



# Synthesis and Characterization of Doped TiO<sub>2</sub> Nanoparticles by the Sol-Gel Method and Investigation of Photocatalytic Activity

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## Abstract

Cu<sup>2+</sup>, Ce<sup>3+</sup>-doped nanostructure TiO<sub>2</sub>-coated Nd<sup>3+</sup> (TiO<sub>2</sub>/Nd<sup>3+</sup>) were prepared by sol-gel method. TiO<sub>2</sub> were synthesized by the sol-gel method using tetra n-butyl orthotitanat (TBT) as a precursor. The prepared nanoparticles characterized by FT-IR, XRD, SEM-EDS and TEM. The XRD showed that the major phase of nanocomposite is anatase. The morphology of the TiO<sub>2</sub>/Nd<sup>3+</sup>/Cu<sup>2+</sup> and TiO<sub>2</sub>/Nd<sup>3+</sup>/Ce<sup>3+</sup> microsphere was investigated using SEM. The TEM shows that the size of TiO<sub>2</sub>/Nd<sup>3+</sup>/Cu<sup>2+</sup> and TiO<sub>2</sub>/Nd<sup>3+</sup>/Ce<sup>3+</sup> were 8-10 nm. Moreover, particle shapes were spherical. IR spectrum indicated that Ti-O bond-formed in the chitosan-TiO<sub>2</sub> nano composite. Acid red 151 (AR 151) removed photo-chemically by adding doped TiO<sub>2</sub> nanoparticle and H<sub>2</sub>O<sub>2</sub> in the presence of the UV radiation. The results showed that the photo-degradation percentage decreased as oxidant concentration increases. The maximum degradation percentage (H<sub>2</sub>O<sub>2</sub> 0.2M) was about 96% TiO<sub>2</sub>/Nd<sup>3+</sup> catalyst. The result also showed that the kinetics model reaction in presence of both catalysts followed the fromof pseudo-second order equation presented by Blanchard.

**Keywords:** Cu<sup>2+</sup>, Ce<sup>3+</sup>-doped, kinetic, Sol-gel, Chitosan

## Introduction

Titania has become one of the most interesting materials and it has attracted considerable attention in recent years, due to its unique electro-optic properties and its potential applications for photo-electrode, gas sensor, self-cleaning, antifogging and environmental pollution remediation, mainly due to the

hydrophilic property of TiO<sub>2</sub> [1,2]. Toxic organic compounds and heavy metals mainly from industrial activities such as plating, metallurgy, and dyeing industries, are a threat to human and the surrounding environment, due to their toxicity and persistence after the release into the natural environment [3,4]. These pollutions must be removed or destroyed to

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