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Conjugated microporous polymer with matched energy band structure as photocatalyst for simultaneous removal of heavy metal ion and organic pollutant

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Experimental section

Synthesis of TAPP

The *p*-nitrobenzaldehyde (4 g) and nitrobenzene (25 mL) were added to the flask, followed by the addition of lactic acid (15 mL). Subsequently, the mixture was stirred to dissolve. A solution of nitrobenzene (15 mL) and pyrrole (1.83 mL) was added dropwise into the reaction and then heated to 140 °C for 2 h. After the reaction was over, the solution temperature was reduced to 60 °C and methanol (15 mL) was added, then cooled to room temperature. After overnight, the precipitant was filtered, washed and dried. The purple TNPP (1.1 g) solid was obtained with a yield of 15%.

TNPP (500 mg), $Na_2S \cdot 9H_2O$ (2.6 g), NH_4Cl (160 mg) and N, N-dimethylformamide (50 mL) were added into the flask, and then was stirred to dissolve. The mixture solution was heated to react at 70 °C for 8 h. When the reaction was over, the mixture solution was poured into deionized water and settle overnight. After overnight, the precipitant was filtered, washed and dried. The dried precipitant was further purified using dichloromethane by Soxhlet extraction. Finally, the purple TAPP solid (0.324 g) was obtained in a yield of 80%."

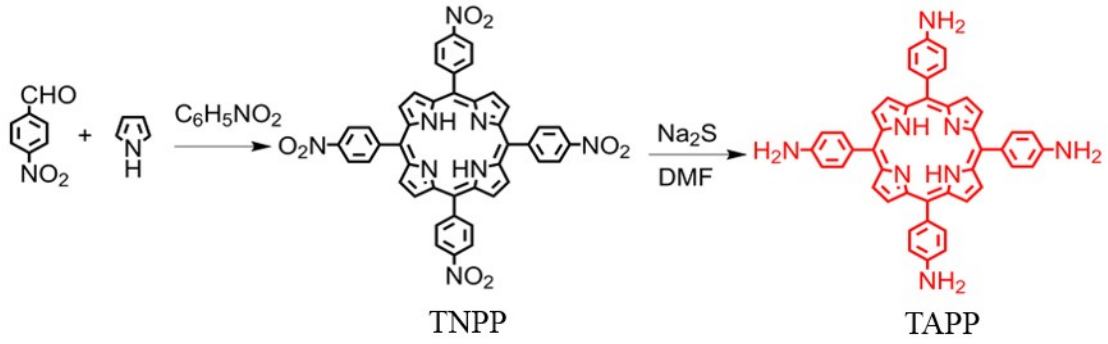

Fig. S1 Synthesis of TAPP.

Synthesis of Cu-TAPP-PD-CMP and Ni-TAPP-PD-CMP

In a 50 mL flask, TAPP-PD-CMP (50 mg), and $Cu(AC)_2 \cdot H_2O$ (180 mg) or $Ni(AC)_2 \cdot H_2O$ (176 mg) was dissolved in DMF (40 mL) solution. The mixtures were heated at 120 °C for 10 h. After cooling to room temperature, the reactants were poured into beaker with a large amount of ultrapure water, filtered, washed three times with deionized water, and dried in a vacuum oven for 24 h to obtain the product Cu-TAPP-PD-CMP or Ni-TAPP-PD-CMP.

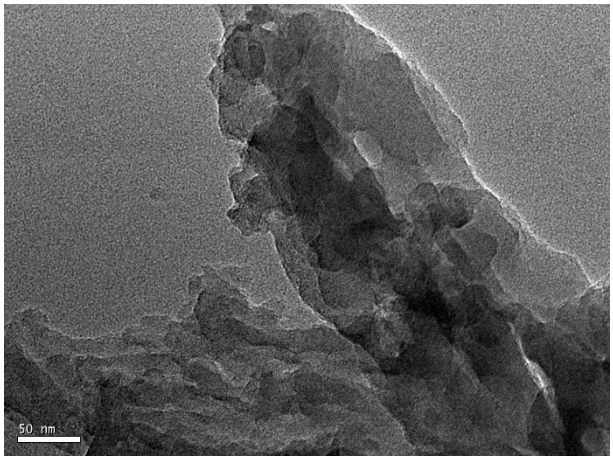

Fig. S2 TEM image of TAPP-PD-CMP.

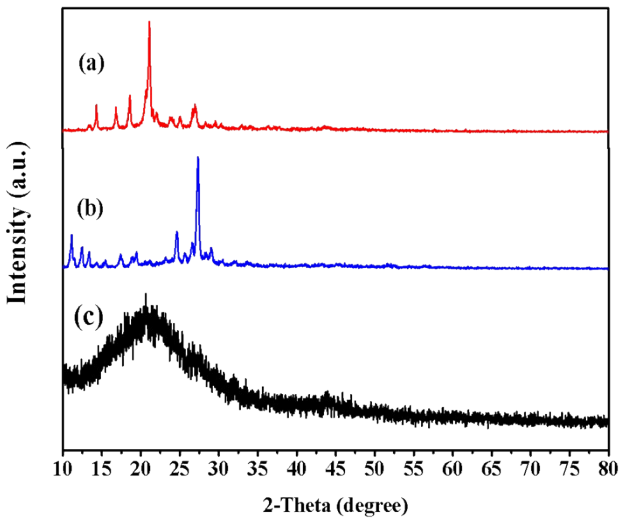

Fig. S3 PXRD patterns of (a) TAPP, (b) PD and (c) TAPP-PD-CMP.

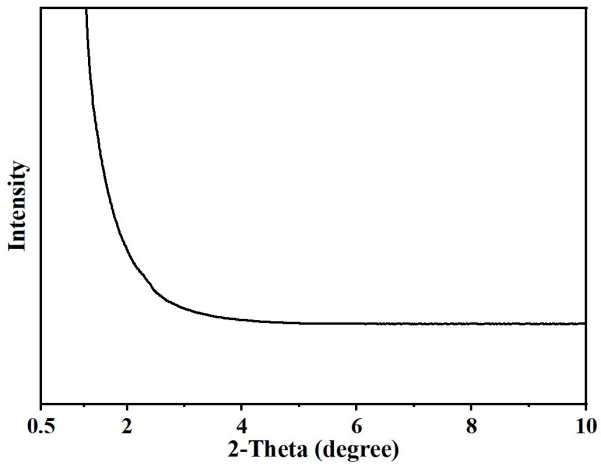

Fig. S4 Small angle XRD of TAPP-PD-CMP.

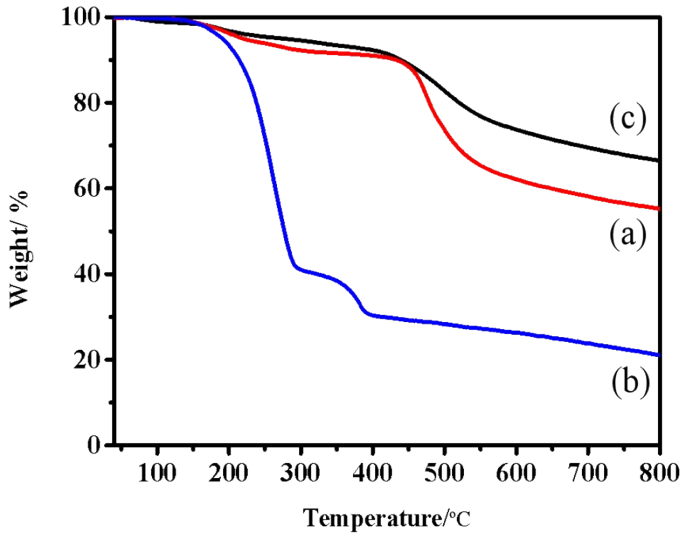

Fig. S5 TG curves of (a) TAPP, (b) PD and (c) TAPP-PD-CMP.

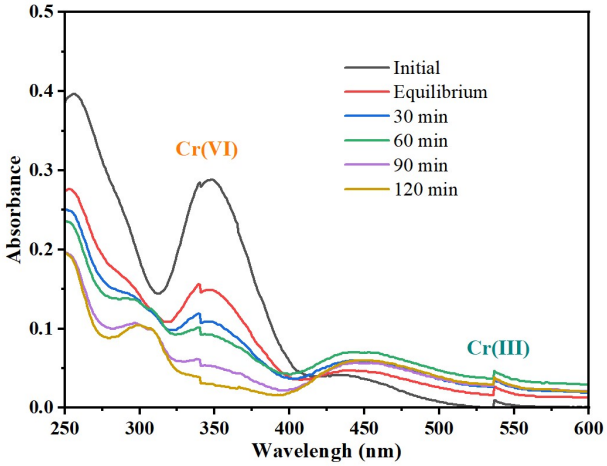

Fig. S5 UV−Visible spectra of Cr(VI) in mono-component system over TAPP-PD-CMP.

Fig. S6 UV−Visible spectra of Cr(VI) in mono-component system over TAPP-PD-CMP.

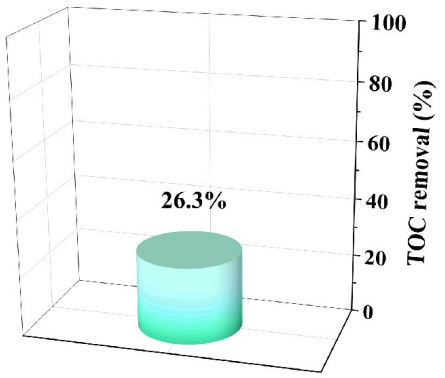

Fig. S7 Removal of TOC after photocatalytic reactions.

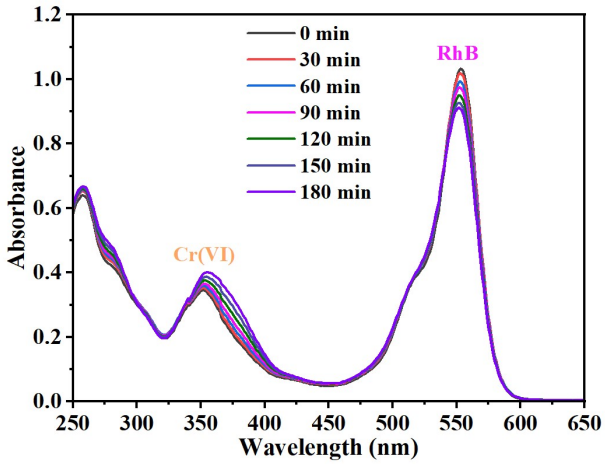

Fig. S8 Time-dependent UV−Vis spectra of RhB and Cr(VI) without catalyst.

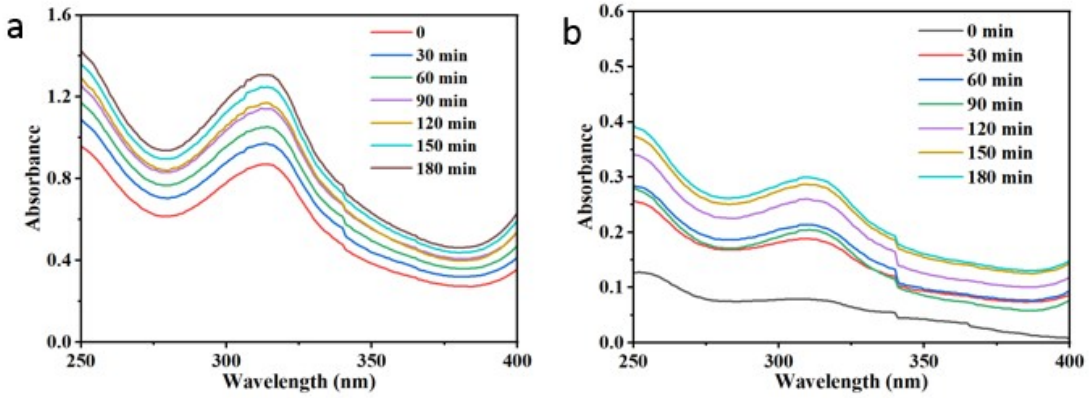

Fig. S9 Time-dependent UV−Vis spectra of Cr(VI) under (a) pH=1 and (b) pH=5.

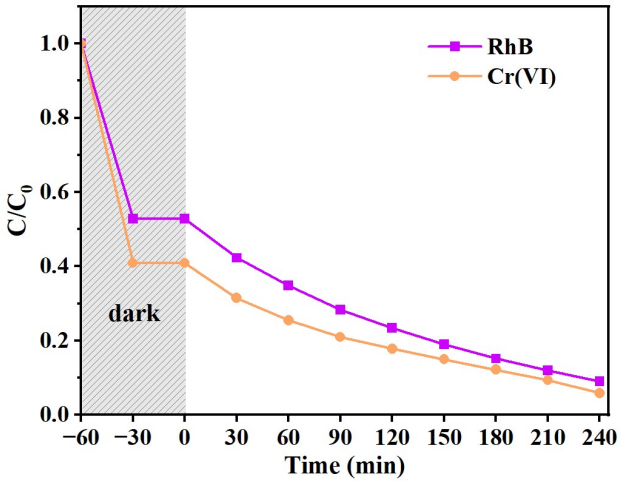

Fig. S10 Degradation rate curve of RhB and reduction rate curve of Cr(VI) in a mixed solution over TAPP-PD-CMP.

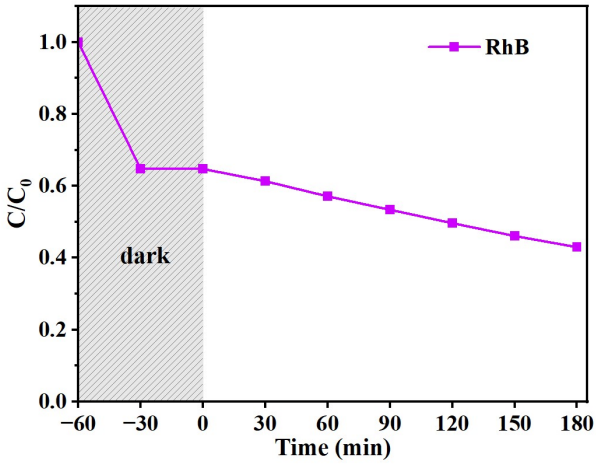

Fig. S11 Degradation rate curves of RhB in mono-component system over TAPP-PD-CMP.

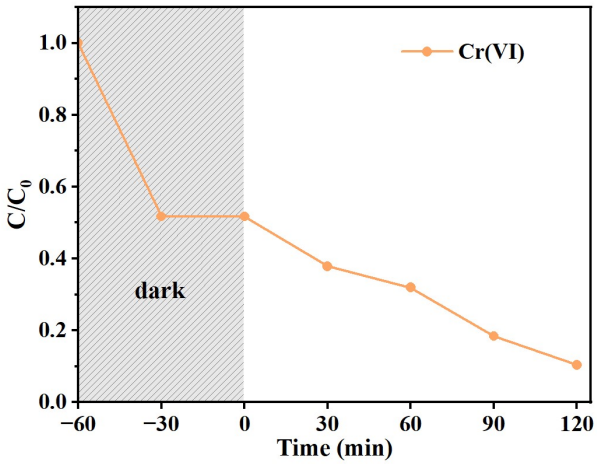

Fig. S12 Reduction rate curves of Cr(VI) in mono-component system over TAPP-PD-CMP.

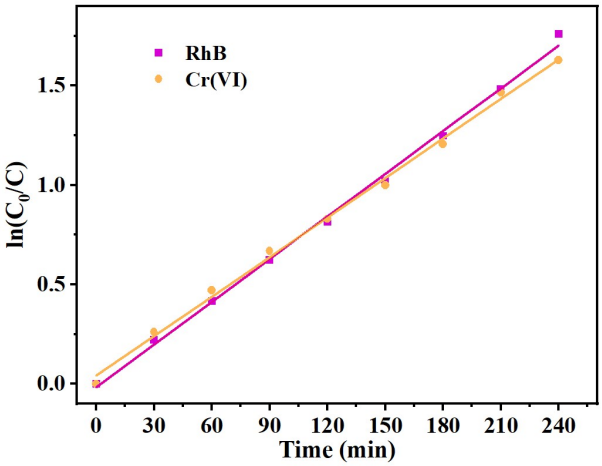

Fig. S13 Pseudo-first order kinetics model of the mixed RhB and Cr(VI) photocatalysis process.

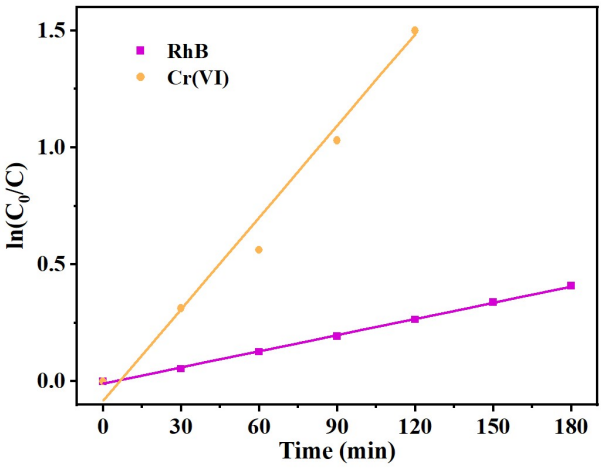

Fig. S14 Pseudo-first order kinetics model of the alone RhB and alone Cr(VI).

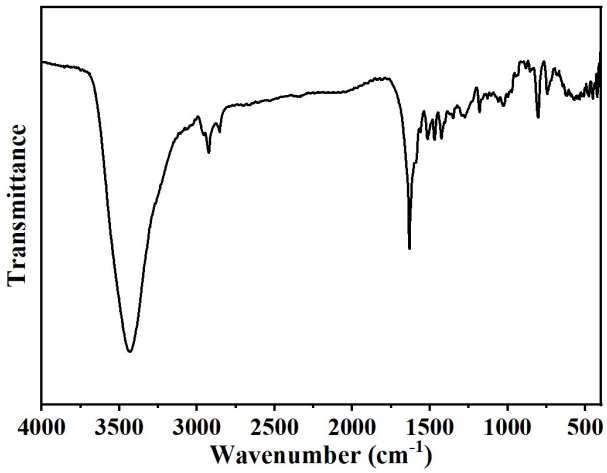

Fig. S15 FT-IR spectrum of TAPP-PD-CMP after four photocatalytic cycles.

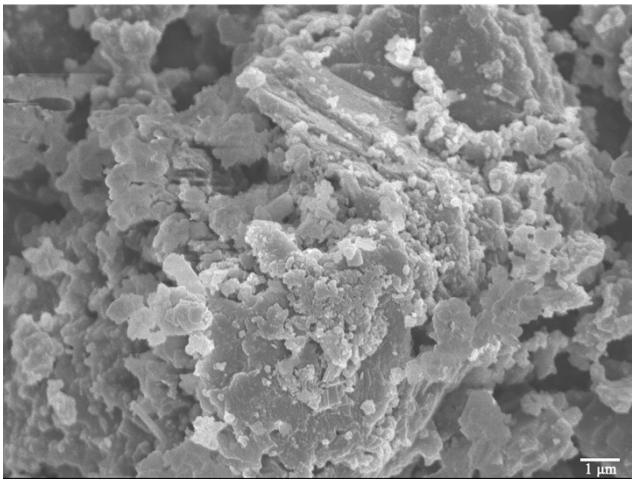

Fig. S16 SEM image of TAPP-PD-CMP after four photocatalytic cycles.

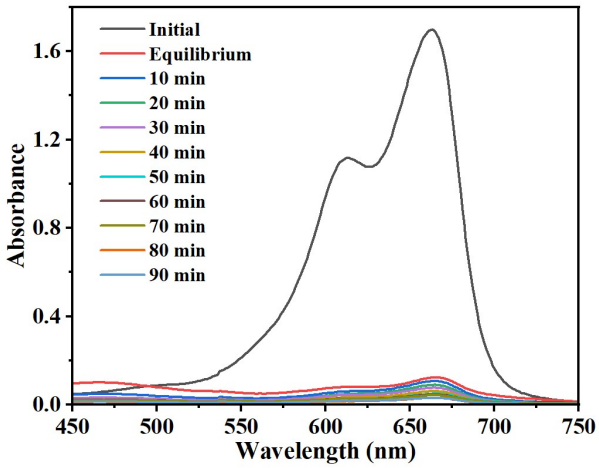

Fig. S17 Time-dependent absorption-photocatalysis UV−Vis spectra of MB in presence of TAPP-PD-CMP photocatalyst.

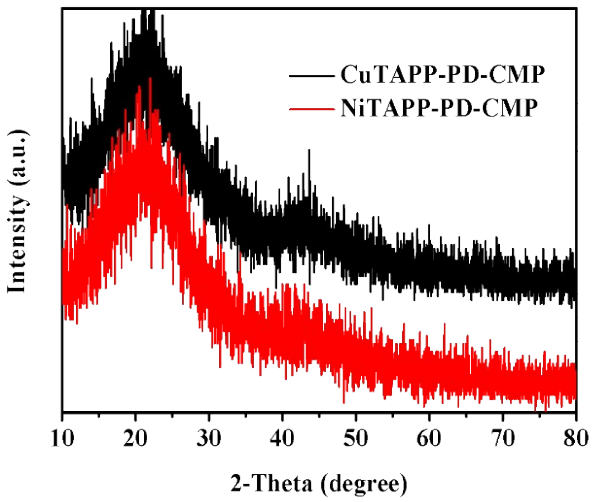

Fig. S18 PXRD pattern of Cu-TAPP-PD-CMP and Ni-TAPP-PD-CMP.

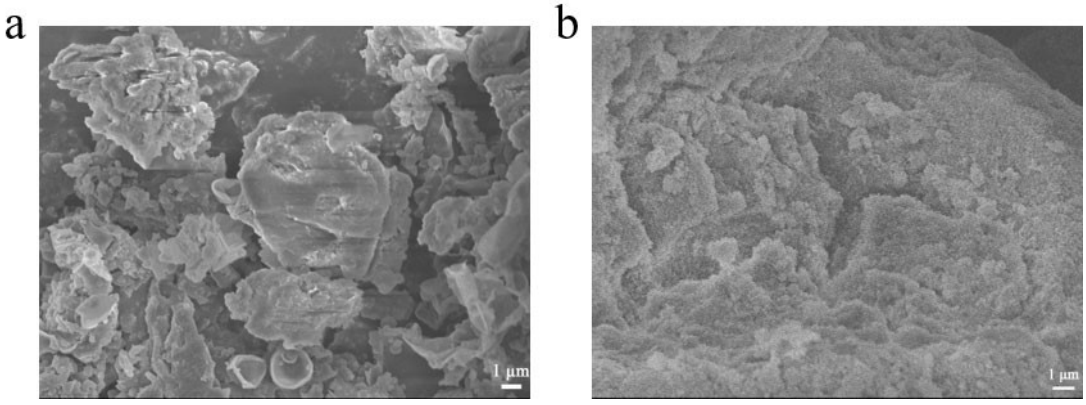

Fig. S19 SEM image of Cu-TAPP-PD-CMP and Ni-TAPP-PD-CMP.

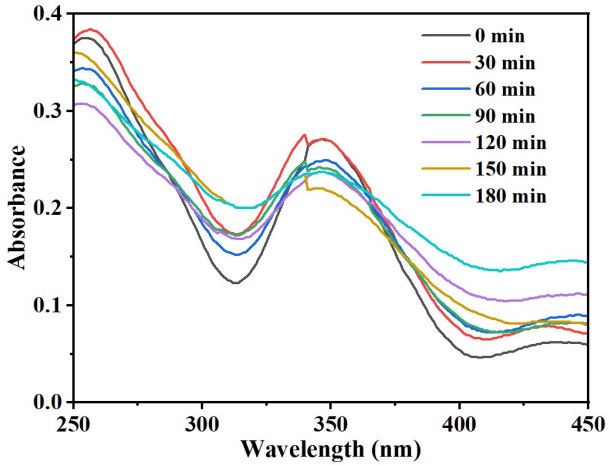

Fig. S20 Time-dependent UV−Vis spectra of Cr(VI) over NiTAPP-PD-CMP.

Table S1 Solubility tests of TAPP-PD-CMP and monomers

solvent	TAPP	PD	TAPP-PD-CMP
Water	−	−	−
Ethanol	+	+	−
Tetrahydrofuran	+	+	−
N,N-Dimethylformamide	+	+	−
Dimethyl Sulfoxide	+	+	−
Dichloromethane	+	−	−
Petroleum ether	−	−	−
Ethyl acetate	−	−	−
Toluene	−	−	−