Supplementary Information for

Construction of Novel Flower-like Functionalized Black Phosphorus Nanosheets/P-doped BiOCl S-Scheme Photocatalysts with Improving Photocatalytic Activity in RhB and Cr(VI) Degradation

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Reagents. Bismuth nitrate pentahydrate ($Bi(NO_3)_3 \cdot 5H_2O$, ≥99%), potassium chloride (KCl, ≥99.5%), ethylene glycol (99.5%), ethanol (99.7%), sodium hydroxide (NaOH, ≥98%), phosphorus oxychloride (97%) stannum powder (97%), Iodine (≥99.8%), red phosphorus (99%), Poly dimethyl diallyl ammonium chloride water solution (20 wt%), potassium dichromate ($K_2Cr_2O_7$, 99%), 1,4 benzoquinone (BQ, ≥98.5%), isopropanol (IPA, ≥99.7%), oxalic acid (≥99.5%), methanol (99.9%), acetonitrile (99.9%), were purchased from the Macklin Reagent. Deionized water was used in all the experiments from ULUPURVERY water system.

Characterization. Zeta potential measurements were obtained dynamic light-scattering analysis using the zetaPALS(Brookhaven Instruments). In detail, 10 mg BP crystal was dispersed in 20 ml PDDA solution by sonication at room temperature for 2 h. 10 mg P-BiOCl was dispersed in 10 ml H_2O by sonication at room temperature for 15 min. The crystalline structure was analysed by an X-ray diffraction system (XRD, Bruker D8FOCUS) with a Cu Kα radiation source (λ = 0.15406 nm). Fourier Transform infrared spectroscopy (FTIR) spectra were taken by PerkinElmer Frontier. Raman spectra were detected by Horiba LabRAM HR Evolution device at the wavelength of 375 nm. Surface areas and pore size distributions were measured via nitrogen adsorption and desorption at 77.3 K using an ASAP 2420-4 (Micromeritics) volumetric adsorption analyzer. TEM (JEOL 3010) and HRTEM (JEOL JEM F200) was employed to study the microstructure of the prepared samples. SEM was tested by Hitachi S7800. XPS was performed with ESCALAB-250 spectrometer with Al Kα radiation. The phosphorus content was measured by Agilent 7800 ICP-OES. UV-vis DRS and PL emission spectra were measured using Shimadzu UV3600i spectrophotometer and Hitachi F7000 spectrophotometer, respectively. And time-resolved PL spectra were acquired using an Edinburgh FLS1000 device. Electrochemical impedance spectroscopy (EIS) and transient photocurrent response was measured by a three-electrode system (CHI660E, Chenhua Instruments Co., Shanghai, China) which was performed at an AC voltage of 5 mv in an aqueous solution of 0.5M Na_2SO_4.

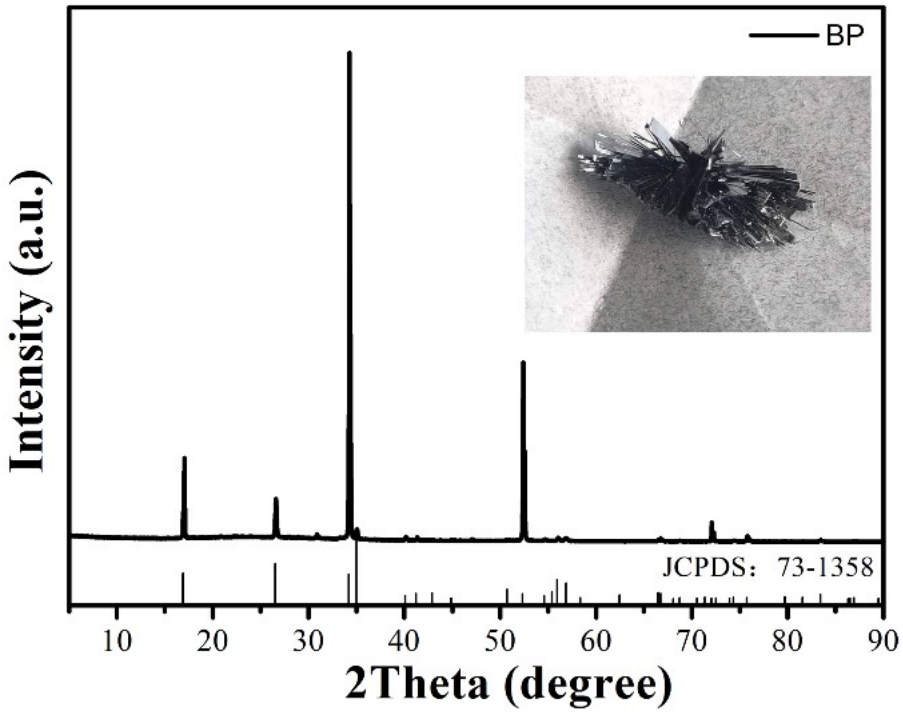

Fig S1. XRD pattern of bulk BP, optical image of bulk BP (insert)

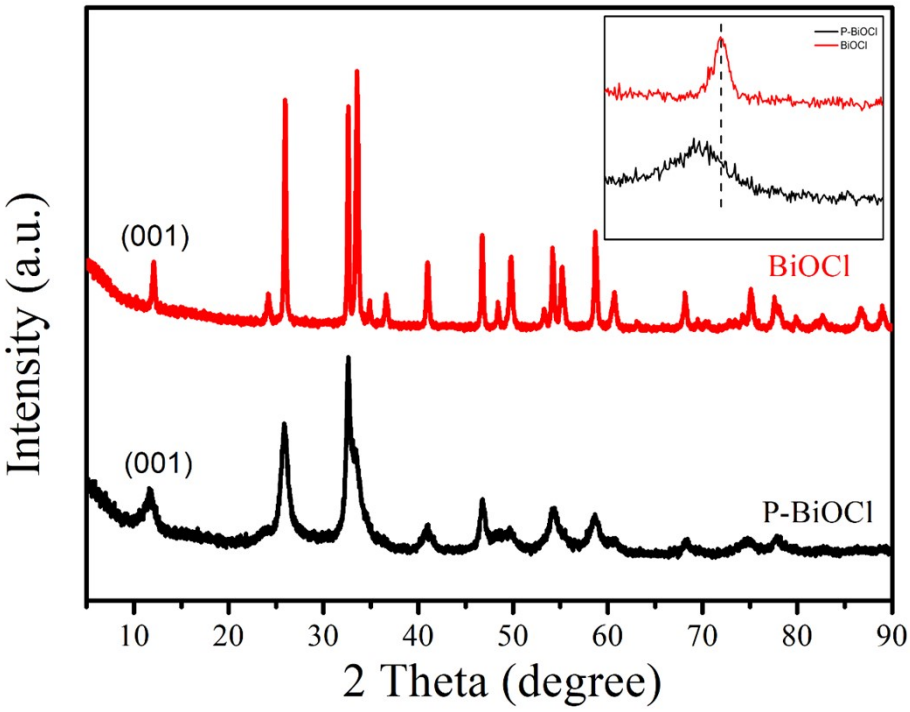

Fig S2. XRD patterns of the BiOCl and P-BiOCl and samples

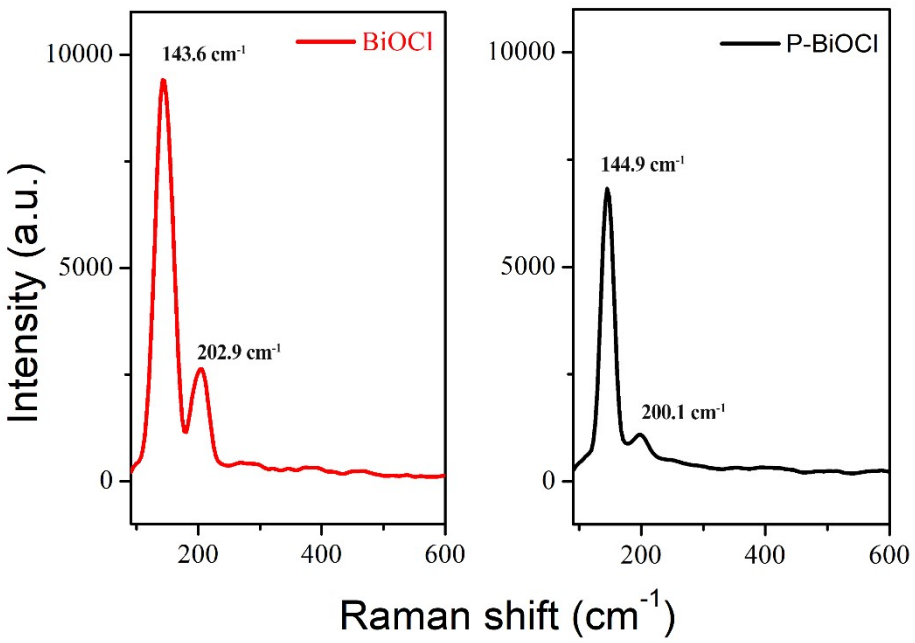

Fig S3. Raman spectra of the BiOCl and P-BiOCl samples

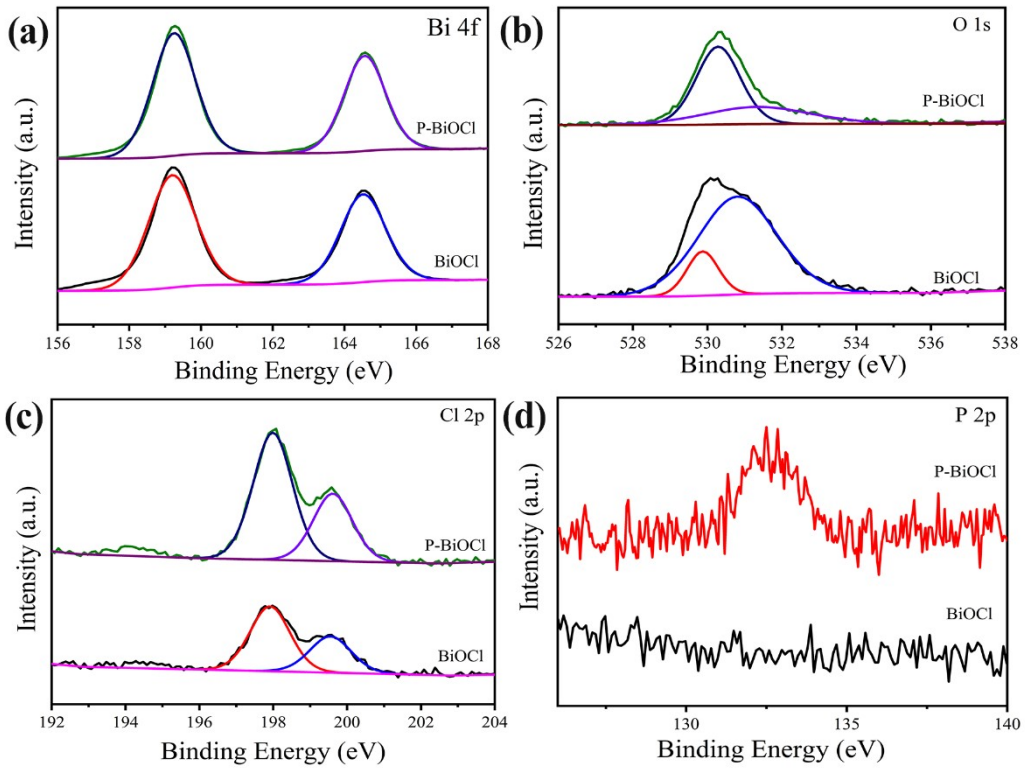

Fig S4. XPS spectra of the (a) Bi 4f, (b) O 1s, (c) Cl 2p and (d) P 2p regions of BiOCl and P-BiOCl samples

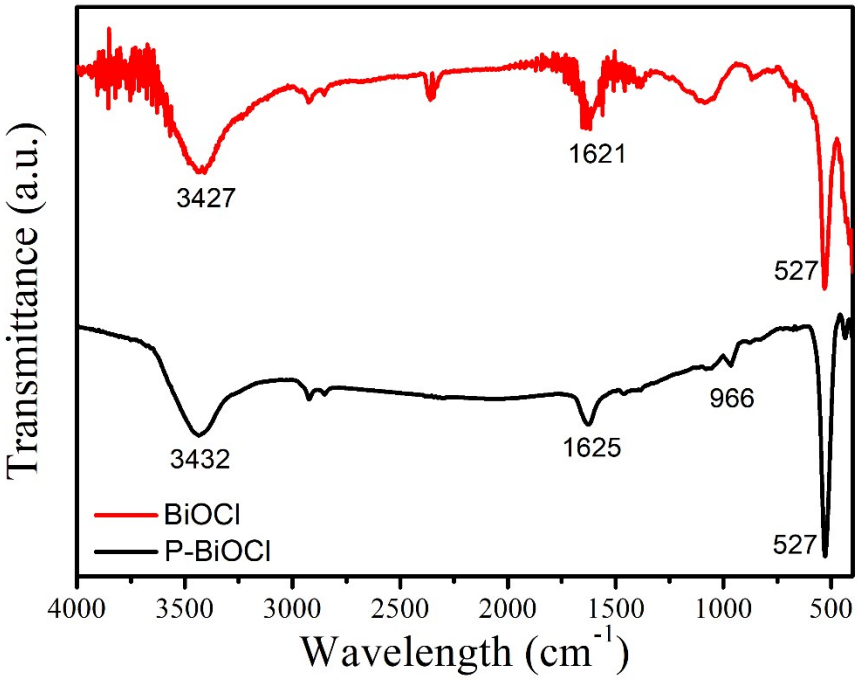

Fig S5. FTIR spectra of the BiOCl and P-BiOCl samples

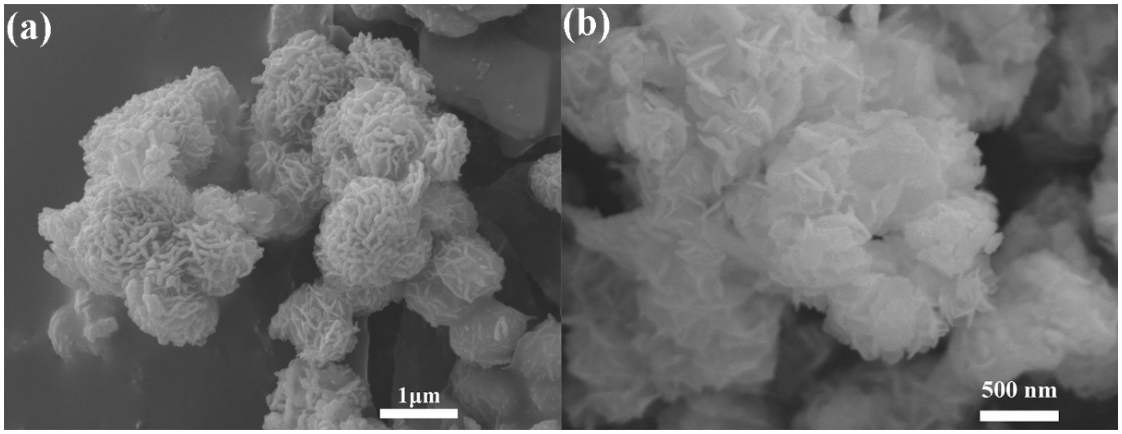

Fig S6. SEM images of BP/BiOBr (a), BP/BiOI (b)

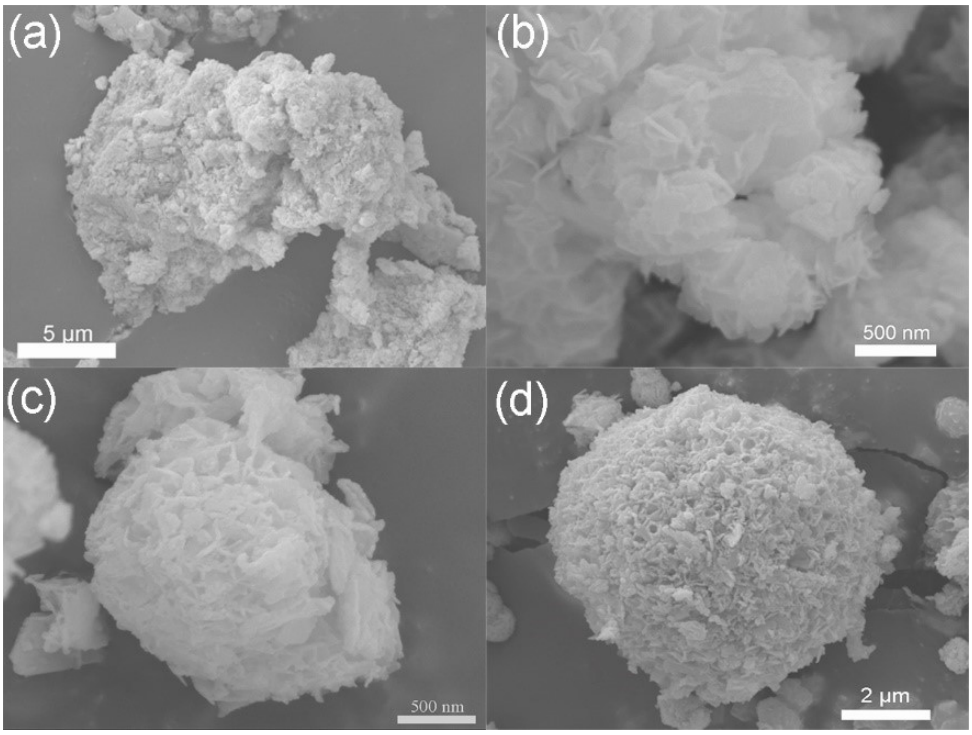

Fig S7. SEM images of 5%-BP/BiOCl (a), 10%-BP/BiOCl (b), 15%-BP/BiOCl (c) and 20%-BP/BiOCl (d).

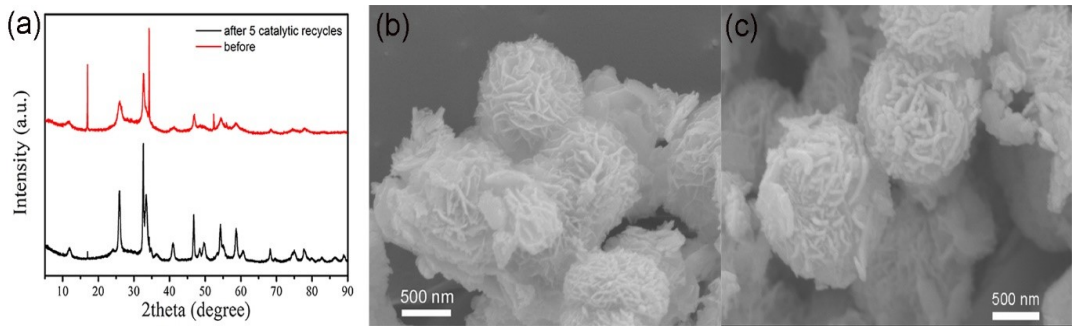

Fig S8. (a) XRD pattern of fresh sample(red) and recycled sample(black) of 15%-BP/P-BiOCl, SEM images of fresh sample (b) and recycled sample (c) of 15%-BP/P-BiOCl.

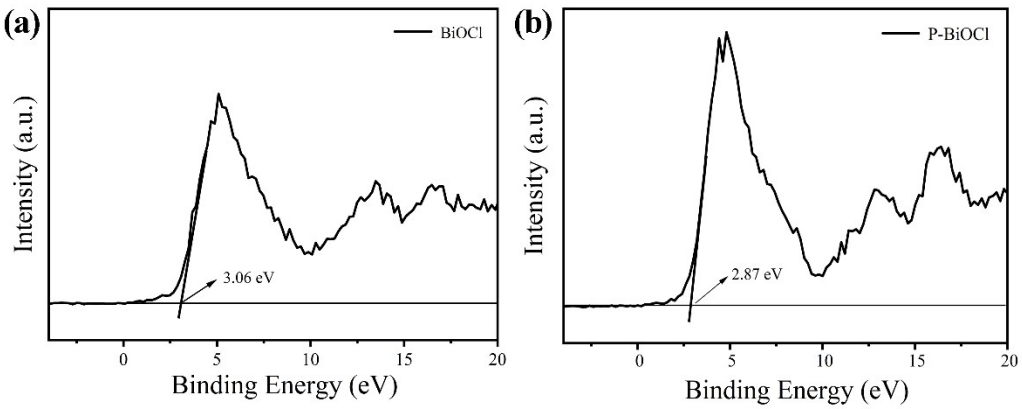

Fig S9. XPS valence band spectra of (a) BiOCl and (b) P-BiOCl samples