Supplementary information

Text S1

Characterization

Prepared samples were analyzed by Fourier transform-infrared spectra (FTIR, Shimadzu-8400S) to confirm their functional groups. The morphological changes were also made clear using a scanning electron microscope (SEM, JEOL JSM 6360 LA, Japan). To investigate the crystal phase was utilized X-ray Phillips diffractometer. Moreover, X-ray photoelectron spectroscopy (XPS, Thermo Scientific ESCALAB 250Xi VG, USA) was used to identify the elemental composition of the Sn-MOF/GO composite surface. The textural characteristics were investigated by using the Brunauer–Emmett–Teller method (BET-Beckman coulter, SA3100, USA). Variations of surface charges of Sn-MOF and Sn-MOF/GO composite were investigated by using Zeta-sizer (Malvern-UK).

Table S1

Adsorption Isotherm equations

1- Langmuir	$\frac{C_e}{q_{e=}} \frac{1}{bq_m} + \frac{C_e}{q_m}$	**Where** q_e: is the equilibrium adsorption capacity. q_m: is the monolayer adsorption capacity. C_e: is the residual concentration of Pb^{2+} at equilibrium. b: is Langmuir constant. $R_{L:}$ is the separation factor calculated from b as follows: $\left(R_L = \frac{1}{1 + bC_0}\right)$
2- Freundlich	$\log q_e = \log K_F + \frac{1}{n} \log C_e$	K_F and n are Freundlich constants.
3- Temkin	$q_e = B \ln A + B \ln C_e$ $B = \frac{RT}{b}$	b: is Temkin constant related to the heat of adsorption. A : is the equilibrium binding constant. T : is the absolute temperature. R: is the gas constant. (8.314 J/mol.k).
Dubinin-Radushkevich (D-R)	$\ln q_e = \ln q_s - K_{ad} \varepsilon^2$ $\varepsilon = RT \ln\left(1 + \frac{1}{C_e}\right)$	ε : is the Polanyi potential. K_{ad} : is a constant related to mean free energy of adsorption per mole of adsorbate. q_s : is the saturation adsorption capacity

Table 2

values of the separation factor R_L

C_o	50	100	150	200
R_L	0.114	0.061	0.041	0.031

Table S3

Pseudo-first-order	$\ln(q_e - q_t) = \ln q_e - k_1(t)$	q_e: is the amount of Pb^{+2} that adsorbs onto Sn(II)-BDC MOF /GO composite at equilibrium. q_t : is the amount of Pb^{+2} adsorption at time t. k_1 : is the rate constant of pseudo first-order
Pseudo- second- order	$\frac{t}{q_t} = \frac{1}{k_2 q_e^2} + \frac{t}{q_e}$	k_2 : is the rate constant pseudo-second-order.
Elovich model	$q_t = \frac{1}{\beta}\ln(\alpha\beta) + \frac{1}{\beta}\ln(t)$	α : is Elovich coefficient that represents the initial adsorption rate. β : is Elovich coefficient that relates to the extent of surface coverage and activation energy for chemisorption.

Adsorption kinetics equations of different models

Table S4

Equations for thermodynamic parameters

$\ln K_e = \frac{\Delta S^O}{R} - \frac{\Delta H^O}{RT}$	ΔS^o : is the change in entropy ΔH^o : is the change in enthalpy K_e: is the thermodynamics equilibrium constant T: absolute temperature R: Universal gas constant
$K_e = \frac{C_{Ae}}{C_e}$	C_{Ae} : is the concentration of Pb^{2+} on Sn-BDC-MOF/GO composite surface C_e : is the concentration of Pb^{2+} at equilibrium
$\Delta G^O = \Delta H^O - T\Delta S^O$	ΔG^o : is the change in free energy

Table S5

Equations for distribution coefficient (K_d) and relative selectivity factor (α)

$K_d = \frac{q_e}{C_e}$	K_d : is the distribution coefficient q_e: is the is the amount of metal ions that adsorbs onto Sn(II)-BDC MOF /GO composite at equilibrium. C_e: is the concentration of metal ions at equilibrium
$\alpha = \frac{K_{d\,(Pb^{2+})}}{K_{d\,(M^{2+})}}$	α: is the ratio between the distribution coefficient of lead ions to distributions coefficient of other metals ions

Fig. S1

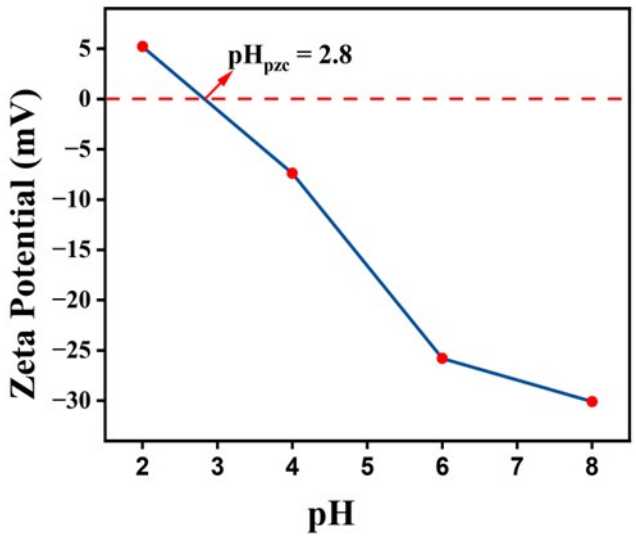

Fig. S1 ZP of Sn-BDC-MOF/GO composite at different pH values.

Fig. S2

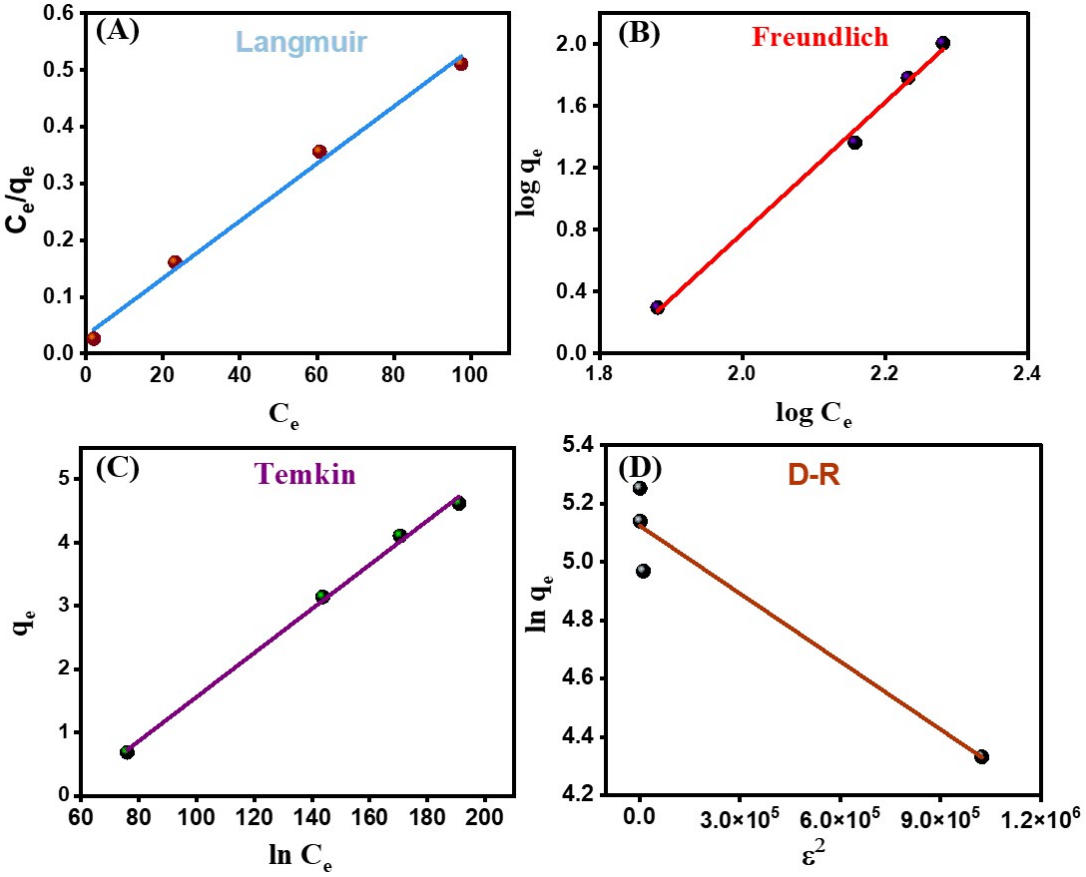

Fig. S2 Adsorption isotherm models; (**A**) Langmuir, **(B)**Freundlich, (**C**)Temkin, (**D**) D-R for the adsorption Pb(II) by Sn-BDC MOF/Composite.

Fig.S3

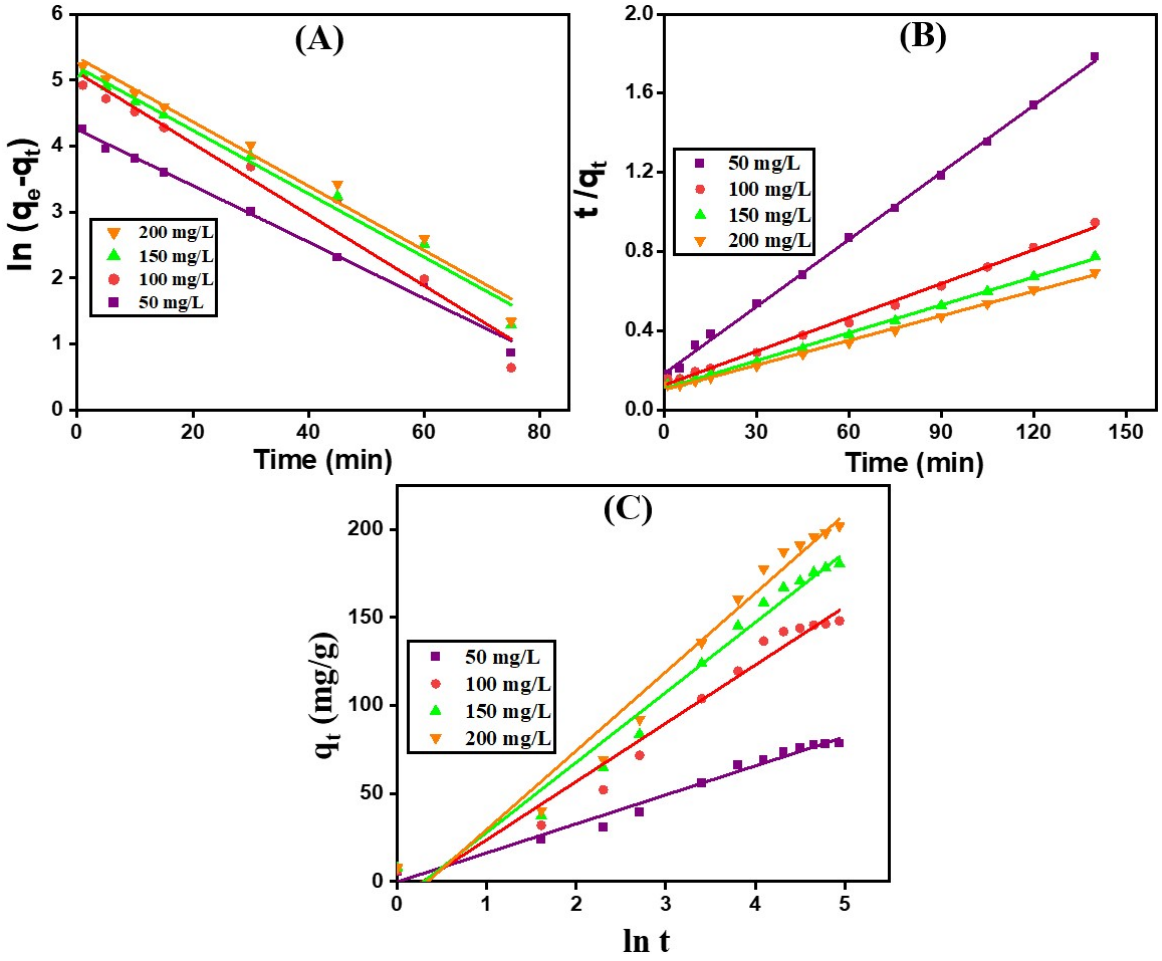

Fig.S3 kinetics studies for the adsorption of Pb(II) ions by Sn-BDC MOF composite (**A**) Pseudo-First-order, **(B)** Pseudo-Second-order, and (**C**) Elovich