of TiO_2 to SnO_2 (100:0, 75:25, 50:50, 25:75, and 0:100). The crystalline structures were analyzed using X-ray diffraction (XRD), and the surface morphology was examined using scanning electron microscopy (SEM). XRD analysis revealed that TiO_2 calcined at 500 °C exhibited the bronze phase structure (TiO_2 (B)). Increasing the calcination temperature to 700 and 900 °C resulted in mixed crystalline phases of anatase and rutile. The synthesized materials were subsequently evaluated for the photocatalytic degradation of methyl orange (MO) dye.

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