Supporting information

Efficient removal of organic dyestuff in water contamination over MOF-derived Co-based adsorbent

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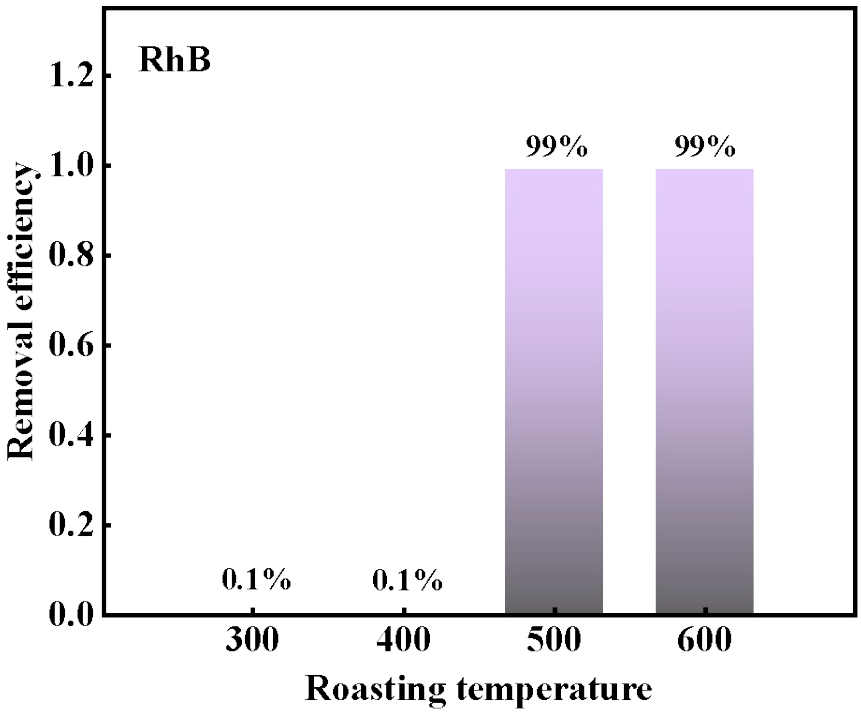

Fig. S1. The time-dependent removal efficiency of RhB aqueous solution (125 mg/L) over $Co_{0.5}$(PTA)@C catalysts at different roasting temperatures (300 ℃, 400 ℃, 500 ℃, and 600 ℃). (Reaction condition: 30 mg adsorbent, 60 mL dye solution, 60 minutes.)

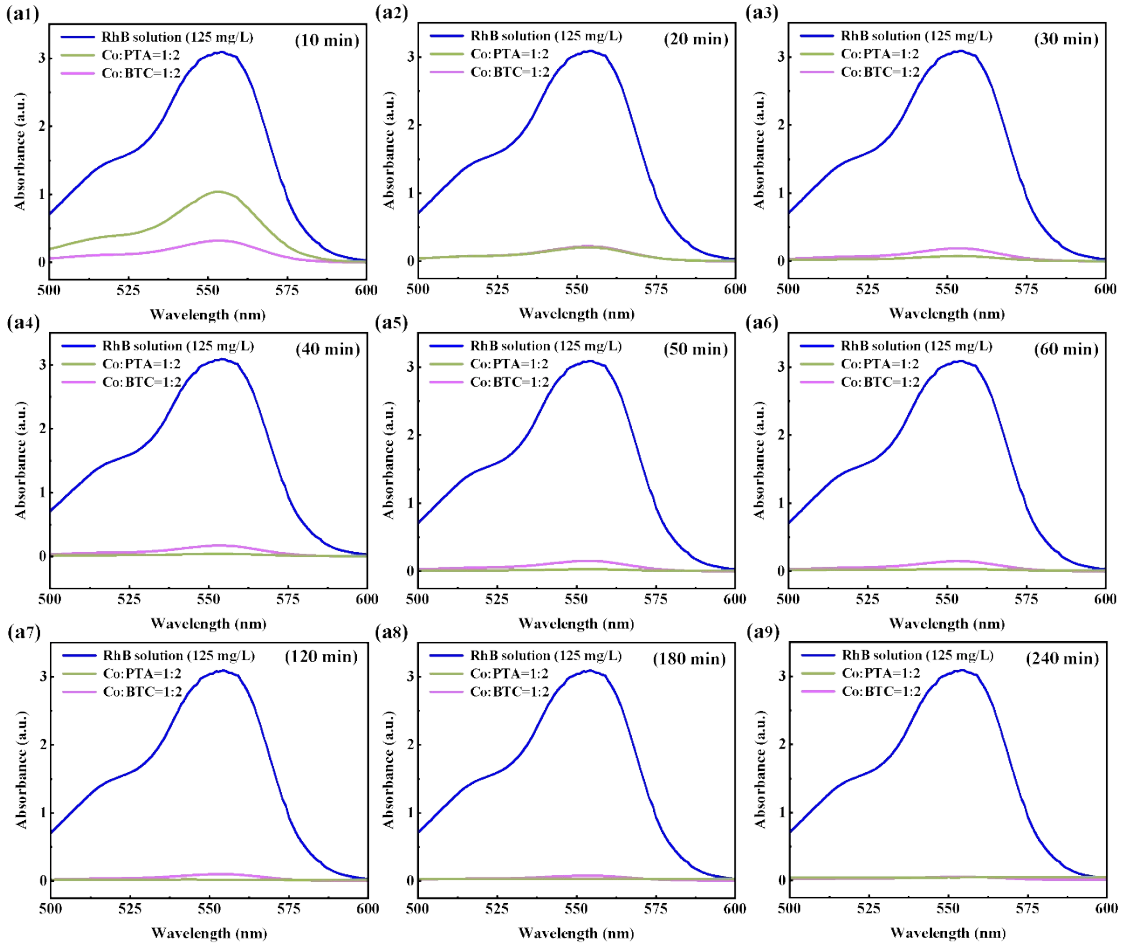

Fig. S2. The adsorption of RhB aqueous solution (125 mg/L) over $Co_{0.5}$(BTC)@C and $Co_{0.5}$(PTA)@C catalysts with the best ratio (1:2) (a1-a9) Visible light absorption spectra (10-360 min).

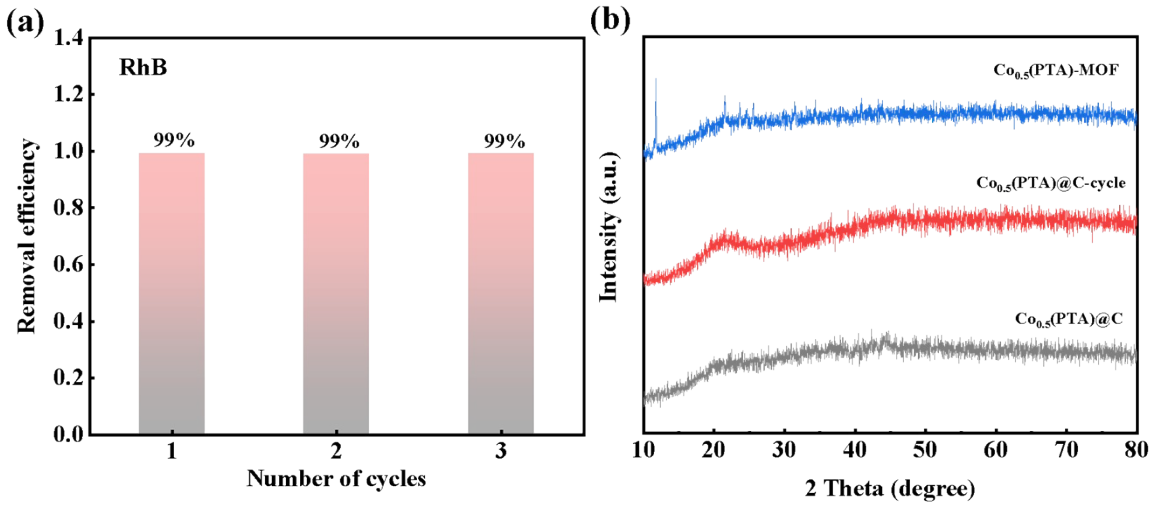

Fig. S3. (a) Removal efficiency of cycled $Co_{0.5}$(PTA)@C samples. (b) XRD spectra of $Co_{0.5}$(PTA)@C, $Co_{0.5}$(PTA)@C-cycle and $Co_{0.5}$(PTA)-MOF samples.

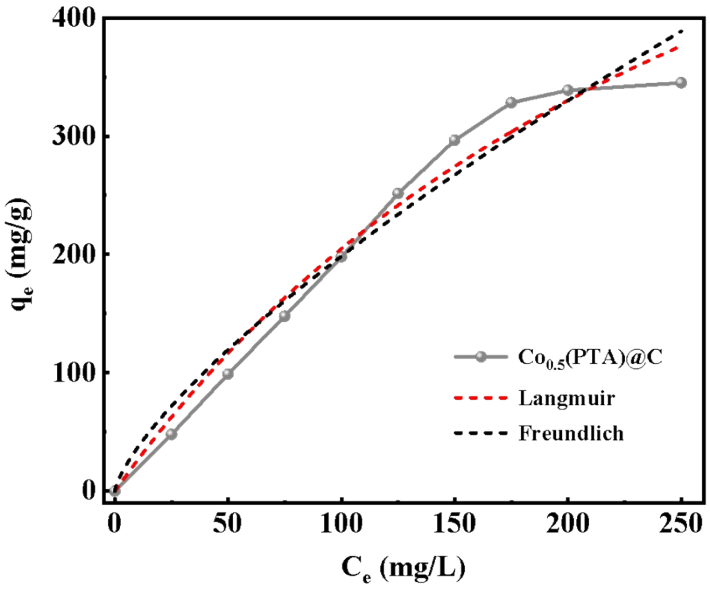

Fig. S4. The Langmuir and Freundlich adsorption isotherms of RhB over $Co_{0.5}$(PTA)@C (solid and broken lines present the experimental curve and the simulated values, respectively).

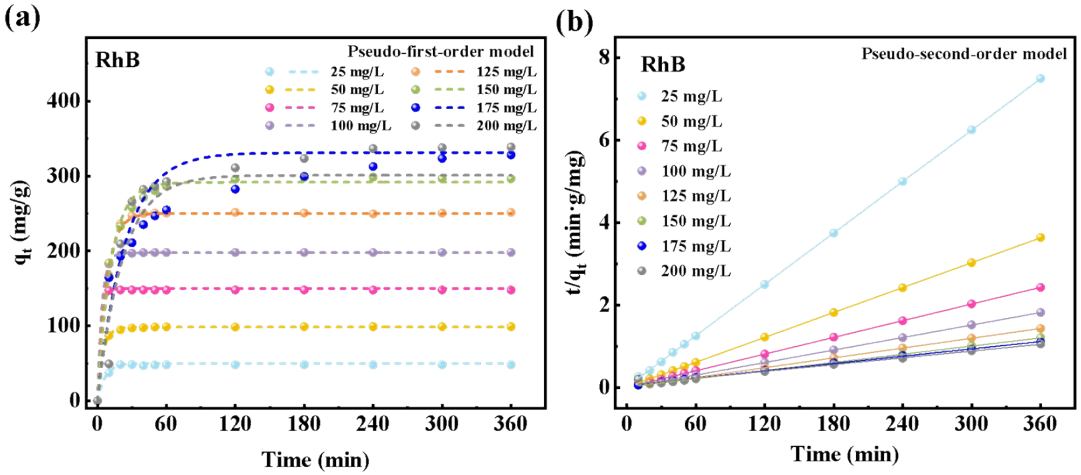

Fig. S5. Nonlinear kinetic curves fitted to the pseudo-first-order and pseudo-second-order models of RhB.

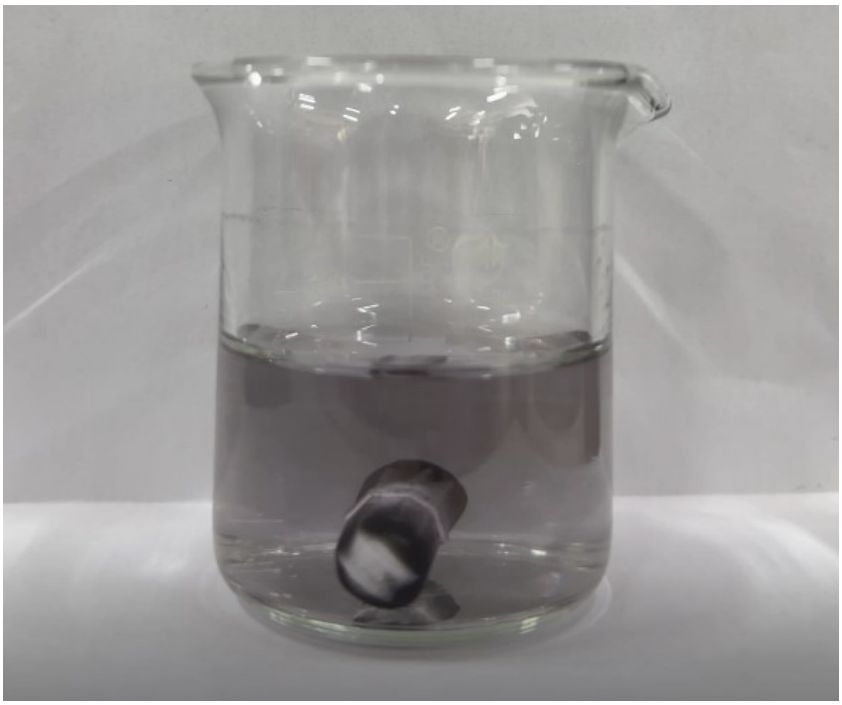

Fig. S6. Magnetism of MOF-derived metal-based catalysts.

Table S1. The adsorption of different initial concentrations from 25 mg/L to 200 mg/L (RhB aqueous solution) over $Co_{0.5}$(PTA)@C catalysts. (Reaction condition: 30 mg adsorbent, 60 mL dye solution, 500 rpm, 360 minutes.)

	A	q_t (mg/g)				removal efficiency			
C_0		60 min	120 min	180 min	240 min	60 min	120 min	180 min	240 min
25	0.02	98.67	47.97	47.97	47.97	0.97	0.99	0.99	0.99
50	0.01	98.67	98.40	98.99	98.99	0.99	0.99	0.99	0.99
75	0.01	147.87	147.87	147.87	147.87	0.99	0.99	0.99	0.99
100	0.01	197.96	197.96	197.96	197.96	0.99	0.99	0.99	0.99
125	0.15	286.36	295.72	298.03	298.53	0.95	0.98	0.99	0.99
150	0.44	250.55	251.48	250.58	249.50	0.99	0.99	0.99	0.98
175	0.85	254.72	282.44	299.54	312.77	0.74	0.82	0.87	0.91
200	0.87	292.50	310.84	323.31	336.73	0.73	0.78	0.81	0.84

C_0 (mg/L) – the initial concentrations.
A – the absorbance (RhB, λmax = 554 nm).
q_t (mg/g) - the time-dependent adsorption capacities.

Table S2. The correlation parameters and coefficients of Langmuir and Freundlich for RhB adsorptions over $Co_{0.5}$(PTA)@C.

Isotherm models	parameters/coefficients	RhB
Langmuir	q_m (mg/g)	8.49×10^{3}
	K_L (dm^3/mg)	3.18×10^{-3}
	R^2	9.79×10^{-1}
	Reduced Chi-Sqr	3.83×10^{2}
Freundlich	K_F ((mg/g) (L/mg)1/n)	6.80
	n	1.37
	R^2	0.96
	Reduced Chi-Sqr	6.44×10^{2}

K_L - the Langmuir constant, which is defined as the ratio of the adsorption rate constant to the desorption rate constant.
K_F - the Freundlich constant, which is related to adsorption capacity and adsorption strength under the Freundlich model.

Table S3. The correlation parameters and coefficients of the pseudo-first-order and pseudo-

second-order kinetic models for RhB adsorptions over $Co_{0.5}$(PTA)@C.

C_0	$q_{e,exp}$	Pseudo-first-order kinetic			Pseudo-second-order kinetic		
(mg/L)	(mg/g)	k_1 (min^{-1})	R_1^2	$q_{e1,cal}$ (mg/g)	k_2 (min^{-1})	R_2^2	$q_{e2,cal}$ (mg/g)
25	47.97	1.50×10^{-1}	9.79×10^{-1}	50.00	1.16×10^{-2}	9.99×10^{-1}	48.12
50	98.99	2.11×10^{-1}	9.99×10^{-1}	98.32	1.11×10^{-2}	9.99×10^{-1}	99.31
75	147.87	3.50×10^{-1}	9.98×10^{-1}	150.00	6.75×10^{-3}	9.99×10^{-1}	148.15
100	197.96	2.56×10^{-1}	9.99×10^{-1}	197.66	1.47×10^{-2}	9.99×10^{-1}	197.63
125	251.55	1.25×10^{-1}	9.97×10^{-1}	250.00	3.25×10^{-3}	9.99×10^{-1}	251.89
150	296.51	8.56×10^{-2}	9.91×10^{-1}	291.65	6.56×10^{-4}	9.99×10^{-1}	303.03
175	328.31	4.56×10^{-2}	9.29×10^{-1}	300.96	1.68×10^{-4}	9.99×10^{-1}	338.98
200	338.73	4.20×10^{-1}	9.56×10^{-1}	331.17	1.25×10^{-4}	9.99×10^{-1}	363.64

Table S4. The detailed data on BET surface area, pore size, and the Co content of M@C catalysts.

Samples	The content of Co[a] (At. %)
$Co_{0.5}$(PTA)@C	1.10
$Co_{0.5}$(PTA)@C-cycled	1.04

a - detected by ICP.