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SHAPE-DEPENDENT CARBONIZED PANI-COATED TiO_2 NANOCRYSTALS AND ITS USE IN THE DECOMPOSITION OF ORGANIC POLLUTANTS

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Abstract

Differently-shaped TiO_2 photo-nanocatalysts play a principal role in the remediation of environmental and pollution challenges considering their proven potential for treating organic contaminants in wastewaters [1]. However, increasing the photoactivity of TiO_2 *i.e.* its optical response from UV into visible region is a constant challenge of many ongoing researchers [2]. An proceed towards this demand may be the creation of hybrid functional nanocomposites by coating the TiO_2 nanocrystals (NCs) with electronically coupled conductive polymers (*e.g.*, polyaniline (PANI), polypyrrole, etc.) [3]. By the carbonization process of mentioned conductive polymers at high temperatures, obtained final material possess carbon-like structure which impart additional properties [4]. Thus, the evolution of carbonized PANI (CPANI)-coated TiO_2 NCs opens up the possibility for tailoring the photocatalyst with distinctive properties. This study implies development of new nanocomposites based on CPANI and colloidal TiO_2 nanoparticles (NPs) (TPC) and CPANI and TiO_2 nanotubes (NTs) (TTPC). Sol-gel and hydrothermal synthesis paths were used to obtain TiO_2 NCs. The influence of their size and shape on the photocatalytic activity of formed carbonized nanocomposites was estimated. TPC and TTPC nanocomposites were synthesized according to the steps: 1) the non-carbonized PANI/TiO_2 class was firstly prepared by the chemical oxidative polymerization of aniline with ammonium peroxydisulfate in the presence of TiO_2 NPs or NTs and 2) the subsequent carbonization process was applied (650 °C). Developed hybrid nanocomposites were morphologically and structurally characterized by TEM measurements and Raman spectroscopy, while their functionality was estimated through the photocatalytic degradation processes of Methylene blue and Rhodamine B. All TPC and TTPC nanocomposites showed excellent photocatalytic properties, however, shape-depending of used TiO_2 NCs.

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