Journal of Applied Geochemistry
Vol. 17, No. 3 (2015). pp. 258-265

A HIGHLY EFFICIENT SOLAR LIGHT ACTIVE IRON (III)-DOPED TIO_2 NANO-CATALYST FOR TEXTILE WASTEWATER TREATMENT

Fang Han[1,2], Ravi Naidu[1, 2] Venkata Subba Rao Kambala[*1, 3]

[1]*Centre for Environmental Risk Assessment and Remediation, University of South Australia, Mawson Lakes, SA 5095, Australia*

[2]*Cooperative Research Centre for Contamination Assessment and Remediation of the Environment, P.O. Box 486, Salisbury South, SA 5106, Australia*

[3]*Ecofix Pty Ltd, Sydney, NSW 2000, Australia*

E-mail: venkat.kambala09@gmail.com

Abstract

Iron(III)-doped TiO_2 nano photocatalyst was prepared via a simply modified sol-gel process at ambient conditions. The sample was characterized by transmission electron microscopy (TEM), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), photoluminescence (PL) emission spectra, UV-Vis diffuse reflection spectra (UV-Vis DRS) and vibrating magnetometer. It was found that Fe^{3+} doping at 2 wt.% decreased the crystal size and improved the well-defined nanocrystalline powders with high surface area (47.3 $m^2\ g^{-1}$). Compared to the undoped TiO_2, 2 wt.% Fe^{3+}-TiO_2 showed red-shifted absorption edge and enhanced absorption in the range from 400 to 800 nm. The charge separation of electron-hole pairs was significantly promoted due to Fe^{3+} doping. In addition, the 2 wt.% Fe^{3+}-TiO_2 was paramagnetic in nature at room temperature (RT). Photocatalytic properties of the catalyst were investigated by treatment of textile wastewater under solar light. Complete color removal and 73% of total organic carbon (TOC) removal were successfully achieved.

Keywords: Titanium dioxide; Iron doping; Photocatalysis; Solar light; Textile wastewater