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Photocatalytic enhancing for tin oxide nanoparticles by codoping with nitrogen and bismuth

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ABSTRACT

The photocatalytic oxidation of organic dye molecules is an active area of present day's research. In this context, a new visible-light-driven photocatalyst of Bi–N codoped SnO_2 nanoparticles was prepared by hydrothermal method. The structural, morphological and optical properties were characterized by using UV–visible-diffuse reflectance spectroscopy, Fourier transform infrared spectroscopy, X-ray diffraction, scanning electron microscopy, energy dispersive X-ray spectroscopy, transmission electron microscopy, Brunauer–Emmett–Teller and X-ray photoelectron spectroscopy analysis. Bi–N codoped SnO_2 showed an enhanced photocatalytic activity for the degradation of crystal violet by facilitating electron–hole pair separation. The highest crystal violet degradation was found in 97% (with 72.8% chemical oxygen demand removal) achieved with Bi, N–SnO_2 concentration of 0.2 g/L, initial dye concentration 5 μM, pH 7 and irradiation time 180 min. Bi, N codoping in tin oxide had synergetic effect in enhancing its photocatalytic activity. The effects of doping on the SnO_2 nanoparticles included reduced energy band gap, high crystalline and small crystallite size as well as increased photocatalytic activity.

Keywords: Tin oxide; Crystal violet; Hydrothermal method; Photocatalyst

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