Enhancement of photocatalytic activity on salicylic acid by nonmetal-doped TiO$_2$ with solvothermal method

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ABSTRACT

Nonmetal-doped TiO$_2$ nanoparticles have been prepared by the solvothermal method. The as-prepared photocatalysts have been characterized by X-ray diffraction, UV–vis diffuse reflectance spectra, Scanning electron microscope, Transmission electron microscopy, Specific surface area (BET) and X-ray photoelectron spectroscopy. The results indicate different atom radius and valence of the N, S and B atoms that cause the different doping ways, and it could form different lattice, which led to different surface area and pore volume of as-prepared photocatalysts. It is confirmed that S as S$^{6+}$ incorporate into the crystal lattice of the S–TiO$_2$, which may be the O–S–O–Ti–O linkages in the crystal lattice. It may be N and S as Ti–N–O or Ti–N–O$_2$ and S$_2^{2−}$ in the crystal lattice of the N&S co-doped TiO$_2$, respectively, which may be the S–Ti–N–O linkages in the crystal lattice. Photocatalytic activity was studied by degradation of salicylic acid under visible light. The degradation rate of salicylic acid reached 76.25% with N&S co-doped TiO$_2$ photocatalyst in 120 min, which is the highest of all the as-prepared photocatalysts. Furthermore, the experimental data of photocatalytic degradation well followed the Langmuir–Hinshelwood kinetics.

Keywords: Photocatalytic activity; Salicylic acid; Nonmetal doped; TiO$_2$; Solvothermal method