TiO_2 Nanoparticles with Tetra-pad Shape Prepared by an Economical and Safe Route at very Low Temperature

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Abstract

We report an organics free and safe route for the preparation of titanium dioxide (TiO_2) nanoparticles having tetrapad shape. The approach is based on a very simple reaction of titanium powder and de-ionized water at very low temperatures of ~140^oC without using any organics or surfactants. By the morphological investigations using FESEM and HRTEM, it was observed that the grown products are having tetrapad shape with the diameters in the range of 10-50nm. The EDS and XRD pattern confirmed the composition and crystallinity of the grown nanoparticles and revealed that the grown products are pure TiO_2 with the tetragonal anatase phase. Since only water, which is regarded as a benign solvent is used during the preparation of nanoparticles, we believe that the product so produced is biocompatible and bio-safe and can be readily used for food and medicine. Besides other advantages, the present method is economical, fast, low temperature, free of pollution and environmentally benign which will make it suitable for large scale production.

Keywords: De-ionized water, Titanium powder, Bio-safe synthesis, Nanoparticles

1. Introduction

As a promising photocatalyst, titanium dioxide (TiO_2) materials are playing a significant role in helping to solve many serious environmental and pollution challenges. TiO_2 also bears tremendous hope in helping ease the energy crises through effective utilization of solar energy based on the photovoltaic and water splitting devices (Chen X, Mao, S.S, 2007). It is widely used as photocatalyst due to its relatively cheap cost, non toxicity and high chemical stability. As a photocatalyst, it is used for the decomposition of various organic pollutants. Compared to other semiconducting photocatalysts, TiO_2 has been proven to be the most preferable material for photocatalytic processes due to its biological and chemical inertness, high photoreactivity, non toxicity and photostability (Asahi R, Morikawa, T, Ohwaki T, Aoki K, Taga Y, 2001). Due to its wide band gap (3.2 eV for