

Electronic Supplementary Information

Rapidly Simultaneous Removal of Cationic Dyes and Cr(VI) by Boron Cluster Polyaniline with Target Site

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Experimental section

Chemical

Polyaniline (PA) was synthesized by referring to the literature method. All other reagents (AR) were purchased from Aladdin Chemical Reagent Co., Ltd. and used as is. Milli-Q ultrapure ($18 \text{ M}\Omega \text{ cm}^{-1}$) water was used throughout the research process.

Material preparation

Preparation of polyaniline nanowires

First, 8 mmol of aniline and 2 mmol of tartaric acid were dispersed in 20 mL of deionized water to form a homogeneous mixture (placed in an ice water bath for 5 min). Then, 20 ml of an aqueous solution in which 8 mmol APS was dissolved was added to the above mixed solution, and the reaction was carried out for 12 h under stirring. Finally, the filter cake was washed repeatedly with water and ethanol to obtain dark green polyaniline nanowires.

Polyaniline modified closo-[B₁₂H₁₂]²⁻

4 g PA was fully dispersed (30 min ultrasonic treatment) in 1L water, and then 20 mL of 12 M concentrated hydrochloric acid was added. After stirring for 12 h, the filter cake was collected by filtration and re-dispersed in 500 mL water. Then, 10 mmol boron clusters dissolved in 500 mL of water were added to the PA suspension and magnetic stirring was continued for 12 h. The filter cake was collected by filtration, washed three times with absolute ethanol, and dried in vacuum at 90 °C for 6 hours to obtain PA/B12.

Characterization method

The Fourier transform infrared spectrum signal is collected on an infrared spectrometer (FT-IR, Thermo iS10) with potassium bromide as the platform. The micro morphology of the material was collected on a field emission scanning electron microscope (SEM, Zeiss SIGMA), where the accelerating voltage was 5 kV and the mode was InLens.

Pollutant adsorption program

First, use ultrapure water to prepare Cr(VI) solution and RhB with accurate concentrations, respectively, 50 mg L⁻¹, 75 mg L⁻¹ and 100 mg L⁻¹. Then, pipette 50 mL containing Cr(VI) or RhB solution into an erlenmeyer flask placed on a constant temperature shaker (temperature: 25 °C, rotating speed 120 rpm). Subsequently, 30 mg adsorbent was added and the timing started. During this period, the concentration

of pollutants was monitored by an ultraviolet spectrophotometer.

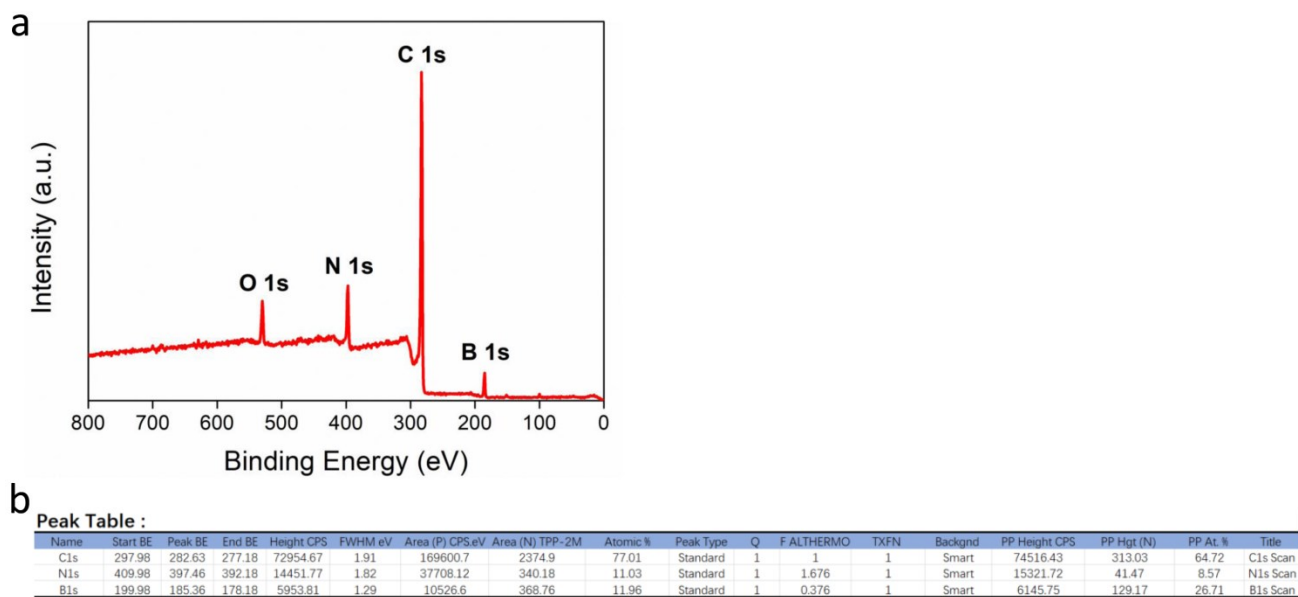


Figure S1. XPS (a) of PPA/B12 and quantitative results (b) of B, C and N elements

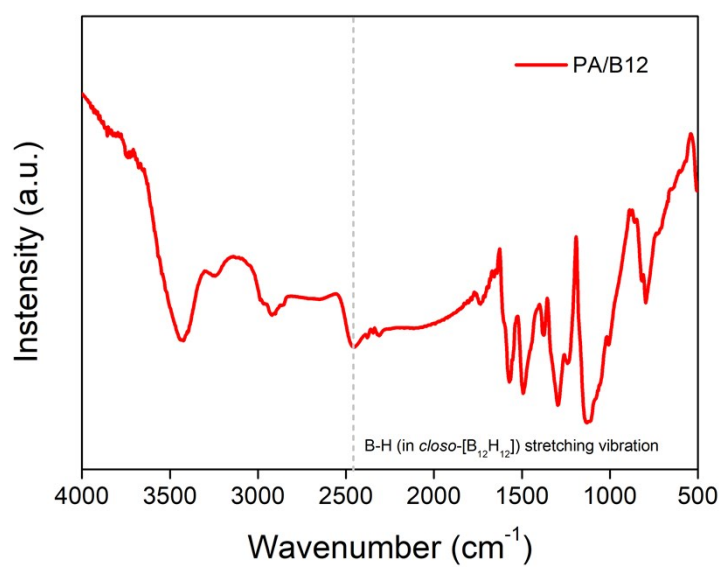


Figure S2. FT-IR spectrum of PA/B12 after 10 times repeated use.

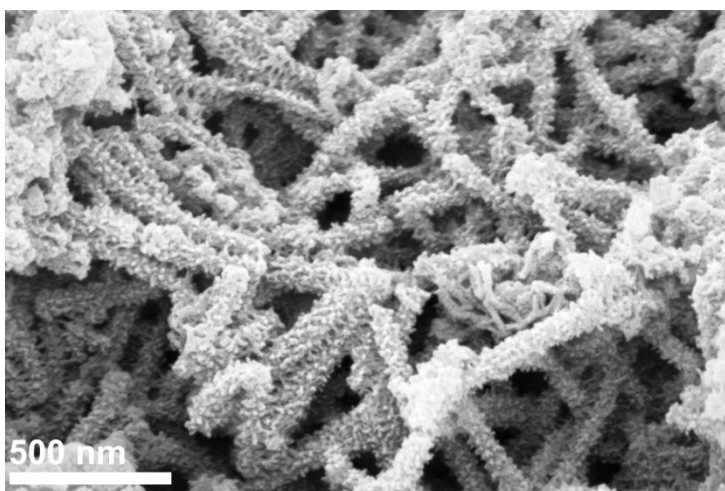


Figure S3. SEM image of PA/B12 after 10 times repeated use

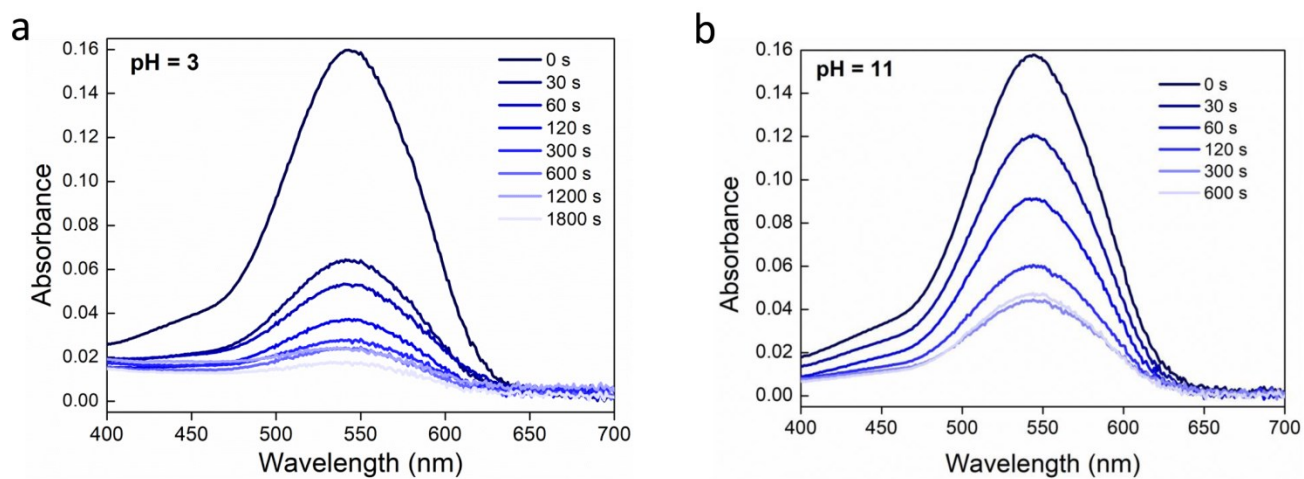


Figure S4. (a) UV-vis spectrum recorded when PPA/B12 adsorbed Cr(VI) at pH=3; (b) UV-vis spectrum recorded when PPA/B12 adsorbed Cr(VI) at pH=11. [Solution volume: 50 mL; adsorbent quality: 30 mg]

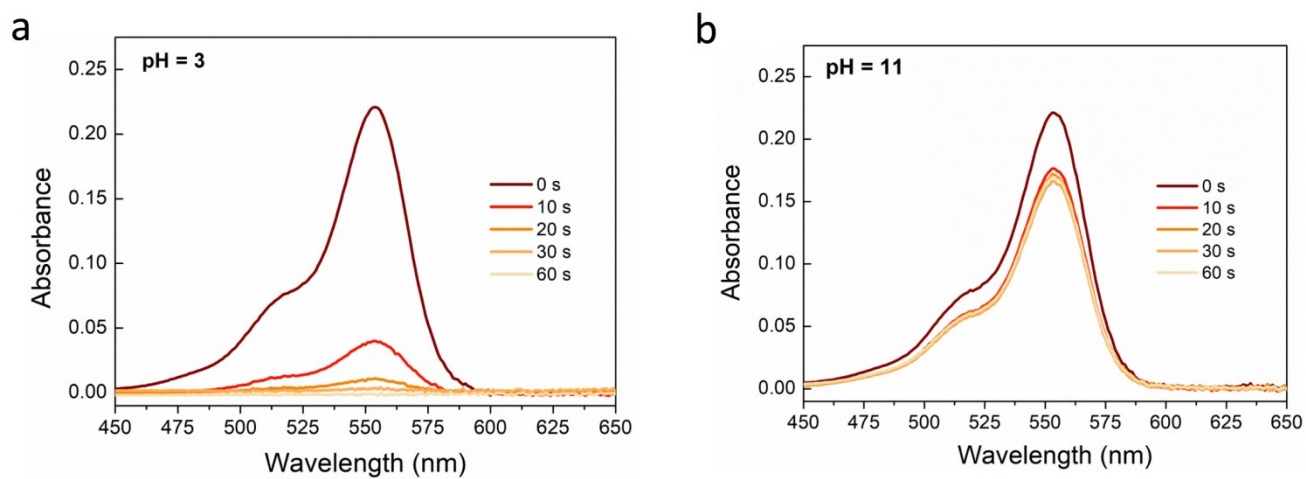


Figure S5. (a) UV-vis spectrum recorded when PPA/B12 adsorbed RhB at pH=3; (b) UV-vis spectrum recorded when PPA/B12 adsorbed RhB at pH=11. [Solution volume: 50 mL; adsorbent quality: 30 mg]

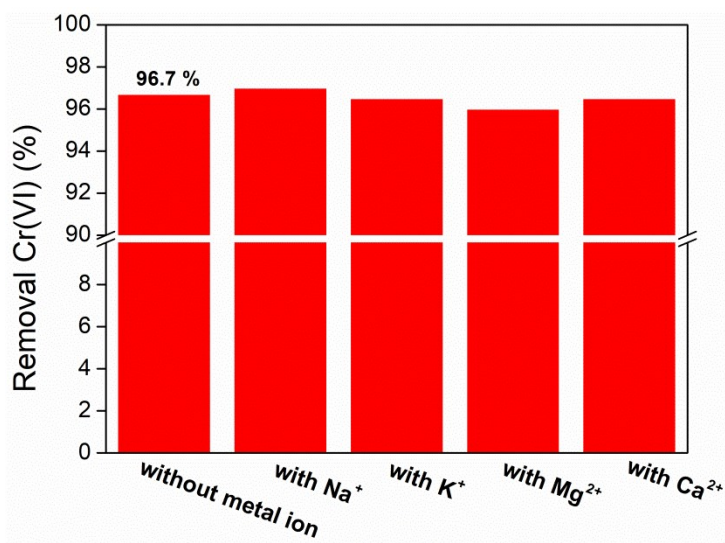


Figure S6. The effect of coexisting metal ions on the adsorption of Cr(VI) on PPA/B12. [Solution volume: 50 mL; adsorbent quality: 30 mg; metal ion concentration 0.1 M]

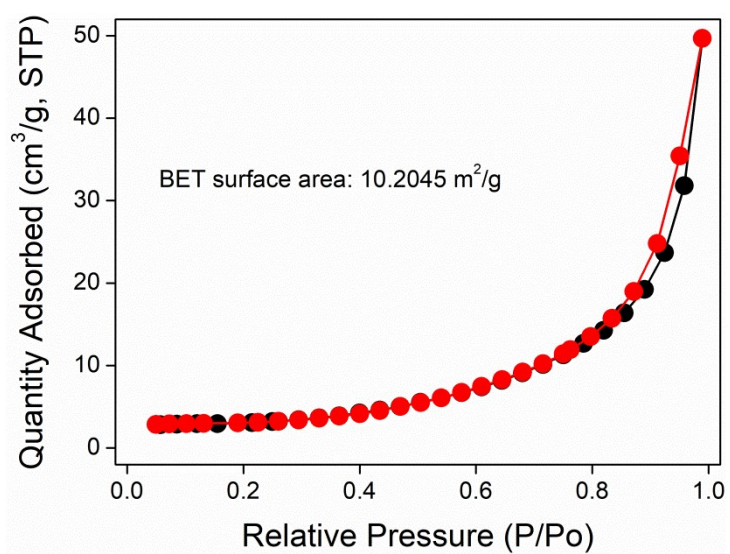


Figure S7. N₂ adsorption-desorption curve of PPA/B12.

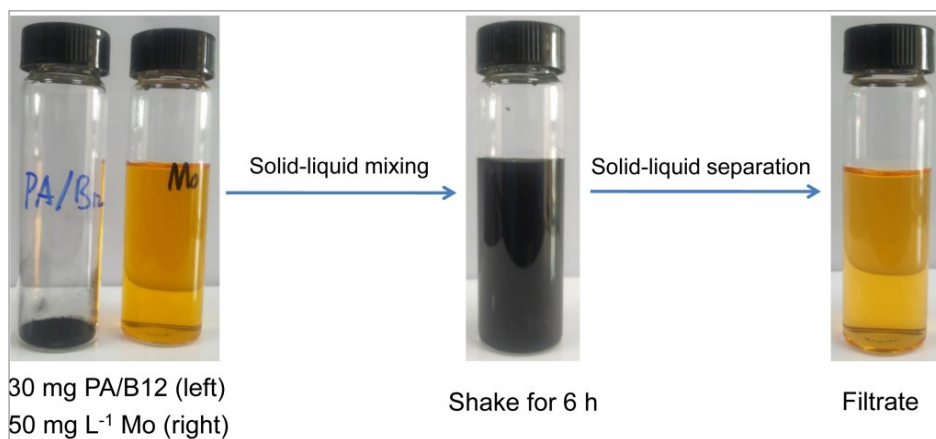


Figure S8. PA/B12 tries to adsorb the anionic dye methyl orange (Mo).

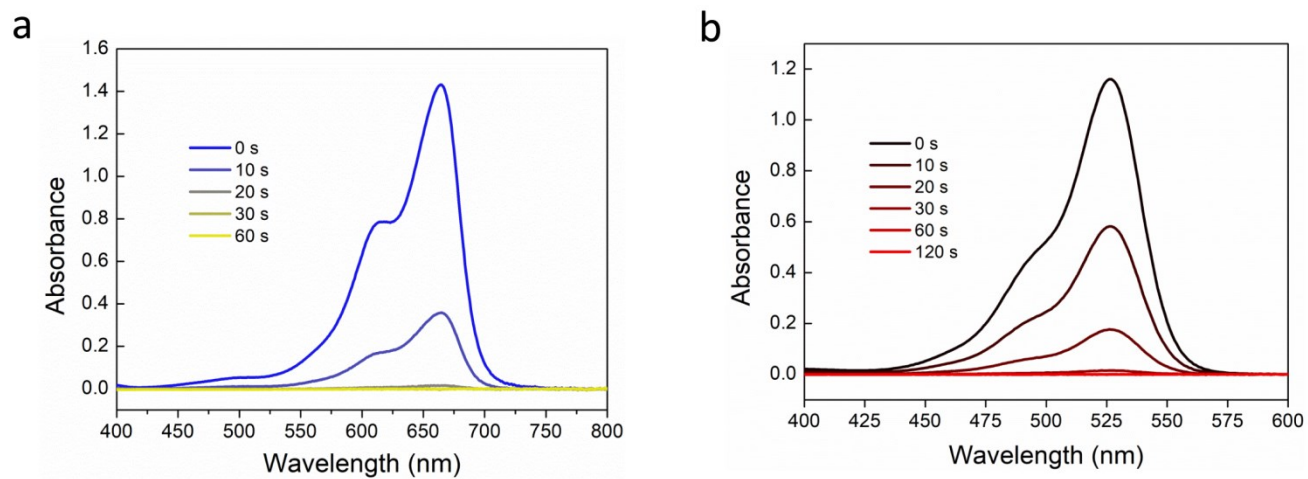


Figure S9. (a) UV-vis spectrum recorded when PPA/B12 adsorbed MB; (b) UV-vis spectrum recorded when PPA/B12 adsorbed Rh6G at pH=11. [Solution volume: 50 mL; adsorbent quality: 30 mg; pH=7]

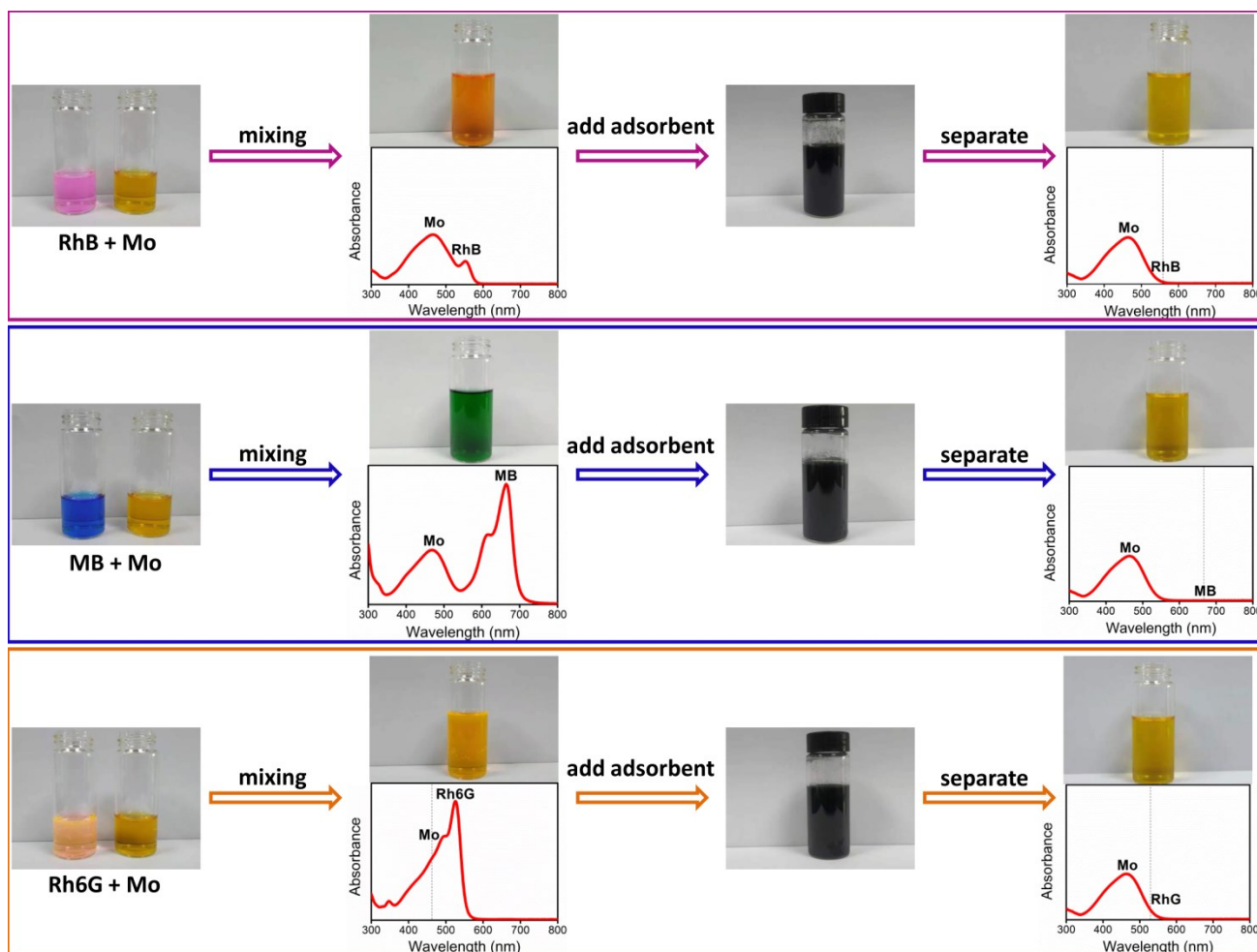


Figure S10. PPA/B12 can rapidly separate RhB, MB and Rh6G from RhB+Mo, MB+Mo and Rh6G+Mo, respectively, with almost no adsorption of Mo.

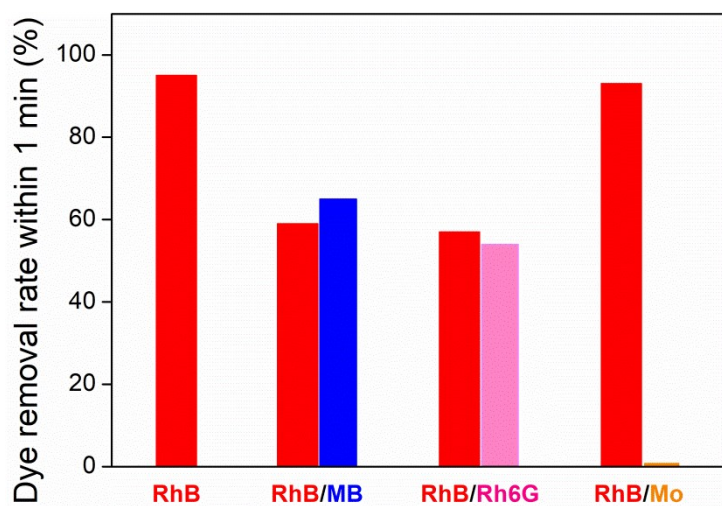


Figure S11. The effect of other dyes on the adsorption of RhB by PPA/B12. [Solution volume: 50 mL; adsorbent quality: 30 mg; the concentration of each dye is 75 mg L⁻¹]

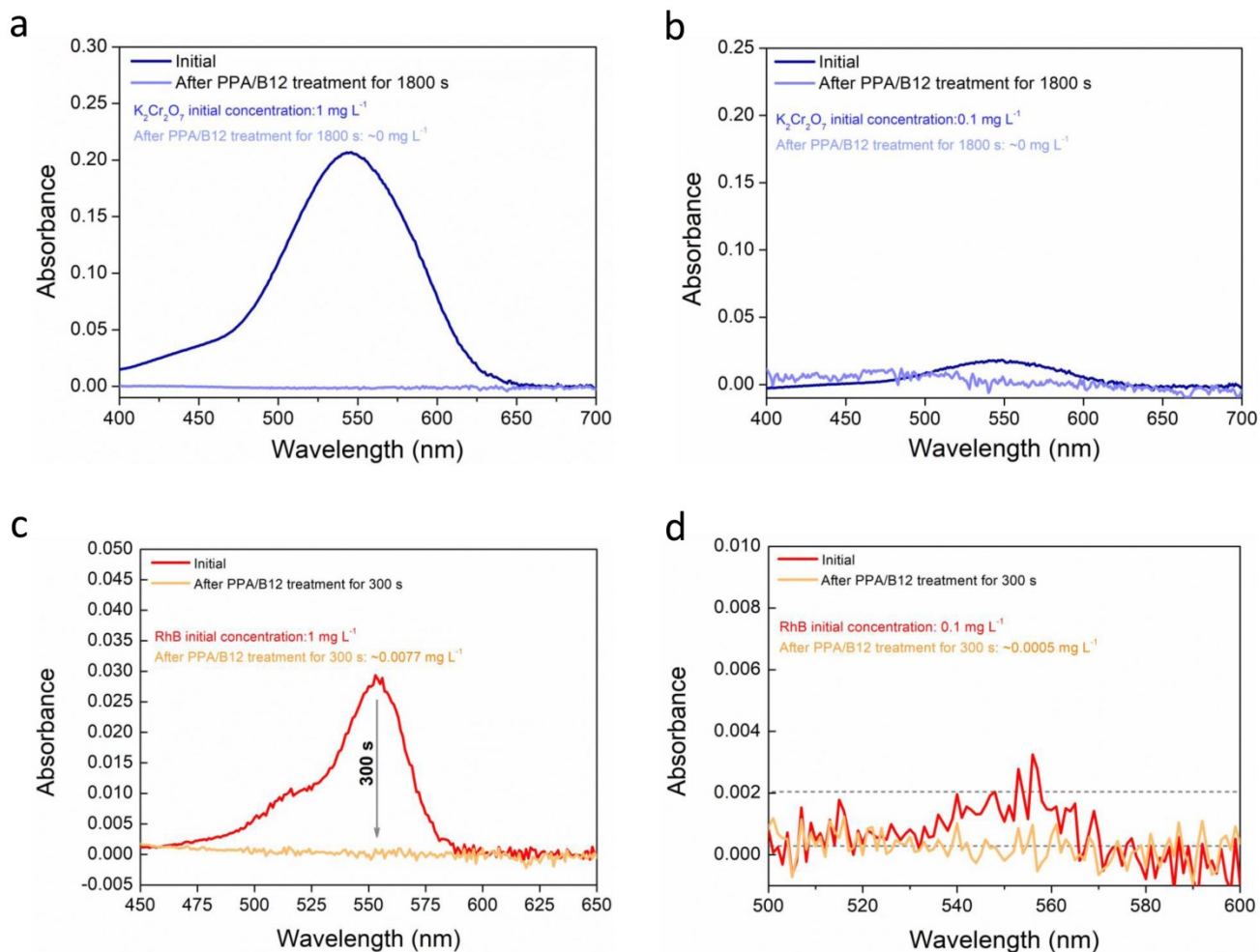


Figure S12. The performance of PPA/B12 in adsorbing low concentration of Cr(VI) and RhB in water at pH=7. (a) For 1 mg L^{-1} $K_2Cr_2O_7$; (b) For 0.1 mg L^{-1} $K_2Cr_2O_7$; (c) For 1 mg L^{-1} RhB; (d) For 0.1 mg L^{-1} RhB. [solution volume: 50 mL; adsorbent quantity: 0.5 mg]