

Novel visible light-induced g-C₃N₄ quantum dots/BiPO₄ nanocrystals composite photocatalysts for efficient degradation of methyl orange

Zesheng Li,^{*a} Bolin Li,^a Shaohong Peng,^a Dehao Li,^a Shiyang Yang,^b Yueping Fang^{*b}

^a Development Center of Technology for Petrochemical Pollution Control and Cleaner Production of Guangdong Universities,

College of Chemical Engineering, Guangdong university of Petrochemical Technology, Maoming, Guangdong, 525000, China;

^b Institute of Biomaterial, College of Science, South China Agricultural University, Guangzhou, 510642, China.

Correspondence author: Zesheng Li E-mail: lzs212@163.com; Yueping Fang E-mail: ypfang@scau.edu.cn.

In a typical synthesis, 20 mL amino cyanide (CH₂N₂) solution (50 wt. % in H₂O) was mixed with a certain quality of bismuth nitrate (Bi(NO₃)₃•5H₂O) and sodium di-hydrogen phosphate (NaH₂PO₄) in the presence of 30 mL diluted nitric acid solution (1 mol L⁻¹). The above mixture was put into an ultrasonic water bath for 60 min in a high-intensity ultrasonic source (100 W and 40 kHz). During the ultrasonic irradiation, the temperature of the reaction solution rose to around 60 °C. When the reaction was complete, the white precipitation was collected and calcined at 550 °C for 4 h under nitrogen atmosphere to obtain the finally g-C₃N₄ QDs/BiPO₄ NCs composite sample. In addition, the single BiPO₄ NCs sample was also synthesized without the addition of CH₂N₂ while other conditions remain unchanged. For performance comparison, single g-C₃N₄ sample was further synthesized by directly calcining CH₂N₂ at 550 °C for 4 h under nitrogen atmosphere.

The XRD patterns were collected in a Bruker D8 Advance X-ray diffractometer (Cu Kα1 irradiation). Transmission electron microscopy (TEM) was recorded on a JEM-2010HR microscope. X-ray photoelectron spectroscopy (XPS) was conducted with two separate systems equipped with monochromatic Al K sources (ESCALab250). The photocatalytic activity was measured in a XPA-II reactor (Nanjing Xujiang Machineelectronic

Plant). To carry out the photochemical reaction the 0.1 g sample was suspended in a methyl orange (MO) dye aqueous solution (100 mL, 30 mg L⁻¹) with stirring in the dark for 1 h to reach an equilibrium adsorption state. Then irradiated with a 300 W Xe arc lamp equipped with an ultraviolet cut off filter to provide visible light ($\lambda > 420$ nm) source. Every a given reaction time (30 min), the solution (5 mL) was sampled and centrifuged, and the MO concentration was determined by an UV-visible spectrophotometer (UV-2550).

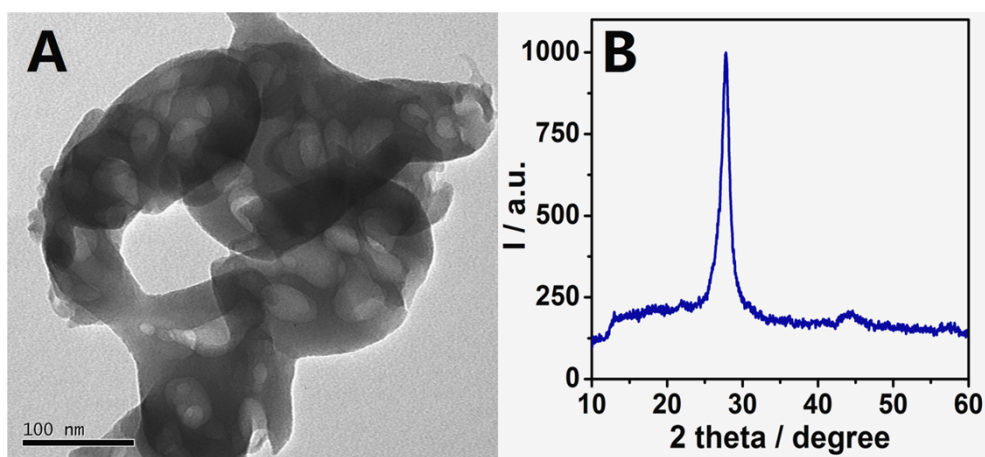


Fig. S1 TEM image (A) and XRD pattern (B) of the single g-C₃N₄ sample.