

Production of Titanium Dioxide Nanoparticles and Nanostructures from Dye Wastewater Sludge - Characterisation and Evaluation of Photocatalytic activity

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Abstract

Producing a useful catalyst (TiO₂) from sludge is possible after the incineration of sludge produced from the flocculation of wastewater by Ti-salts. In this study, TiO₂ was successfully produced from dye wastewater sludge. Titanate nanotubes and nanoaggregates were produced through alkaline-hydrothermal and hydrogen peroxide treatments, respectively. Catalysts were characterised using scanning electron microscope and BET surface measurement. The photocatalytic activity was monitored for the photodegradation of organics in synthetic wastewater (SWW) and the photodecomposition of gas acetaldehyde. Nanotubes with a high surface area of 155.83 m²/g were obtained by alkaline-hydrothermal treatment, while lower surface area (65.22 m²/g) nanoaggregates were synthesized after hydrogen peroxide treatment. In general, nanoparticles, nanotubes and nanoaggregates showed mild photocatalytic activity. All catalysts showed similar photocatalytic activity for the photodecomposition of organics in SWW and the photodecomposition of acetaldehyde.