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Synthesis, Characterization of Dendrimer-Encapsulated N, Pt Co-Doped TiO_2 for the Photodegradation of Contaminated Wastewater

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This study examined the synthesis, characterization of dendrimer-encapsulated N, Pt co-doped TiO_2 for the photocatalytic degradation of an azo dye brilliant black (BB). N, Pt co-doped TiO_2 photocatalysts were prepared by a modified sol-gel method using amine-terminated polyamidoamine dendrimer generation 0 (PG0) as a template and source of nitrogen. Structural, morphological, and textural properties were evaluated using scanning electron microscopy coupled to energy-dispersive X-ray spectroscopy (SEM/EDX), high-resolution transmission electron microscopy (HRTEM), X-ray diffraction spectroscopy (XRD), X-ray photoelectron spectroscopy (XPS), thermal gravimetric analysis (TGA), Fourier transform infrared (FTIR), Raman spectroscopy (RS), photoluminescence (PL) and ultra-violet/visible spectroscopy (UV-Vis). The synthesized photocatalysts exhibited lower band gap energies as compared to the Degussa P-25, revealing a red shift in band gap towards the visible light absorption region. Photocatalytic activity of N, Pt codoped TiO_2 was measured by the reaction of photocatalytic degradation of BB dye. Enhanced photodegradation efficiency of BB was achieved after 180-min reaction time with an initial concentration of 50 ppm. This was attributed to the rod-like shape of the materials, larger surface area, and enhanced absorption of visible light induced by N,Pt co-doping. The N,Pt co-doped TiO_2 also exhibited pseudo-first-order kinetic behavior with half-life and rate constant of 0.37 and 0.01984 min−1, respectively. The mechanism of the photodegradation of BB under the visible light irradiation was proposed. The obtained results prove that co-doping of TiO_2 with N and Pt contributed to the enhanced photocatalytic performances of TiO_2 for visible light-induced photodegradation of organic contaminants for environmental remediation. Therefore, this work provides a new approach to the synthesis of PAMAM templated N, Pt co-doped TiO_2 for visible light photodegradation of brilliant black.

Biography:

Sarre Kadia-Myra Nzaba obtained her Master's Degree at the University of the Western Cape (UWC) in 2015 and is currently registered PhD at the University of South Africa (UNISA). She is working on the photocatalytic degradation of contaminated waste water under the supervision of Dr Alex Kuvarega, Dr Bulelwa Ntsendwana and Prof Bhekie Mamba in the Nanotechnology and Water Sustainability Research Unit (NanoWS) based at the UNISA science campus in Florida park Johannesburg. She is a hard working woman who is passionate about her work.