Application of Floating Titanium Nanotube Photocatalyst for Bisphenol A Degradation

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Introduction

Recent reports show that 2.4 billion people suffer from unsafe drinking water [1]. Photocatalysis is a green solution to provide clean water. The exposure of a photocatalyst to a light irradiation source generates free radicals, which react with organic pollutants present in the water, resulting in the degradation of contaminants [2]. We aim to fabricate a floating photocatalyst involving a 1D Titania nanotube immobilized on Polyurethane foam (TNTs@PU) to remove pollutants from water.

Experimental

We synthesized Titanium nanotube photocatalyst by ultrasound-assisted hydrothermal method and then immobilized the photocatalyst on a polyurethane foam through the wet chemical deposition method. To investigate the photocatalytic activity of floating TNTs@PU, we degraded Bisphenol A (BPA) as a model of pollutants under simulated sunlight irradiation. The floating photocatalyst containing 0.1 g of TNTs was placed in 20 ppm BPA and kept in the dark for 30 min to reach absorption-desorption equilibrium. The BPA solution was then exposed to simulated sunlight (Ultra-Vitalux OSRAM, 300 W, Germany) with an intensity of 35 W/m^2, located 20 cm above the solution. We monitored the concentration of BPA during 180 min of simulated sunlight irradiation by a UV-Vis Spectrophotometer (Evolution™ 220, Thermo Fisher Scientific) at λ_{max}= 276 nm.

Results and Discussion

Figure 1(a) shows the morphology of the fabricated photocatalyst, indicating that the hydrothermal method created the tubular structure of TiO_2 (TNTs). According to Figure 1(b), XRD confirmed lattice planes of anatase and rutile in the TNTs crystalline phase [3]. Figure 1(c) presents the photocatalytic activity of TNTs@PU for BPA degradation. TNTs@PU could degrade 75% of BPA over 180 min of simulated sunlight irradiation.

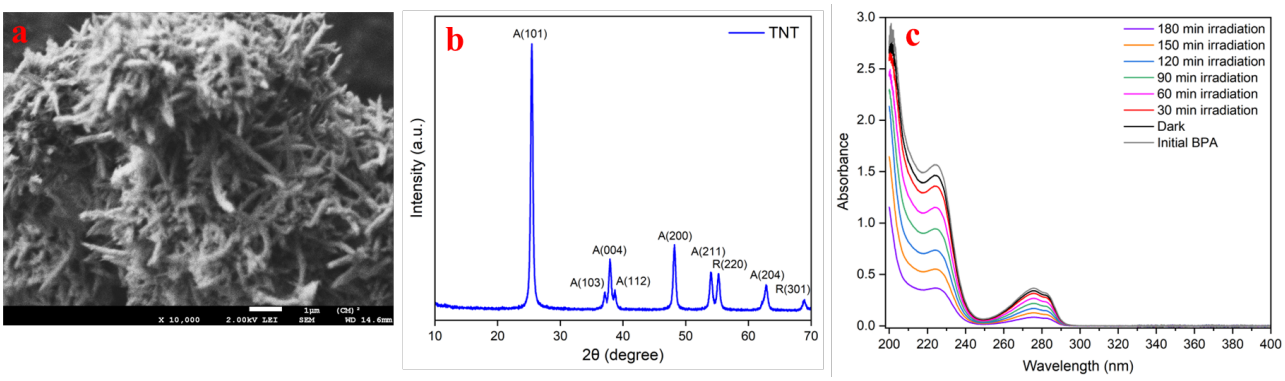

Figure 1. SEM and XRD of TNTs photocatalyst (a, b) and BPA degradation with floating TNTs photocatalyst (c).

Conclusions

We fabricated a floating TNTs@PU photocatalyst to remove 75% of BPA under simulated sunlight irradiation. The obtained results stimulate further studies to evaluate the stability of the material and its ability to degrade other classes of pollutants also in real matrices.

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