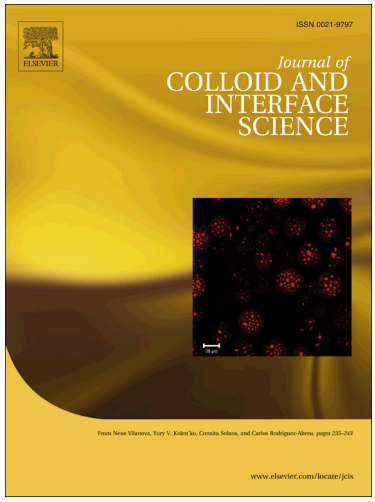

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Synthesis of Mesoporous Sulfur-Doped Ta_2O_5 Nanocomposites and Their Photocatalytic Activities

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Abstract

Mesoporous sulfur (S)-doped Ta_2O_5 nanocomposites have been synthesized for the first time through the sol-gel reaction of tantalum chloride and thiourea in the presence of a F127 triblock copolymer as structure directing agent. The as-formed mesophase S-doped Ta_2O_5 hybrid gels were calcined at 700 °C for 4 hours to obtain mesoporous S-Ta_2O_5 nanocomposites. The experimental results indicated that the surface area of the S-doped Ta_2O_5 was up to 50 m^2g^{-1} and the pore diameter was controllable in the range of 3-7.7 nm. The S-doped Ta_2O_5 nanocomposites behave as superior visible light-sensitive photocatalysts and the 1.5 at% S-doped Ta_2O_5 (S1.5) photocatalyst exhibited excellent photocatalytic activity of ~92% for the photodegradation of methylene blue, identical to 80% TOC removal after three hours illumination under visible light. The photodegradation rate of S1.5 photocatalyst showed 3.4 times higher than the undoped Ta_2O_5 due to their narrow bandgap, large surface area, mesostructure and well crystalline state. The S1.5 photocatalyst could be recycled at least five times without an apparent decrease in its photocatalytic efficiency, indicating its high stability for practical applications. To the best of our knowledge, this is the first report that demonstrates one-step synthesis of mesoporous S-doped Ta_2O_5 nanocomposites as an efficient photocatalyst under visible light illumination.

Keywords: Mesoporous; S-doped Ta_2O_5; Nanocomposites; Photocatalyst; Visible light.