Synthesis, Characterization and Application of High Efficient Visible Light Active Photocatalyst of Pt and Mo Photodeposited Cysteine-Doped TiO2 Nanoparticles

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Abstract

The current study deals with synthesis of a novel visible light active photocatalyst made of C-N-S-doped TiO_2 nanoparticles using a sol-gel method in the presence of a biomolecule L-cysteine as for the carbon, sulfur and nitrogen. Furthermore, in order to inhibit charge carrier recombination of the prepared TiO_2, metal (Pt, Mo)-doped TiO_2 (Pt@TiO_2 and Mo@TiO_2) was synthesized via photodeposition technique. The prepared catalysts were characterized by XRD, SEM, EDX, FT-IR, and UV–Vis DRS spectroscopy. The enhanced photocatalytic activity of doped TiO_2 samples is attributed to the synergistic effects of improved visible-light harvesting ability, enhanced adsorption to organic pollutant and increased efficiency in separation of the photo-generated electron and hole. The loaded metal further greatly decreases the PL intensity, which partly indicates the electron transfer from TiO_2 to metal. All the compositions containing tantalum have higher photoactivity than pure titania. The methyl orange decomposition with Ag-photodeposited method was much higher than that of deposited with sol-gel method. Thus, for the first time, we have demonstrated that TiO_2 codoped with metal (Pt and Mo) and nonmetal (C, N and S) can serve as visible light activated photocatalyst.

Keywords: TiO_2; Cysteine; Pt; Mo; Photocatalysis; Sol-Gel; Photochemical Deposition

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