Photo-Degradation of Dyes Using Co-Doped Nanostructured TiO₂ Films

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Abstract

Wastewater from various industries, including factories, laboratories and food industries, represent serious problems to the environment. Contaminated water can be dangerous and toxic on human beings, microorganisms and aquatic life. The contaminated water may contain a variety of chemicals such as azo dyes, heavy metals and bacteria. The aim of our study consists on the preparation of new nanostructured materials with enhanced properties and high catalytic activity for the degradation of industrial dyes. This paper devoted of the fabrication of microreactor based on nanostructured co-doped Titanium dioxide (TiO₂) thin films for the degradation of Rhodamin B (RhB) dye produced from industry’s in the Kingdom of Bahrain. This study Investigate the structure, morphology, topography, optical properties, and photocatalytic degradation of RhB using Pure TiO₂, Nd-doped TiO₂ and Nd-M (Fe, Cu, Ag and Cd) co-doped TiO₂ thin films. This films, were prepared by sol-gel dip coating method. The analysis explicate the anatase phase of TiO₂ for all samples. Atomic Force Microscopy (AFM) technique shows the topography and morphology of films. Band gap energy calculated using two methods. First, from photoluminescence, the band gap established from 3.25 to 3.14 eV for Nd-TiO₂ and (Nd,Fe)-TiO₂ respectively. In addition, defects found using same method. Then, Uv-visible spectroscopy method showed energy gap between 3.34 for Nd-TiO₂ and (Nd,Cd)-TiO₂ to 3.23eV for (Nd,Ag)-TiO₂. Photo-degradation efficiency under UV light of TiO₂ gives the maximum percent about 75%. This efficiency decreases with doping to 20% for (Nd-Fe) doped TiO₂ film.