Electronic Supplementary Material (ESI) for Dalton Transactions.

Supplementary Materials

Polystyrene-heterojunction semiconductor composite sphere prepared by hydrothermal synthesis process: recyclable photocatalyst under visible light irradiation for removing organic dyes from aqueous solution

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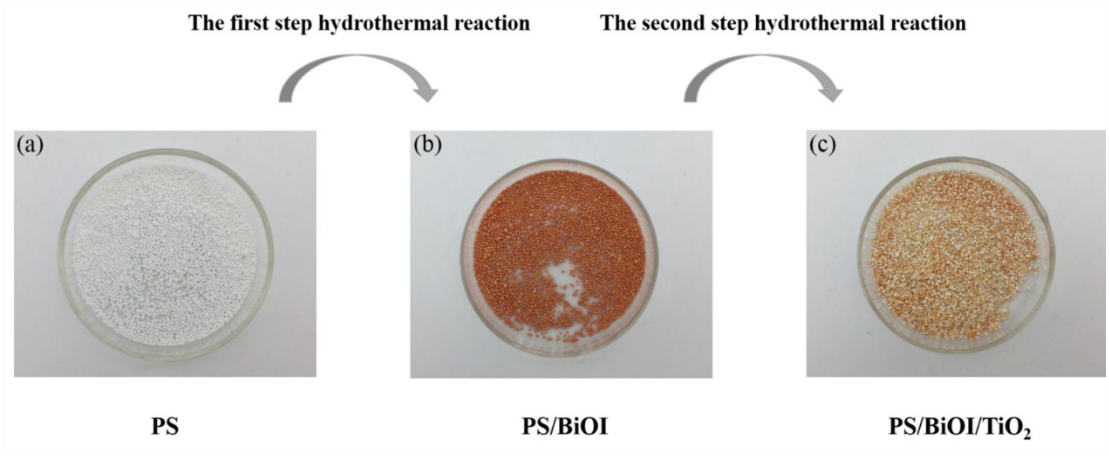

Fig.S1 The coloured variation of the samples.

After the first step hydrothermal reaction, the average size of BiOI (R1) was 5 μm, and after the second step hydrothermal reaction, the average size of TiO_2 (R2) was 100 nm.

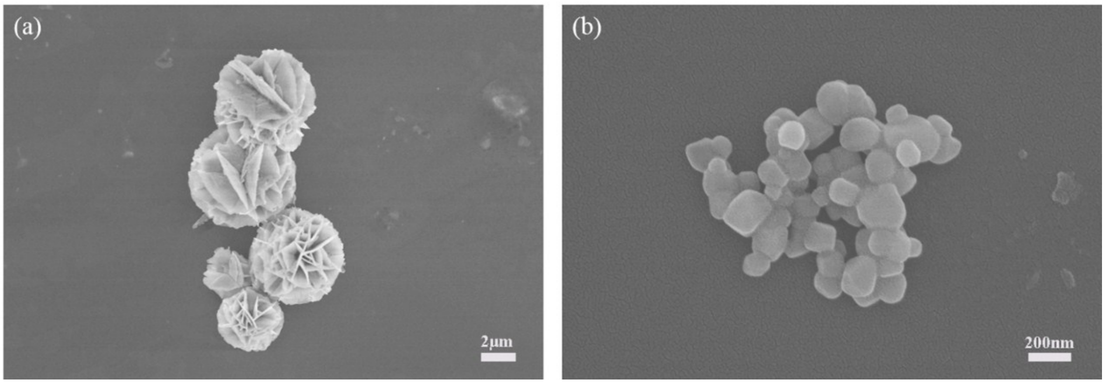

Fig.S2 SEM images of BiOI (R1) (a) and TiO_2 (R2) (b).

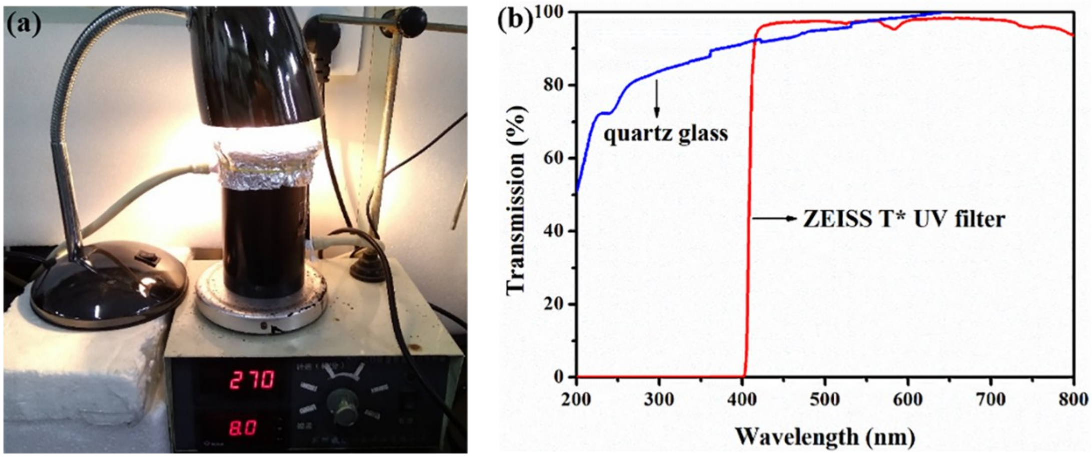

Fig.S3 The photocatalytic reaction device under 40 W incandescent lamp (a), the transmittance test of quartz glass and ZEISS T* UV filter under 200-800 wavelength (b).

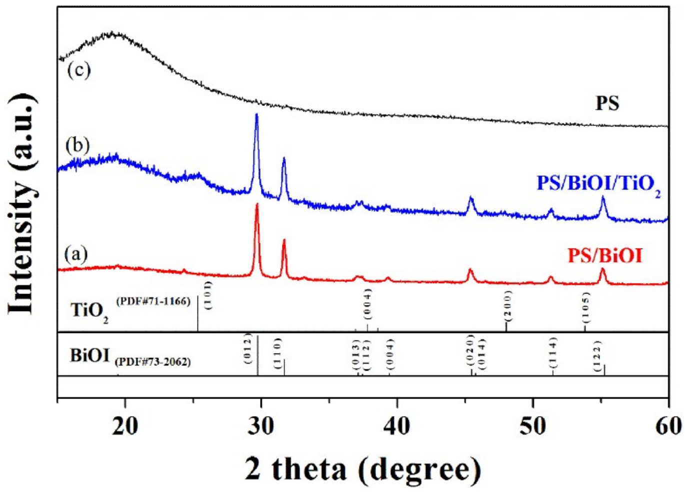

Fig.S4 XRD patterns of PS/BiOI (a), PS/BiOI/TiO_2 (b) and PS (c).

In Fig. S5 (a,b), three glass bottle had H_2O, H_2O and n-dodecane (oil-red), n-dodecane (oil-red), respectively. Behind the glass bottle was a piece of A4 paper with the words of soochow university. Pure water and n-dodecane bottles were clear, the mixture of water and n-dodecane was cloudy. After adding PS/BiOI/TiO_2 to a mixture of water and n-dodecane (oil-red), the mixture became clear after shaking. The above experiment showed that the PS/BiOI/TiO_2 have the ability to absorb oil-soluble dyes in water was attributed to the unique feature of PS spheres. The contact angle (CA) of the droplet on surface of PS/BiOI/TiO_2 decreased over time in Fig. S5 (c-e). Corresponding to evaporation time of 10 min and 20 min, the CA of PS/BiOI/TiO_2 were 120° and 97° and the initial values of CA of PS/BiOI/TiO_2 was 140°. The results indicated that PS/BiOI/TiO_2 possessed good hydrophobicity. In summary, the PS/BiOI/TiO_2 could absorb oil and oil-soluble dyes in the water.

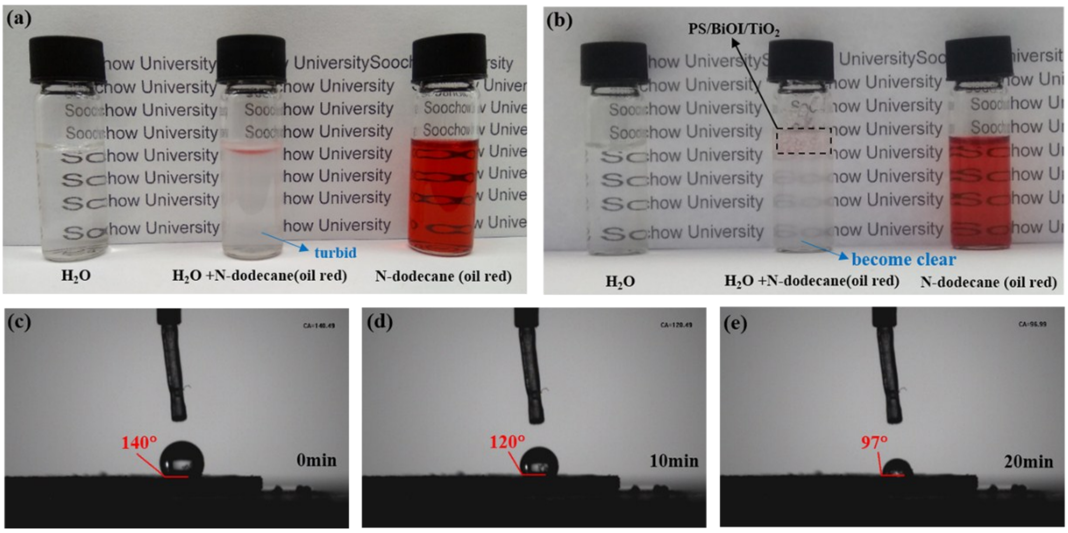

Fig.S5 The experiment of oil-soluble dyes adsorption of PS/BiOI/TiO_2 (a-b), time-evolution of images for a water droplet absorbed by PS/BiOI/TiO_2 (c-e).

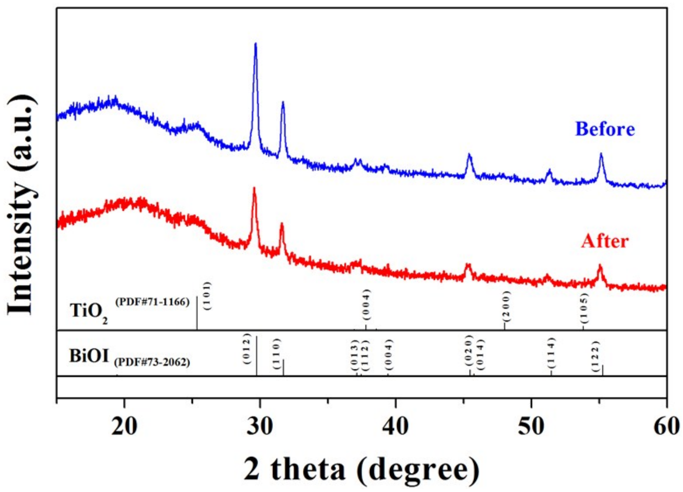

Fig.S6 XRD patterns of the PS/BiOI/TiO_2 composite photocatalyst before and after the three cycles of photo-degradation.

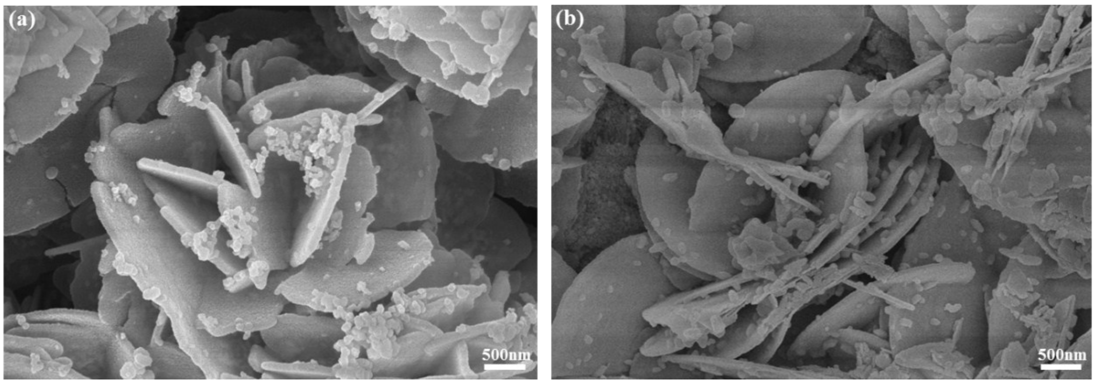

Fig.S7 SEM images of the PS/BiOI/TiO_2 composite photocatalyst before (a) and after (b) the three cycles of photo-degradation.

The photocatalytic activity of other colorless organic pollutants has also been tested here. The aqueous solutions of phenol, aniline and benzoic acid were used as target pollutants for photo-degradation experiments. In these typical experiments, 30 mg PS/BiOI/TiO_2 composite photocatalyst was dispersed in the reactor containing 60 mL of the above colorless organic pollutants aqueous solution (0.1 mM). Determination of degradation of organic pollutants by HPLC [S1]. Test conditions are as follows: the mobile phase is the mixture of CH_3OH and KH_2PO_4 (V/V=45/55), while the detect wavelength is 270 nm (phenol), 230 nm (aniline) and 228 nm (benzoic acid), respectively.

[S1]. N. Wang, L. Zhu, Y. Huang, Y. She, Y. Yu and H. Tang, Journal of Catalysis, 2009, 266, 199-206.

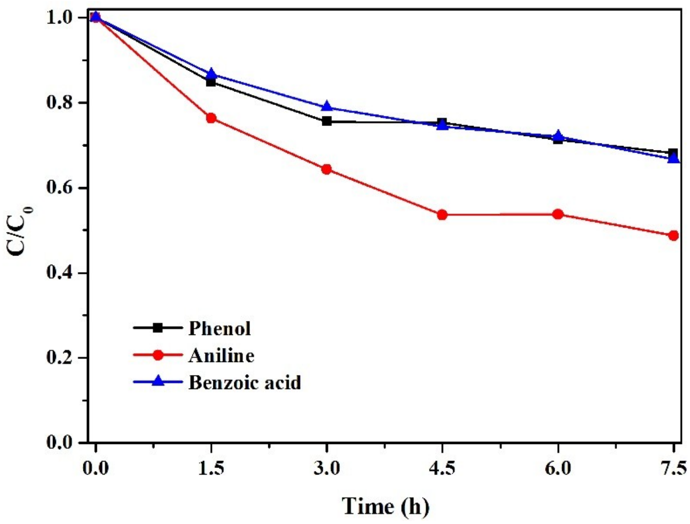

Fig.S8 Concentration variation of several organic pollutants under visible-light irradiation in presence of PS/BiOI/TiO_2 composite photocatalyst.

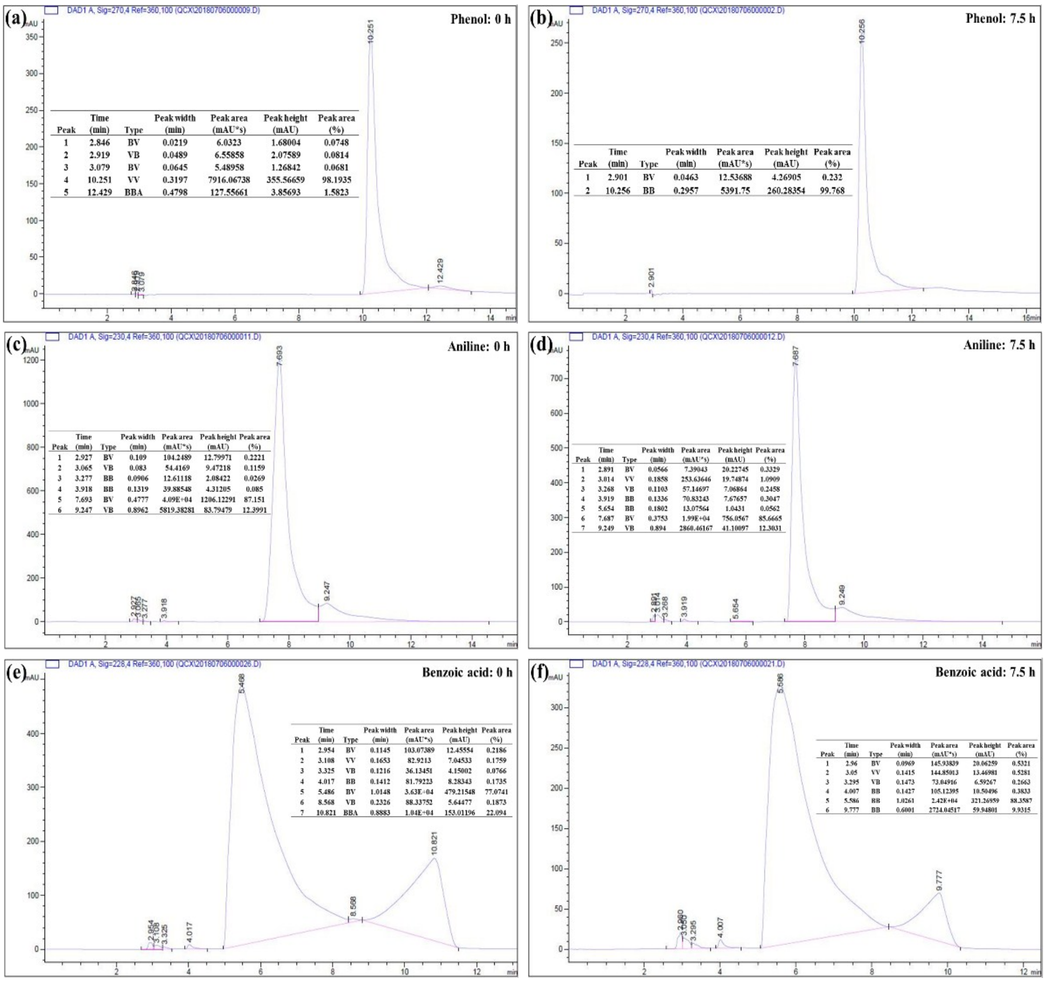

Fig.S9 HPLC chromatograms recorded (a,c,e) before and (b,d,f) after a 7.5 h visible-light irradiation for the decomposition of several organic pollutants in presence of PS/BiOI/TiO_2 composite photocatalyst. (a,b) phenol, (c,d) aniline and (e,f) benzoic acid.

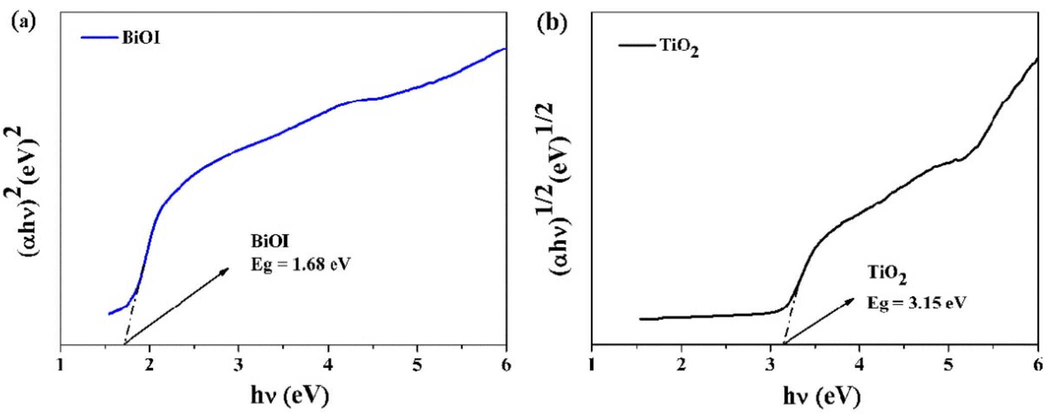

Fig. S10 Plots versus of reference BiOI (a) and TiO_2 (b).

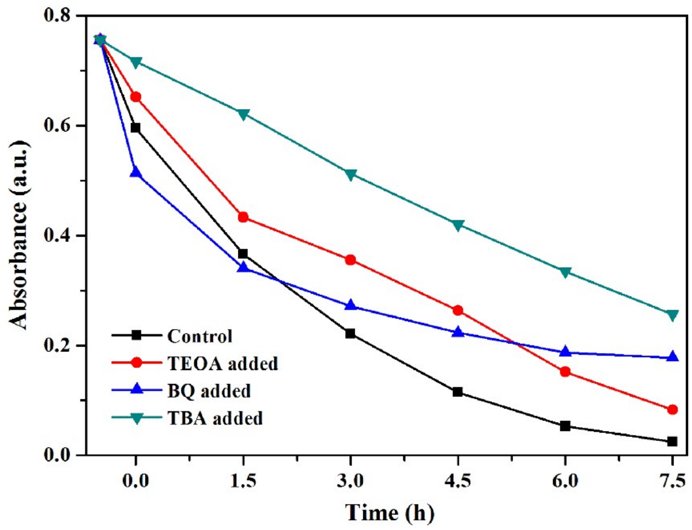

Fig. S11 Effect of different trapping agents on degradation efficiencies of RhB aqueous solution (10 mg·L^{-1}). Conditions: Tris (2-Hydroxyethy) Amine (TEOA, 0.5 mM), benzoquinone (BQ, 0.5 mM) and tert-Butanol (TBA, 0.5 mM).