

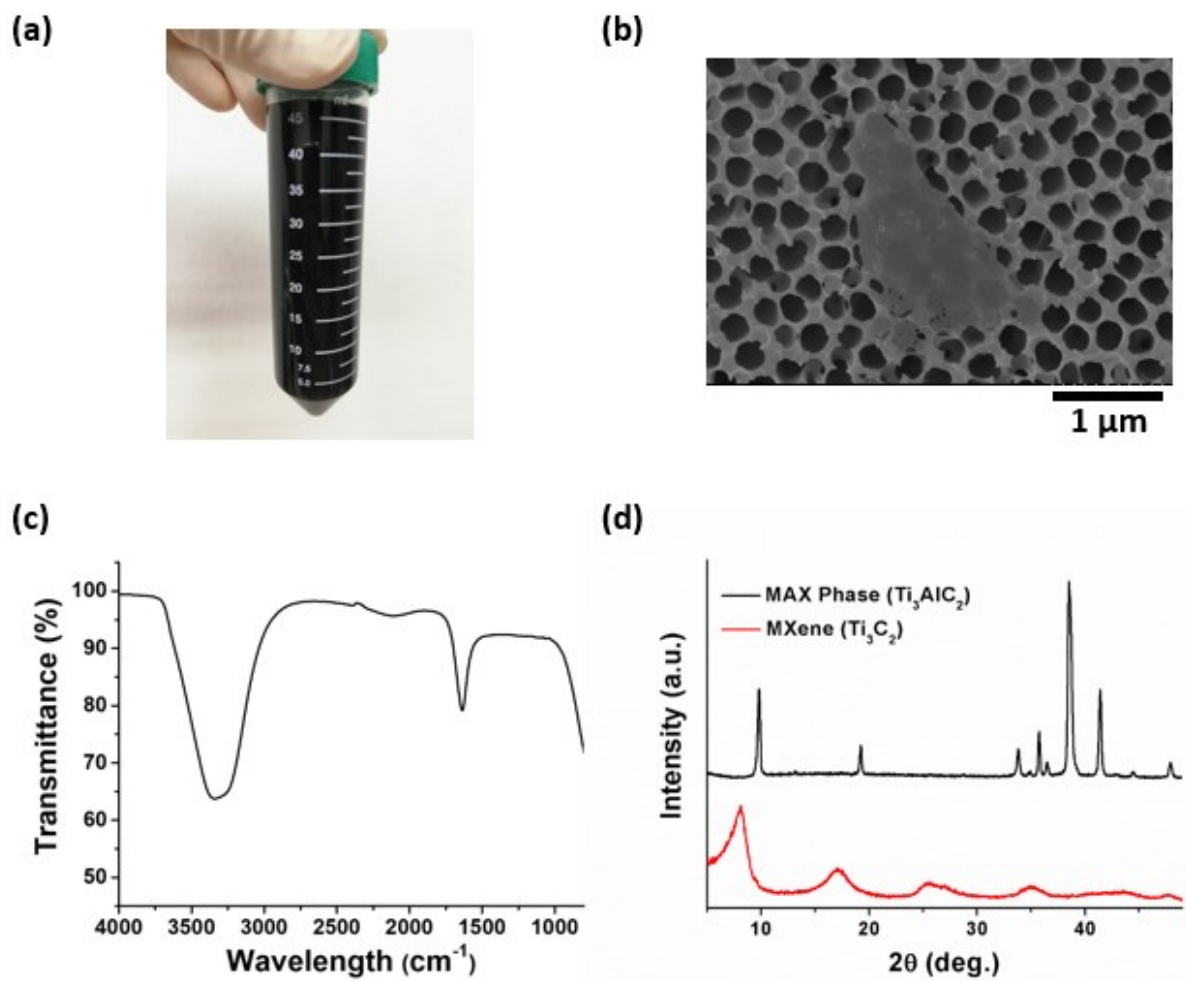
**Polyelectrolyte-grafted  $\text{Ti}_3\text{C}_2$ -MXenes stable in  
extreme salinity aquatic conditions for remediation  
of contaminated subsurface environments  
(Electronic Supplementary Information)**

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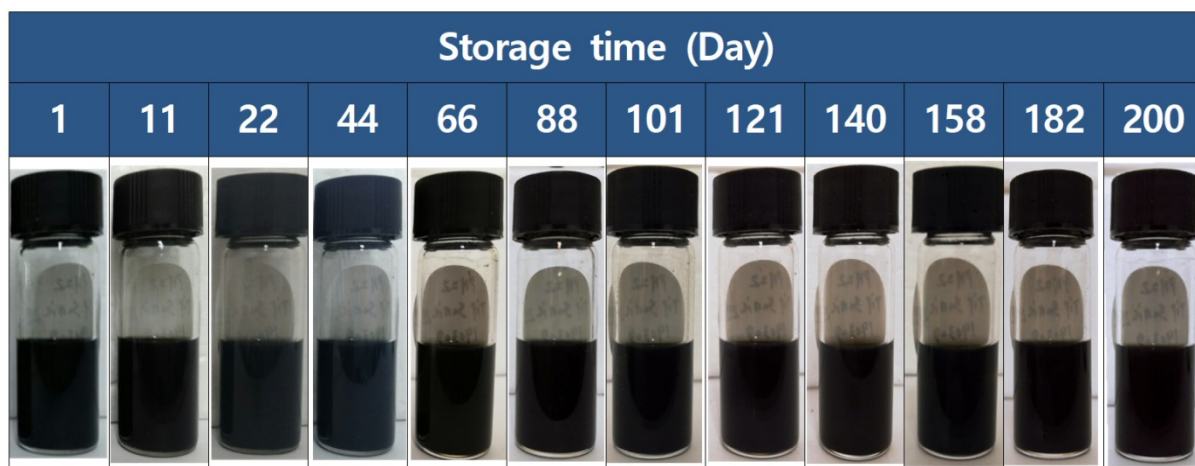
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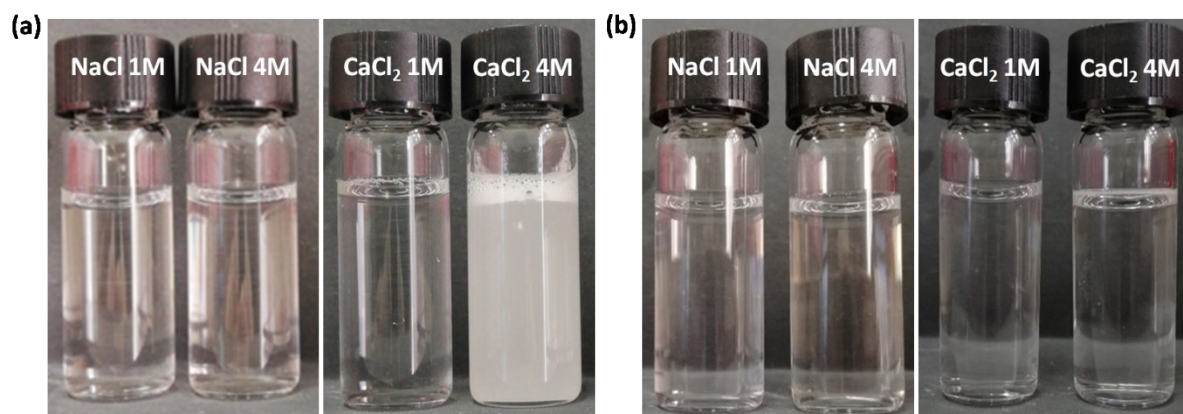
**Figure S1.** (a) The aqueous dispersion of delaminated  $\text{Ti}_3\text{C}_2$ -MXenes. (b) SEM image and (c) FTIR spectra of delaminated  $\text{Ti}_3\text{C}_2$ -MXenes. (d) XRD spectra of  $\text{Ti}_3\text{AlC}_2$ -MAX phase and delaminated  $\text{Ti}_3\text{C}_2$ -MXenes.

Probe sonication	Storage time (Day)						
	1	2	3	4	5	6	7
Not Applied							
Applied							














**Figure S2.** The MXene-*g*-poly(DMAPS-*co*-AA) in API brine, prepared with (lower) or without (upper) applied probe-sonication.



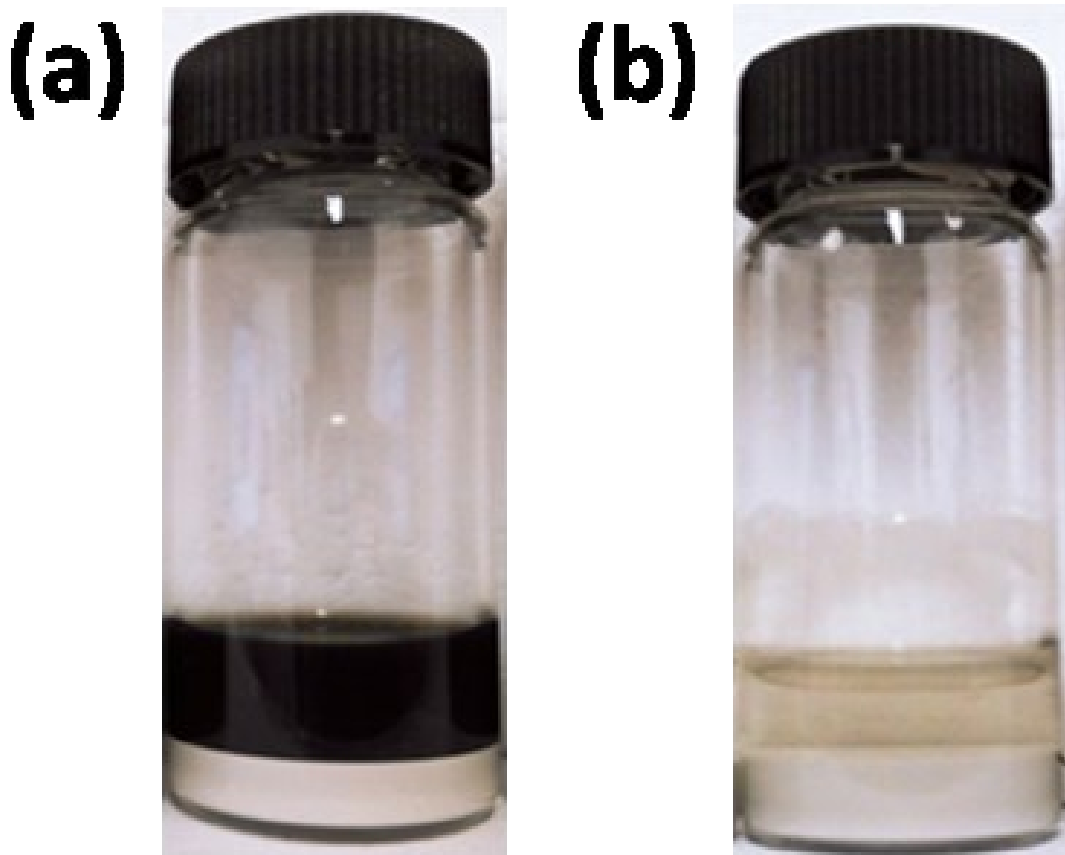
**Figure S3.** Long-term colloidal stability of the MXene-g-poly(DMAPS-co-AA) in API brine.



**Figure S4.** Phase behavior of the (a) poly(AMPS-co-AA) and (b) poly(DMAPS-co-AA) in high-salinity NaCl and CaCl<sub>2</sub> solutions, at the salt concentration ( $C_s$ ) of  $C_s = 1$  M and 4 M.

MXene- <i>g</i> -PE	Storage time (Day)												
	1	6	11	16	22	28	35	38	42	45	50	57	66
MXene- <i>g</i> -poly(AMPS- <i>co</i> -AA)													

**Figure S5.** Long-term colloidal stability of the MXene-*g*-poly(AMPS-*co*-AA), with the grafted poly(AMPS-*co*-AA) of a high  $M_w$  (1,219,631 g mol<sup>-1</sup>) in API brine.

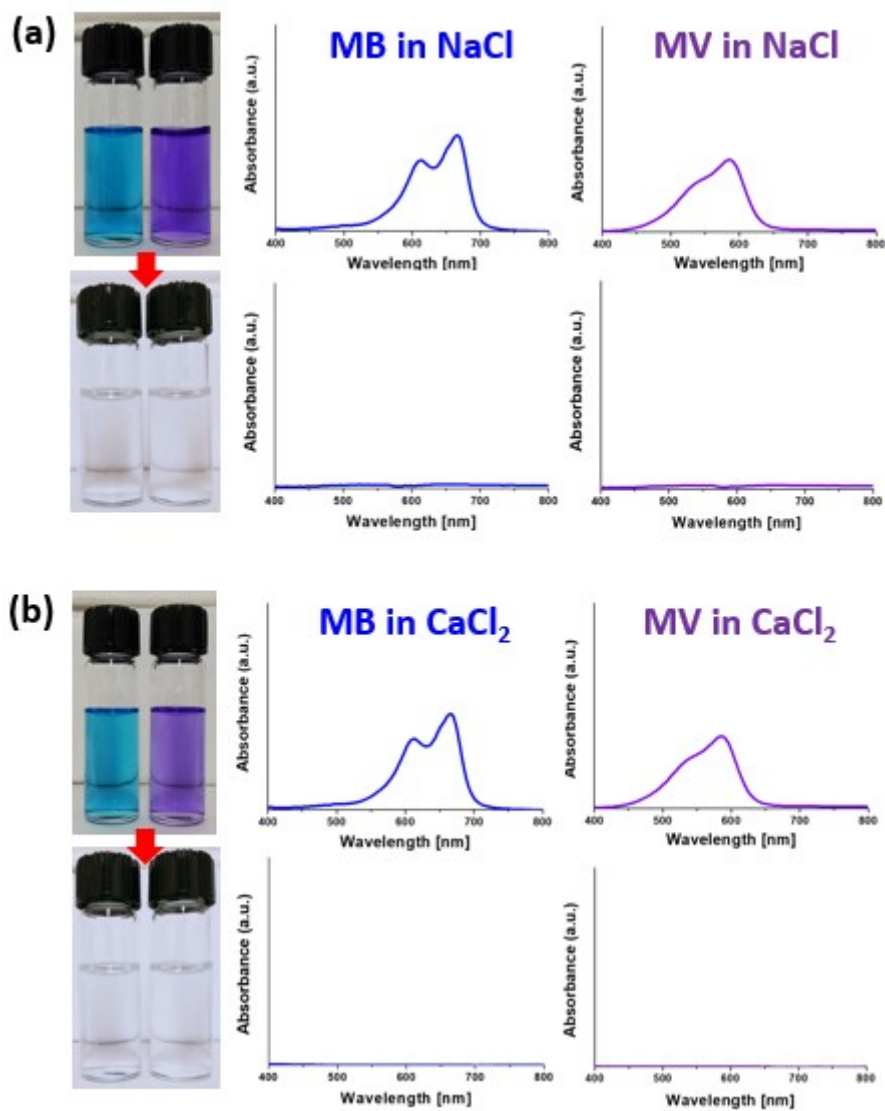


**Figure S6.** Adsorption of the MXene-*g*-poly(AMPS-*co*-AA), with the grafted poly(AMPS-*co*-AA) of a high  $M_w$  ( $1,219,631 \text{ g mol}^{-1}$ ) onto 4 g of  $\leq 10 \mu\text{m}$   $\alpha\text{-Al}_2\text{O}_3$  (BET surface area of  $2.32 \text{ m}^2 \text{ g}^{-1}$ ) in (a) DI water and (b) API brine.

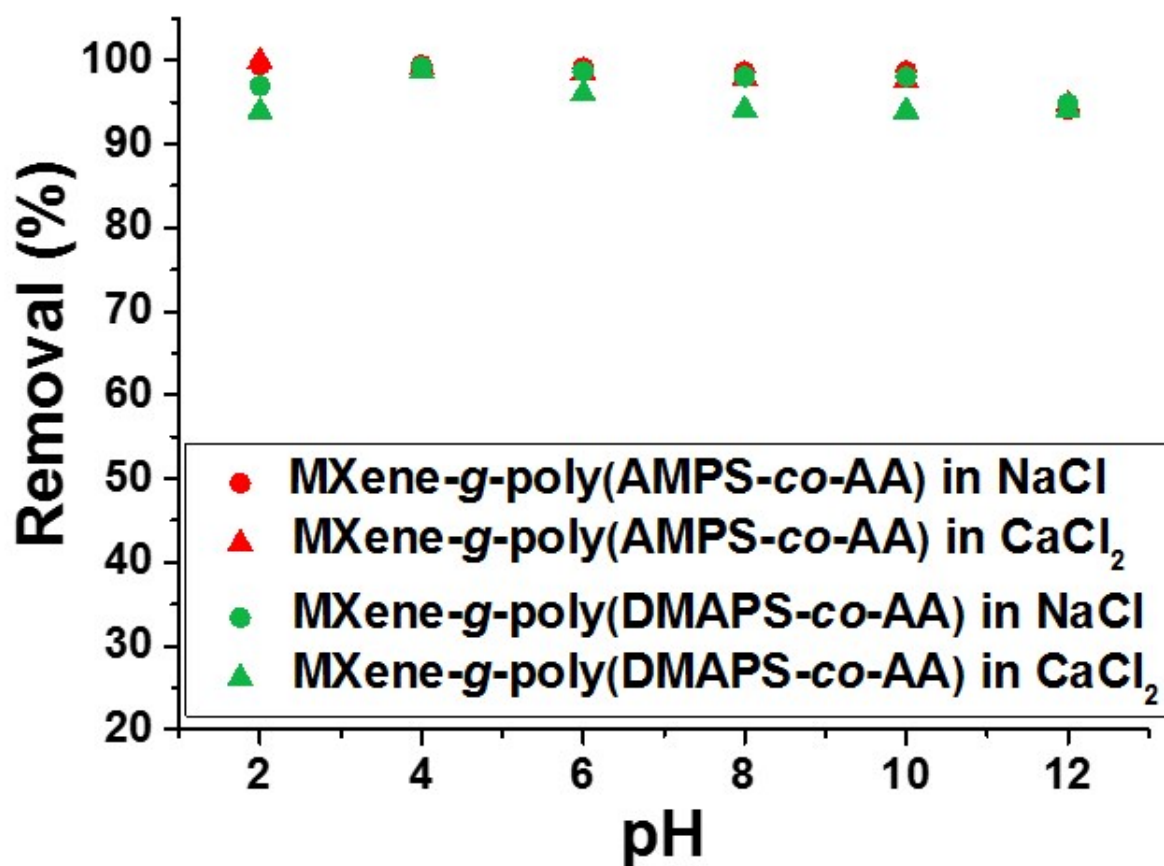


**Figure S7.** Adsorption of the MXenes physically (*not* covalently) grafted with poly(DMAPS-*co*-AA) onto 4 g of  $\leq 10\mu\text{m}$   $\alpha\text{-Al}_2\text{O}_3$  (BET surface area of  $2.32\text{ m}^2\text{ g}^{-1}$ ) in API brine.

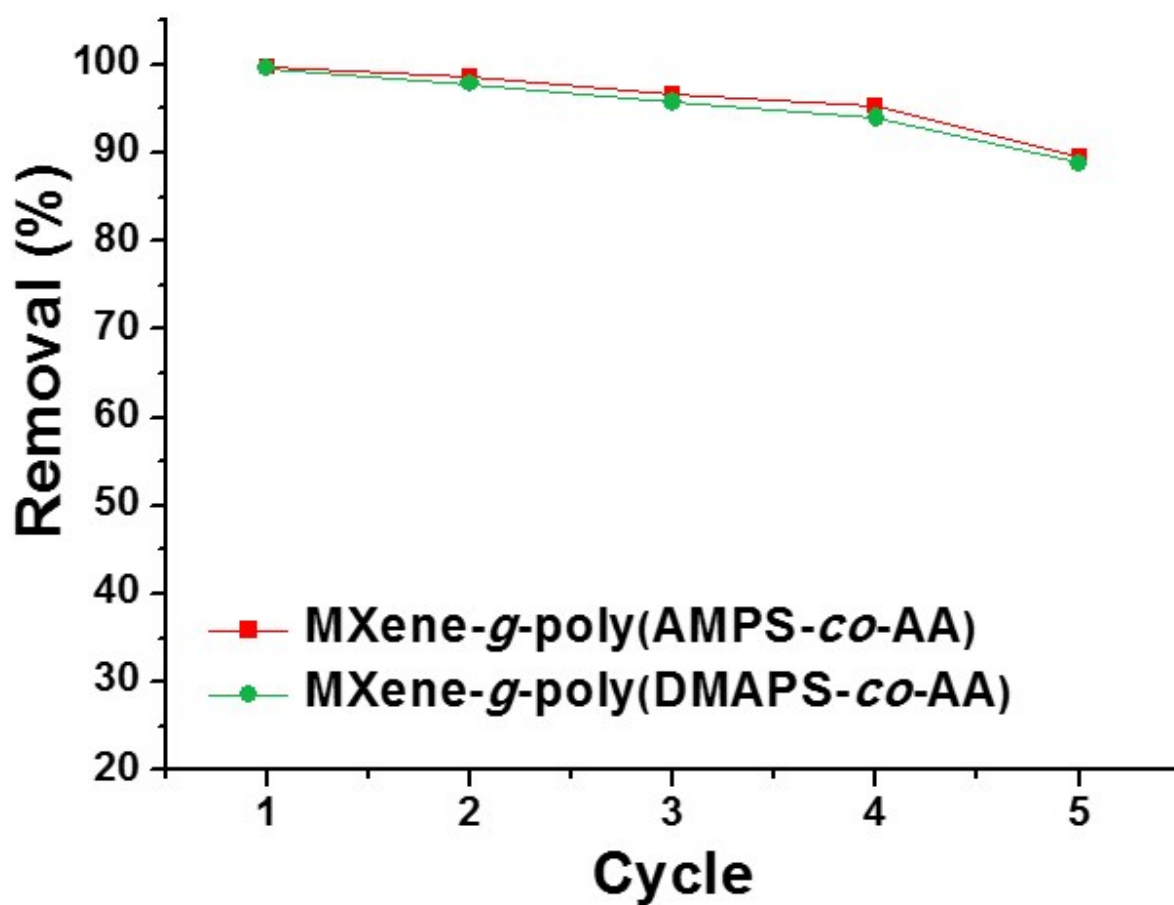




**Figure S8.** The removal of ~5 ppm of MB or MV by the MXene-*g*-poly(AMPS-*co*-AA) in (a) ~0.3 M NaCl and (b) ~0.3 M CaCl<sub>2</sub> solutions, demonstrated by photo images and UV-vis spectroscopy.



**Figure S9.** The MB removal efficiencies of the MXene-g-poly(AMPS-co-AA) (red) and MXene-g-poly(DMAPS-co-AA) (green) investigated for ~0.3 M NaCl (circles) and ~0.3M CaCl<sub>2</sub> solution (triangles) with different pH values (2 – 12) contaminated with ~5 ppm of MB.



**Figure S10.** The MB removal efficiencies of the MXene-g-poly(AMPS-co-AA) (red squares) and MXene-g-poly(DMAPS-co-AA) (green circles) during five repeated tests performed on  $\sim 0.3$  M  $\text{CaCl}_2$  solutions (pH = 8) contaminated with  $\sim 5$  ppm of MB.