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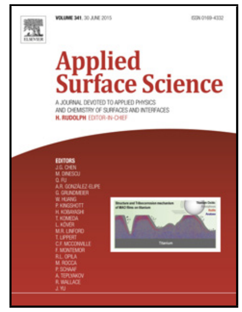

Title: H_2O_2-assisted photocatalysis on flower-like rutile TiO_2 nanostructures: Rapid dye degradation and inactivation of bacteria

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Hierarchically assembled rutile TiO_2 was synthesized at room temperature
Hydrothermal treatment enhanced the crystallinity, while morphology was maintainedHydrothermal treatment also led to larger crystallites and a lower surface area
Effective *K. pneumoniae* killing and MO degradation were achieved with the use of H_2O_2
Higher crystallinity enhanced the reaction rate in the presence of H_2O_2

Equation Chapter 1 Section 1

H_2O_2-assisted photocatalysis on flower-like rutile TiO_2 nanostructures: Rapid dye degradation and inactivation of bacteria

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Abstract
Hierarchically assembled flower-like rutile TiO_2 (FLH-R-TiO_2) nanostructures were successfully synthesized from $TiCl_4$ at room temperature without the use of surfactants or templates. An initial sol-gel synthesis at room temperature allowed long-term hydrolysis and condensation of the precursors. The resulting FLH-R-TiO_2 possessed relatively high crystallinity (85 wt%) and consisted of rod-shaped subunits assembling cauliflower-like superstructures. Hydrothermal evolution of FLH-R-TiO_2 nanostructures at different temperatures (150, 200 and 250 °C) was followed by means of X-ray diffraction, transmission and scanning electron microscopy.
These FLH-R-TiO_2 nanostructures were tested as photocatalysts under simulated daylight (full-spectrum lighting) in the degradation of methyl orange and in the inactivation of a multiresistant bacterium, *Klebsiella pneumoniae*. The effects of hydrothermal treatment on the structure, photocatalytic behavior and antibacterial activity of FLH-R-TiO_2 are discussed.

Keywords
Hierarchical rutile TiO_2; surface morphology; band gap energy; X-ray photoelectron spectroscopy; photocatalytic activity; antibacterial activity

1. Introduction

By virtue of its unique physicochemical properties, TiO_2 is one of the most intensively studied semiconductor oxides. It has been widely used in photocatalysis and photovoltaics and for the production of self-cleaning surfaces [1]. TiO_2 has four naturally occurring polymorphs: anatase, brookite, TiO_2(B) and the most stable form, rutile. Anatase is the most widely studied photocatalyst since it exhibits high photoactivity, whereas generally lower photocatalytic activity is noticed for rutile [2].