Supplementary materials

Effective removal of Pb(II) from synthetic wastewater using $Ti_3C_2T_x$ MXene

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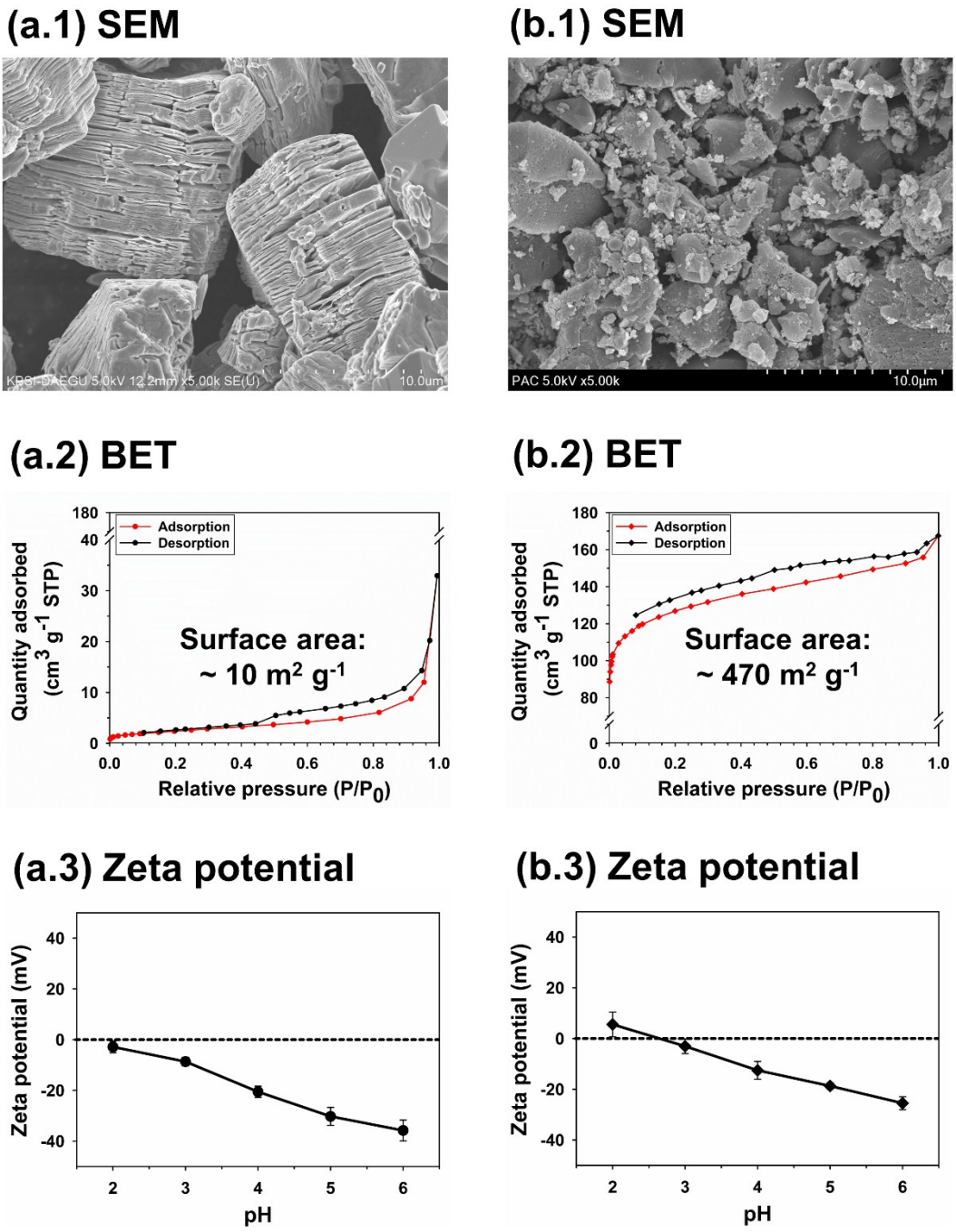


Fig. S1. Various characterizations of (a) MXene and (b) PAC using (1) SEM, (2) BET, and (3) zeta potential.

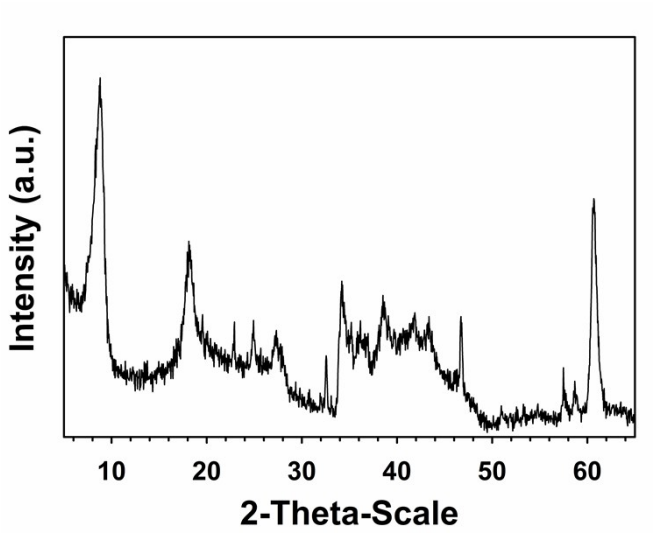


Fig. S2. XRD analysis of MXene to confirm crystallinity.

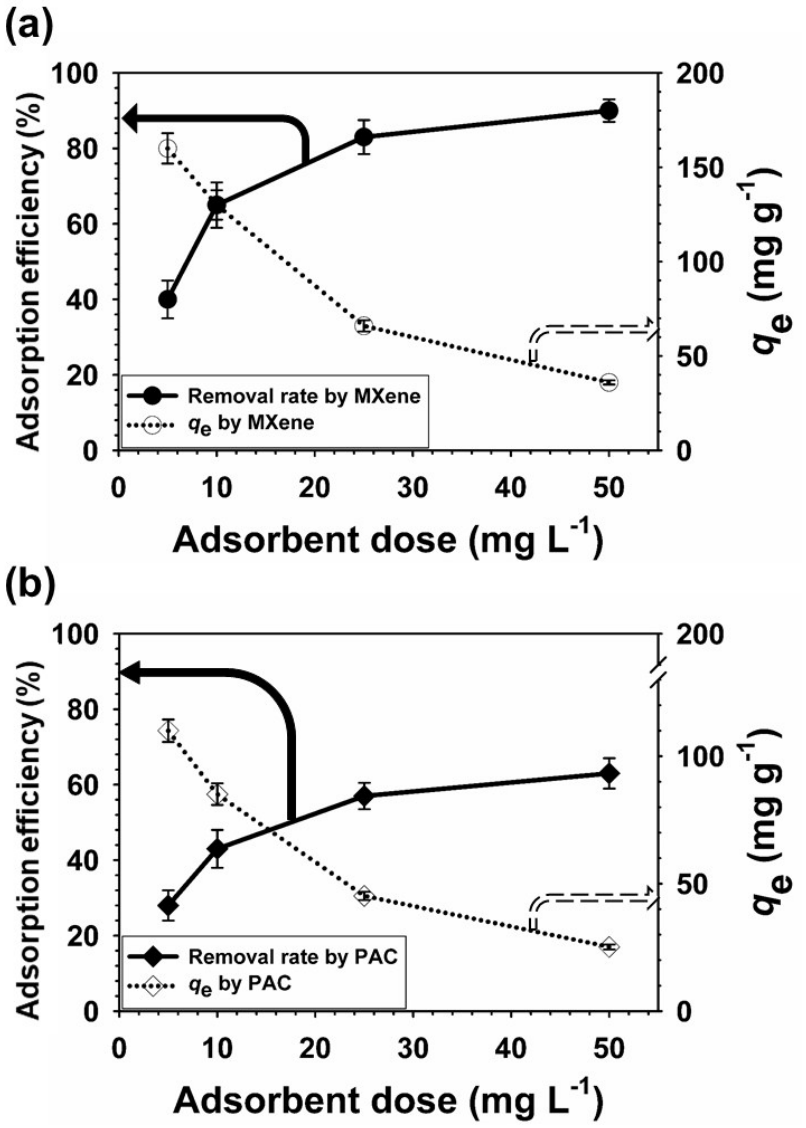


Fig. S3. Influence of (a) MXene and (b) PAC dosage on the q_e and adsorption efficiency of Pb(II) (Conditions: Pb^{2+} concentration = 2 mg L^{-1}; temperature = 293 K; pH = 6; contact time = 2 h).

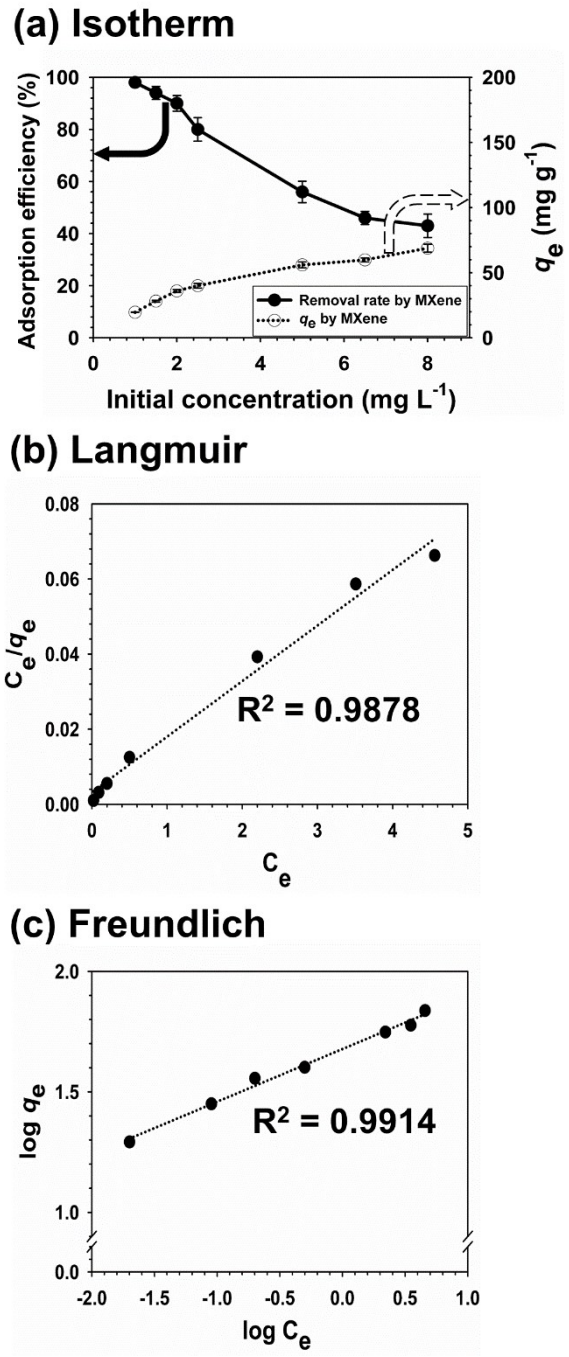
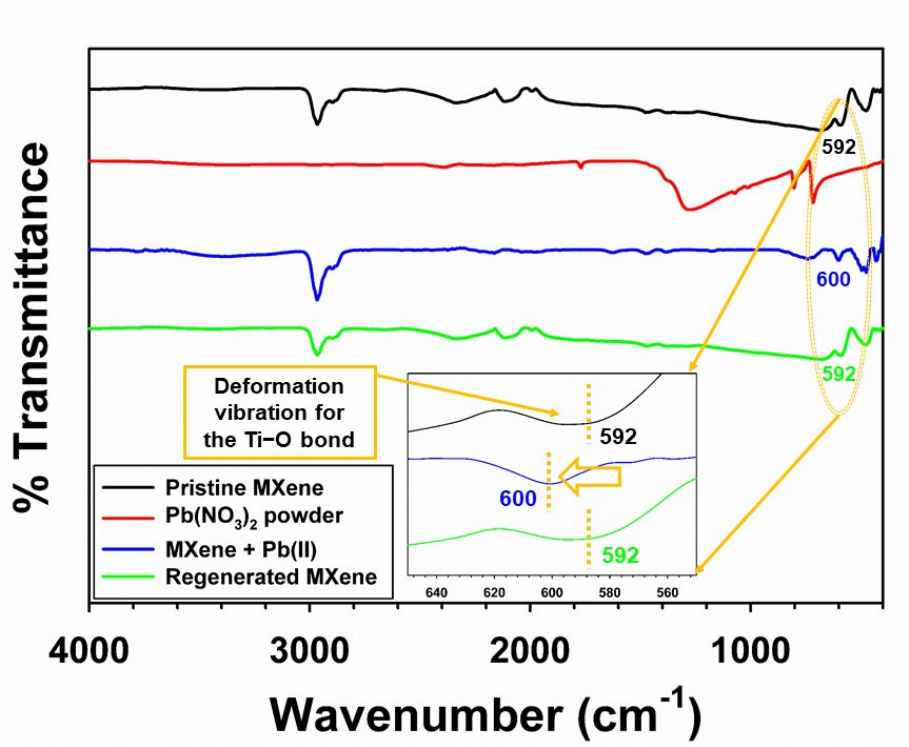


Fig. S4. (a) Influence of initial concentration on the q_e and adsorption efficiency of Pb(II). (b) Langmuir and (c) Freundlich isotherm model to clarify isotherm study of Pb(II) adsorption by MXene (Conditions: MXene dose = 50 mg L^{-1}; Pb^{2+} concentration = 1 to 8 mg L^{-1}; temperature = 293 K; pH = 6; contact time = 2 h).



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42 **Fig. S5**. Confirmation of peak (Ti-O) shift after adsorption of Pb(II) on MXene using FTIR
43 technique.

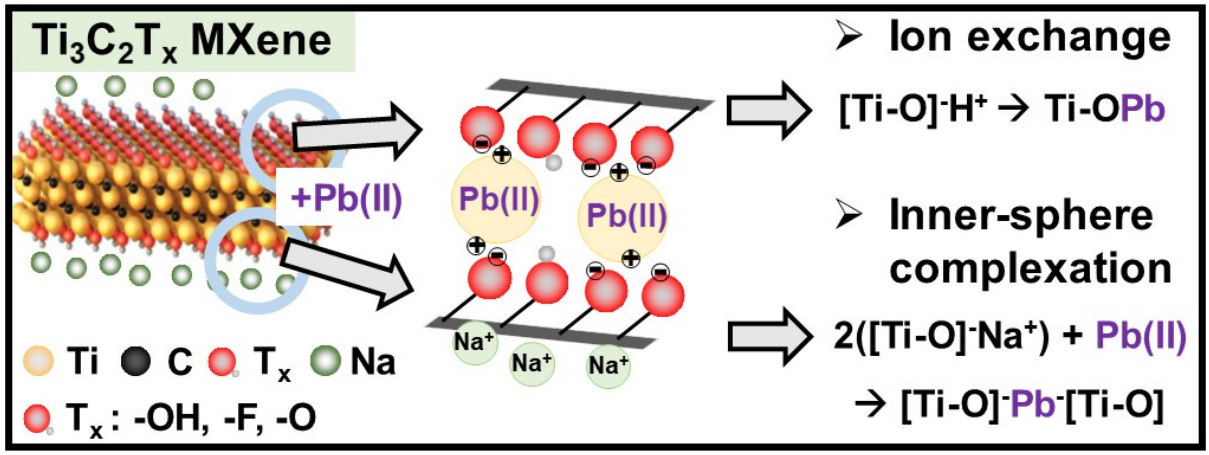

Fig. S6. Schematic diagram related to Pb(II) adsorption mechanism.

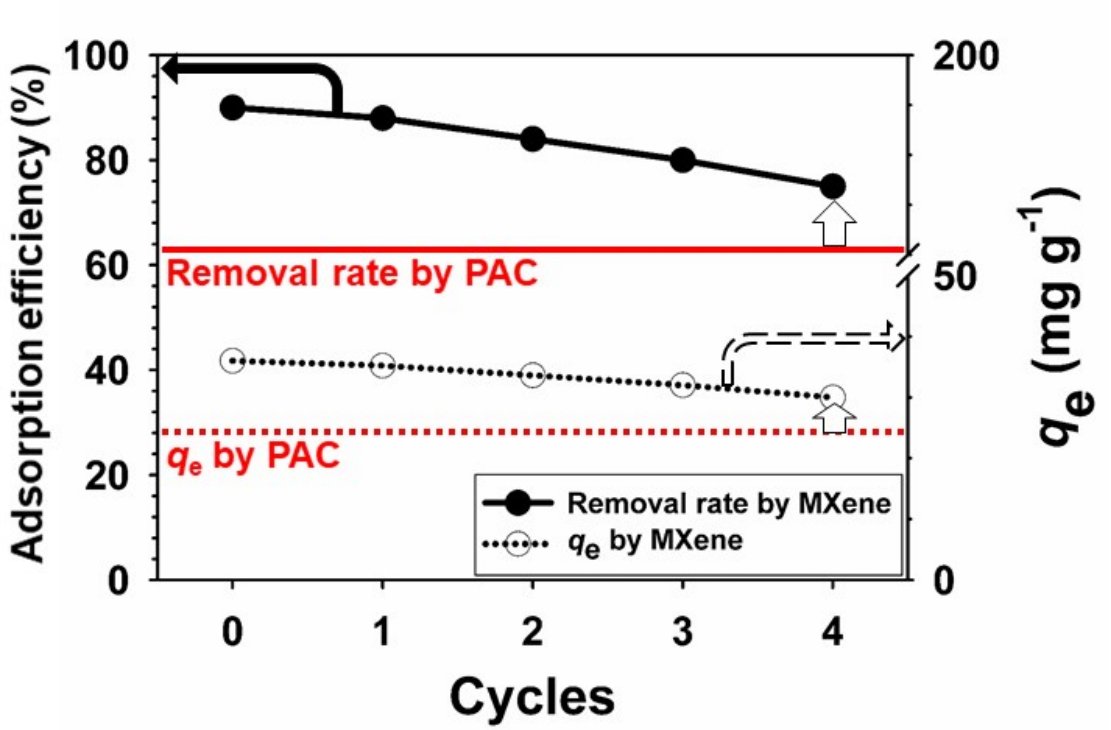

Fig. S7. Confirmation of re-usability for Pb(II) adsorption in four adsorption-desorption cycles (Conditions: MXene dose = 50 mg L^{-1}; Pb^{2+} concentration = 2 mg L^{-1}; temperature = 293 K; pH = 6; contact time = 2 h).

Table S1. Kinetic parameters of Pb(II) adsorption by MXene through four different kinetic models.

Elovich	
a	3.65
b	18.8
R^2	0.521
Intra-particle diffusion	
k_i (mg g $min^{-0.5}$)	0.750
C	26.9
R^2	0.340
Pseudo-first-order	
q_e (mg g^{-1})	3.59
k_1 (min^{-1})	0.0097
R^2	0.473
Pseudo-second-order	
q_e (mg g^{-1})	36.6
k_2 (g mg-min^{-1})	0.0088
R^2	0.999

Table S2. Thermodynamic parameters for Pb(II) adsorption by MXene.

Thermodynamic parameters				
ΔG (kJ mol^{-1}) at different temperature (K)			ΔH (kJ mol^{-1})	ΔS (kJ mol-1 K^{-1})
293	303	313		
-12.65	-13.88	-14.73	17.82	0.10