Desalination and Water Treatment
www.deswater.com

doi: 10.1080/19443994.2014.888681

54 (2015) 744–757
April

Taylor & Francis
Taylor & Francis Group

Solar light-driven photocatalytic degradation of Anthraquinone dye-contaminated water by engineered Ag@TiO_2 core–shell nanoparticles

Ankita Khanna, Vidya Shetty K*

Department of Chemical Engineering, National Institute of Technology Karnataka, Surathkal, Mangalore 575 025, India
Tel. +91 824 2474000 - 3606; Fax: +91 824 2474033; email: vidyaks68@yahoo.com

Received 24 August 2013; Accepted 17 January 2014

ABSTRACT

The Ag core–TiO_2 shell (Ag@TiO_2) nanoparticles were synthesized by one-pot synthesis method followed by calcination and characterized using X-ray diffraction and transmission electron microscopy. The Ag@TiO_2 core–shell-structured nanocatalyst was evaluated for its photocatalytic activity towards the degradation of Acid Blue-129 (AB-129), an Anthraquinone dye under solar light irradiations. The nanoparticles were engineered for efficient photocatalytic degradation of AB-129 by varying the parameters such as catalyst composition, calcination temperature, and calcination time. The catalyst composition with Ag to Ti molar ratio of 1:1.7, calcination temperature of 450˚C, and time of 3 h were found to be the optimum for the efficient photocatalytic degradation of AB-129. The efficacy of Ag@TiO_2 was compared with commercial TiO_2, synthesized nano-TiO_2, and Ag-doped TiO_2 for the photocatalytic degradation of AB-129 and enhanced dye degradation was obtained with Ag@TiO_2. This enhanced activity of Ag@TiO_2 may be attributed to the trapping of conduction band electrons in Ag core and subsequent discharge on supply of air. Solar photocatalytic degradation of AB-129 dye using Ag@TiO_2 followed Langmuir–Hinshelwood kinetics. Ag@TiO_2 can be exploited as an efficient catalyst for the degradation of dye and textile industry wastewater.

Keywords: Core–shell nanoparticles; Calcination; Dyes; Photocatalysis; Solar light irradiation

*Corresponding author.