**Supplementary information**

# Economical synthesis of MOF from CHNS analyzer waste CuO and PET bottles for congo red sequestration: A pathway towards dual mitigation

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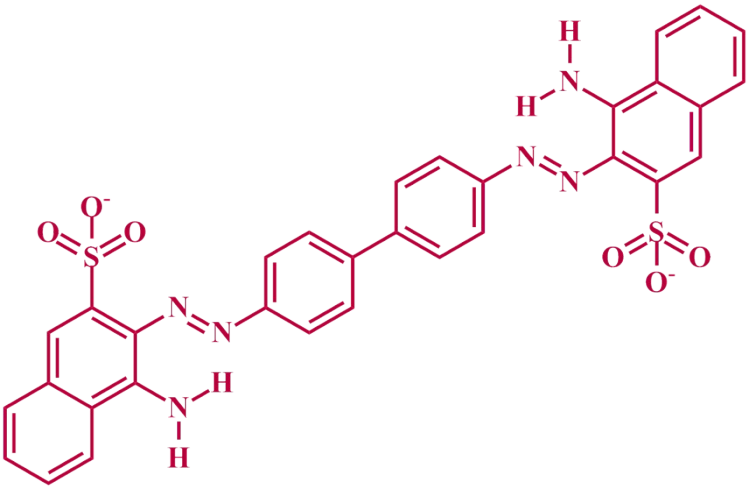

**Fig. S1:** Structure of Congo red (anionic form).

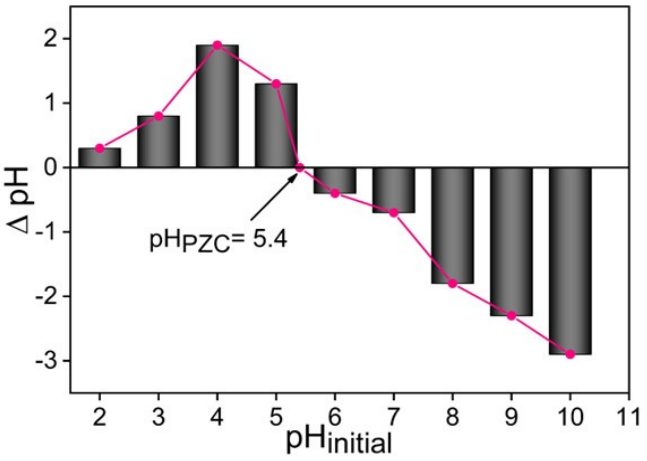


**Fig. S2.** Point zero charge graph of Cu-PTA-MOF.

## Supplementary information

### Text S1: Kinetics model for Adsorption.

The linear equations of the kinetics model employed in the study are following:

$\ln(Q_e - Q_t) = \ln Q_e - k_1 t$ (Pseudo-first-order) (S1)

$$\frac{t}{Q_t} = \frac{1}{K_2 Q_e^2} + \frac{t}{Q_e}$$ (Pseudo-second-order) (S2)

where t (min) is contact time , $Q_e$ and $Q_t$ are the adsorption amounts (mg/g) at equilibrium and time t respectively. Here $k_1$ ($min^{-1}$)and $k_2$ (g. $mg^{-1}$ $min^{-1}$) denote the rate constants of the pseudo-first-order and the pseudo-second-order respectively.

### Text S2: Adsorption isotherm models

The linear equations for the adsorption isotherms employed in the study are outlined below:

$$\frac{C_e}{Q_e} = \frac{1}{K_L Q_m} + \frac{C_e}{Q_m}$$ (Langmuir adsorption isotherm) (S4)

$$lnQ_e = lnK_F + \frac{1}{n} lnC_e$$ (Freundlich adsorption isotherm) (S5)

$$Q_e = \frac{RT}{b_T} lnK_T + \frac{RT}{b_T} lnC_e$$ (Temkin adsorption isotherm) (S6)

$$ln\left(\frac{C_e}{Q_e}\right) = BlnC_e - lnA$$ (Redlich-Peterson adsorption isotherm) (S7)

where $C_o$ and $C_e$ denote initial and equilibrium concentrations of CR (mg/L), $Q_e$ is the extent of the CR adsorbed at the stage of equilibrium (mg/g), $Q_m$ denotes the optimum adsorption capacity (mg/g), $K_L$, $K_F$ and $K_T$ signify Langmuir, Freundlich and Temkin isotherm constants (L/mg) respectively. n and $b_T$ indicate the adsorption intensity and heat of adsorption (J/mol), respectively. R stands for the universal gas constant (8.314 J/mol× K) and T (K) is the temperature. A is Redlich-Peterson isotherm constant (L/mg) and B is R-P parameter.

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## Text S3: Thermodynamic parameters

The equation of thermodynamics parameters employed in the study are given below:

$$\Delta G° = - RT lnK°_C \quad \text{(S8)}$$

$$\Delta G° = \Delta H° - T\Delta S° \quad \text{(S9)}$$

$$lnK°_L = \frac{-\Delta H°}{RT} + \frac{\Delta S°}{R} \quad \text{(S10)}$$

Considering the adsorption isotherm model, the dimensionless thermodynamic equilibrium constant was determined using the following equation:

$$K_L = \frac{(1000 \times K_L \times molecular\ weight\ of\ adsorbate) \times [adsorbate]^0}{\gamma}$$

where $\gamma$ is the activity coefficient(dimensionless), $K_L°$ is the thermodynamic equilibrium constant (dimensionless), [Adsorbate]° is the standard adsorbate concentration (mol $L^{-1}$) and T (K) is the temperature, and R (8.314 J/mol × K) is the universal gas constant. $K_L$ is the fitted adsorption isotherm constant (Langmuir, Freundlich, Temkin and Redlich-Peterson).