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Co-Adsorption and Fenton-like oxidation in the efficient removal of methylene blue by MIL-88B@UiO-66 nanoflowers

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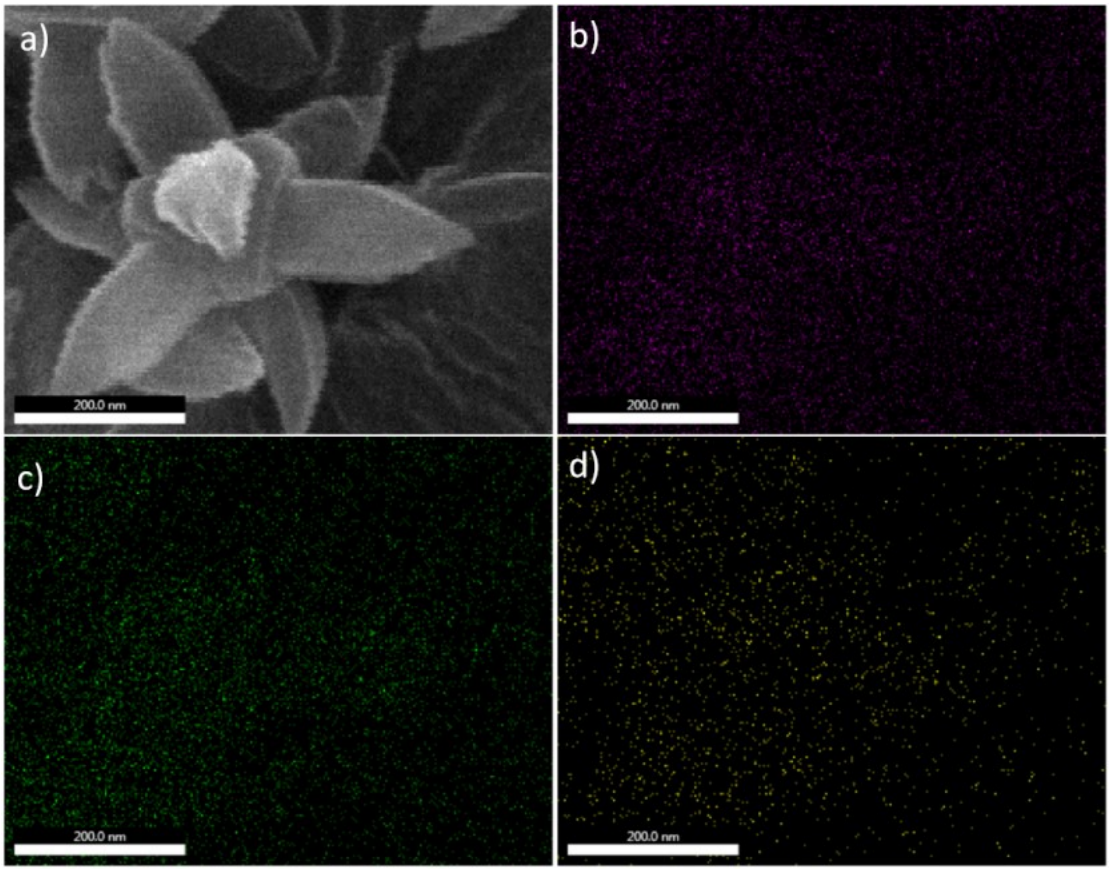

Fig. S1: (a) Scanning electron microscope image before EDS. The EDS mapping of MIL-88B@UiO-66 : (b) O; (c) Zr; (d) Fe.

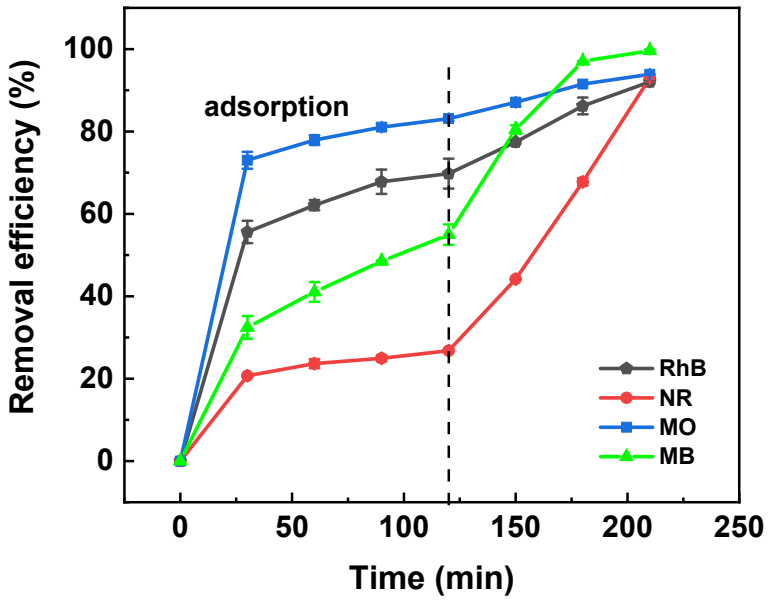

Fig. S2: Removal percentages of four dyes by MIL-88B@UiO-66.

The adsorption thermodynamics for the adsorption of MB on MIL-88B@UiO-66: The adsorption equilibrium of MB by MIL-88B@UiO-66 at elevated temperatures with an initial concentration of 100 mg/L is shown in Fig. 7c. The adsorption thermodynamic parameters including standard Gibbs free energy (ΔG^{θ}), standard enthalpy change (ΔH^{θ}) and entropy change (ΔS) can be calculated based on Eqs. (1) to (4).

$$\Delta G^{\theta} = -RT\ln K_D \quad (1)$$

$$\Delta G^{\theta} = \Delta H^{\theta} - T\Delta S^{\theta} \quad (2)$$

$$\ln K_D = -\frac{\Delta H^{\theta}}{RT} + \frac{\Delta S^{\theta}}{R} \quad (3)$$

$$K_D = \frac{q_e}{C_e} \quad (4)$$

In which, K_D is the partition coefficient of adsorption (L/mg)； q_e and C_e are the adsorbed amounts (mg/g) of MB and the concentrations of MB in solution at equilibrium (mg/L), respectively; R is the gas constant (8.314 J/mol·K), and T is the absolute temperature (K). From Eq. (3), the standard enthalpy change and entropy change can be calculated using the slope and intercept of the line obtained by plotting $\ln K_D$ versus $1/T$ versus, and then standard Gibbs free energy is calculated by using Eq. (2).

Fig. S3 shows the variation of $\ln K_D$ upon with $1/T$, the equation of the curve is simulated as $Y = -2022.72X + 5.33$. The thermodynamic parameters calculated from the fitting results are shown in Table S1. It can be concluded that the adsorption of MB by MIL-88B@UiO-66 is an endothermal and entropy increase process, and the standard Gibbs free energy is a little larger than 0 at the experimental temperature.

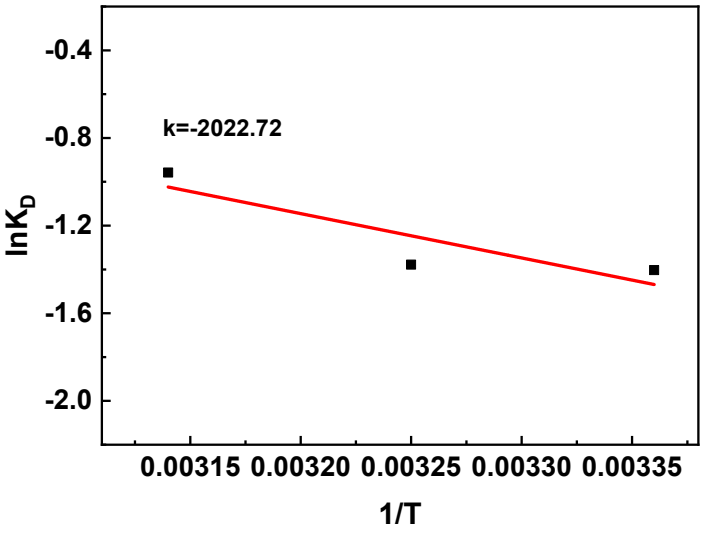

Fig. S3: Plotting curves of lnK_D versus 1/T for MB adsorption on MIL-88B@UiO-66.

Table S1: Thermodynamic parameters of MB adsorption by MIL-88B@UiO-66.

Adsorbents	Temperature /K	ΔH^{θ} (KJ· mol-1)	ΔS^{θ} (J· mol-1· K-1)	ΔG^{θ} (KJ· mol-1)
MIL-88B@UiO-66	298	16.817	44.294	3.617
	308			3.174
	318			2.732

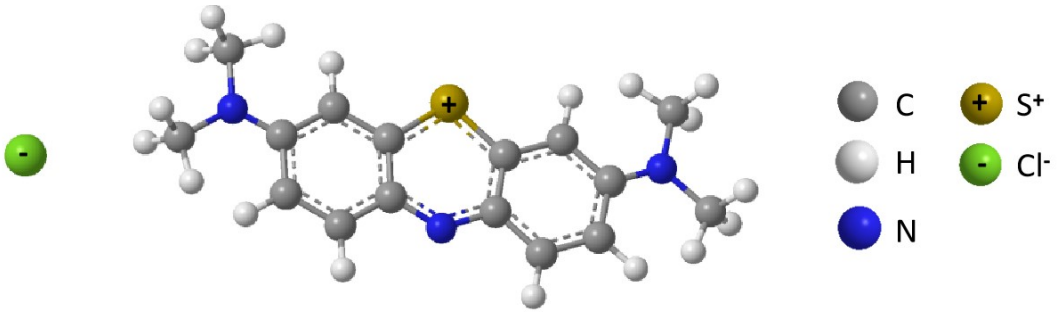

Fig. S4: Structure diagram of methylene blue.

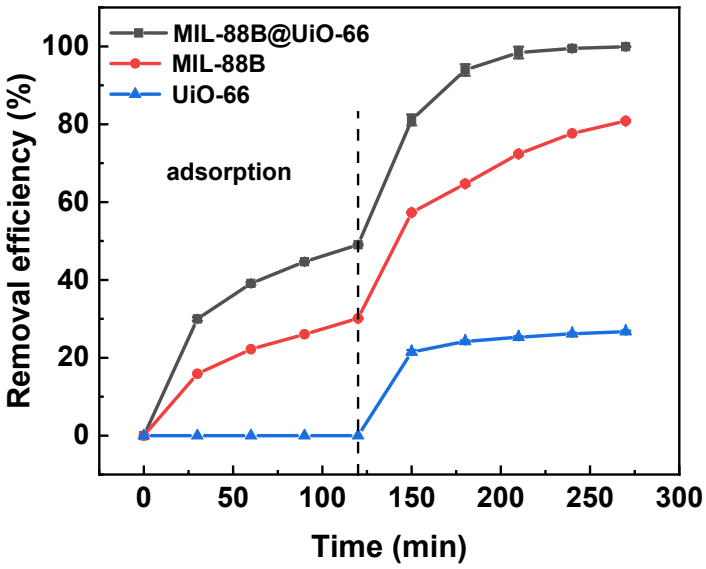

Fig. S5: Comparison of adsorption and Fenton-like catalytic properties of different MOFs. Reaction conditions: *m*(MOF)=80 mg, *n*(H_2O_2)=2*10^{-6} mol, *C*(MB) = 100.0 mg/L, *V*(MB)=100 mL, T=25 ℃.