Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Effect of phase separation and adsorbed water on power consumption and current efficiency of terpolymer conetwork-based anion exchange membrane

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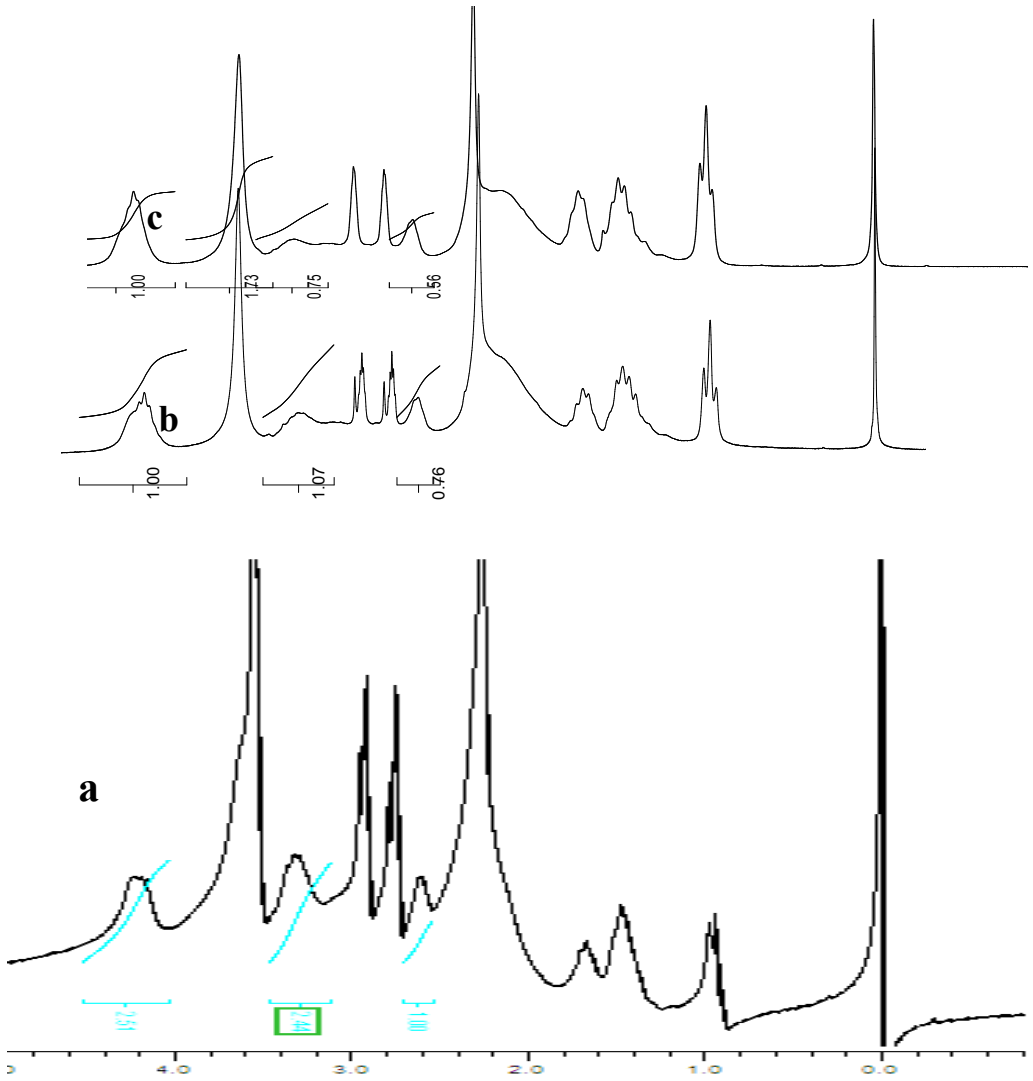

Fig. S1 ^{1}H NMR spectra of (a) PAN-co-PnBA-co-PDMA-2, (b) PAN-co-PnBA-co-PDMA-3 and (c) PAN-co-PnBA-co-PDMA-4 copolymers.

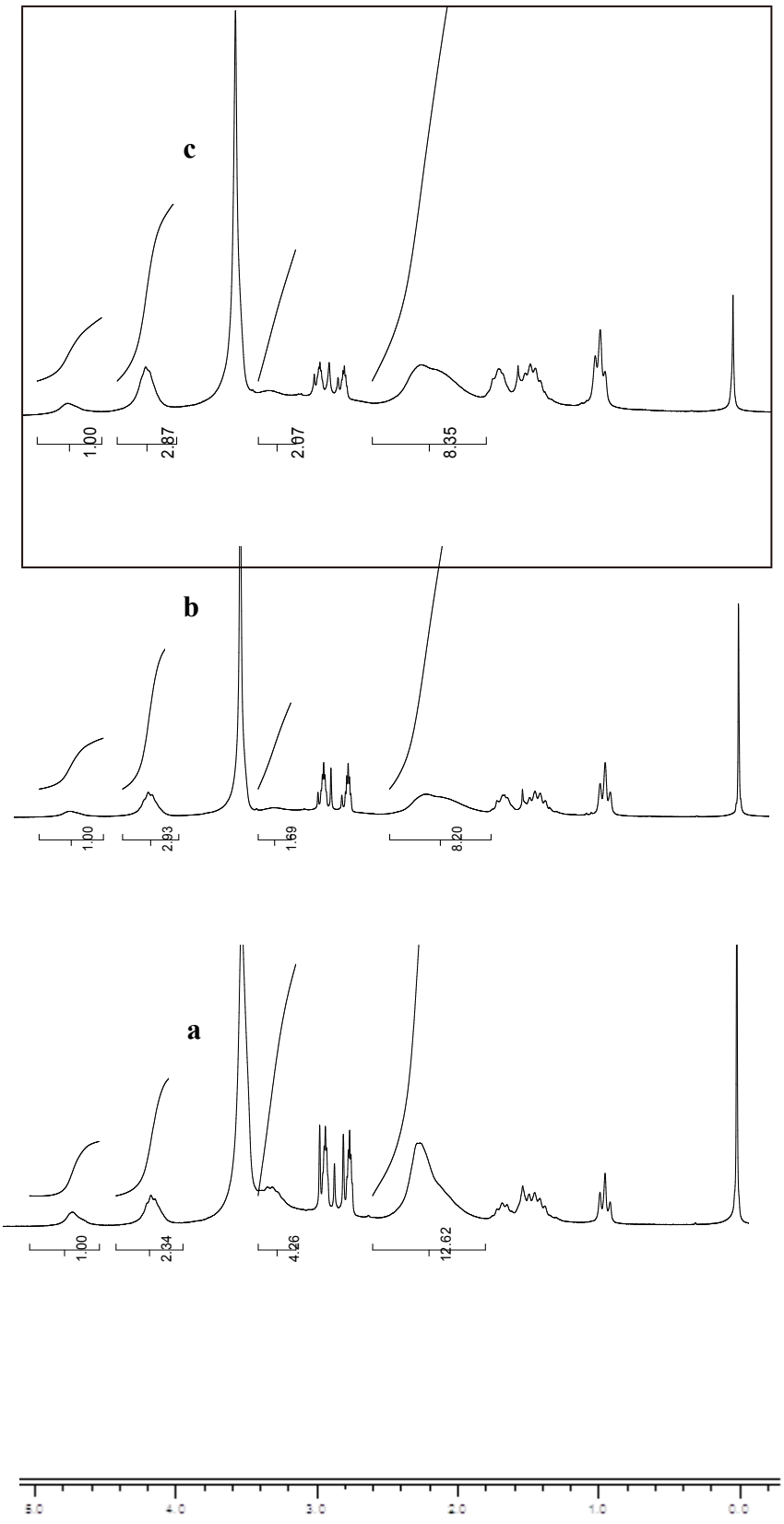

Fig. S2 ^{1}H NMR spectra of (a) PAN-co-PnBA-co-QPDMA-2, (b) PAN-co-PnBA-co-QPDMA-3 and (c) PAN-co-PnBA-co-QPDMA-4 copolymers.

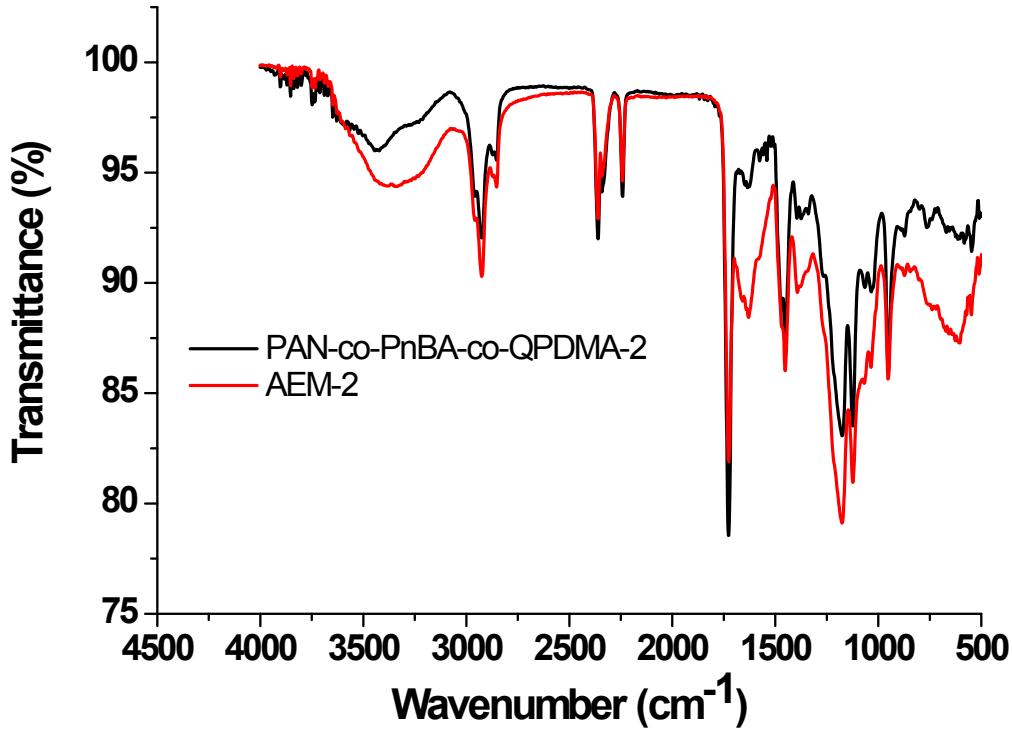

Fig. S3 ATR-IR spectra of PAN-co-PnBA-co-QPDMA-2 copolymer and corresponding AEM-2.

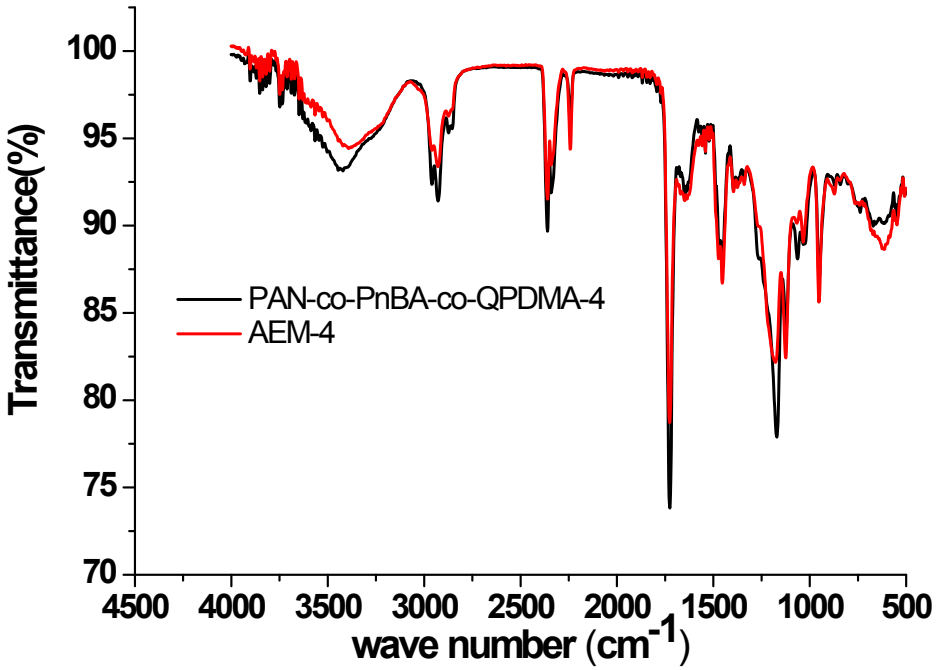

Fig. S4 ATR-IR spectra of PAN-co-PnBA-co-QPDMA-4 copolymer and corresponding AEM-4.

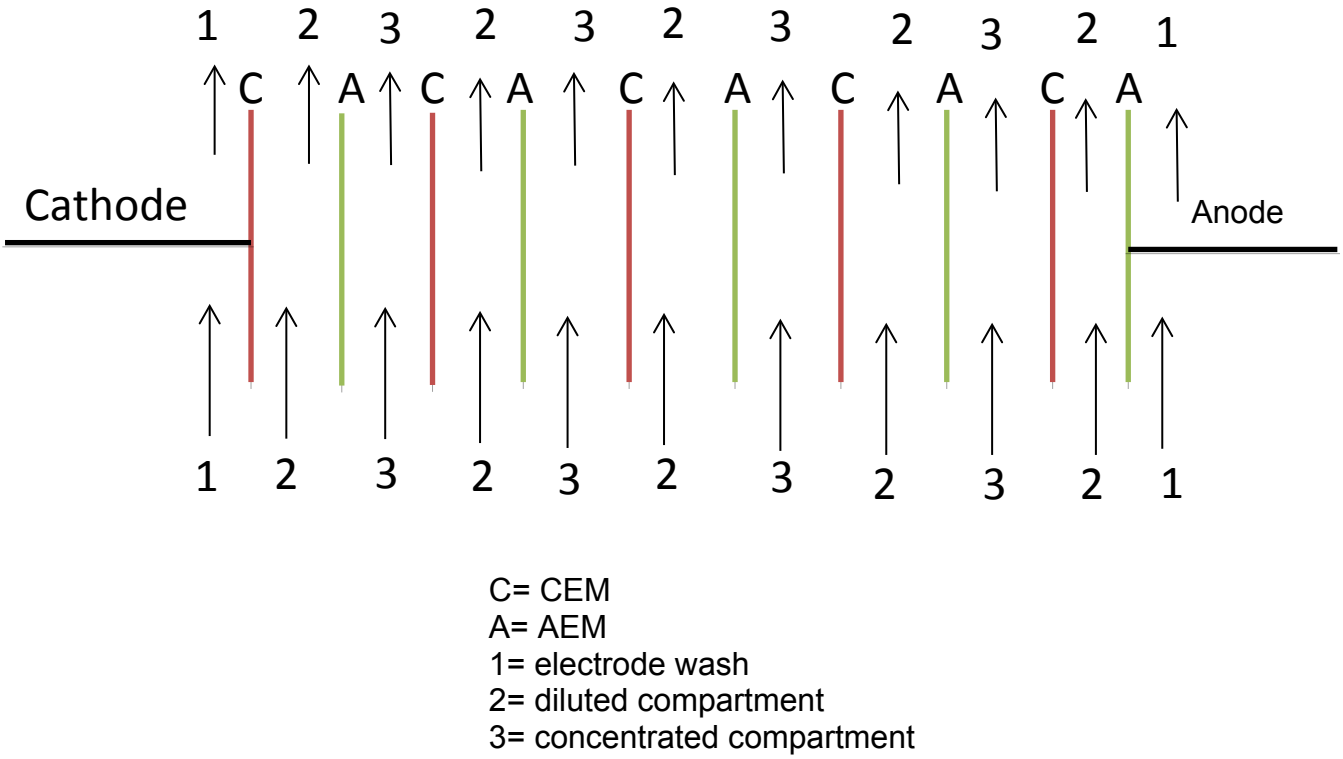

Fig. S5 Schematic diagram of ED unit.

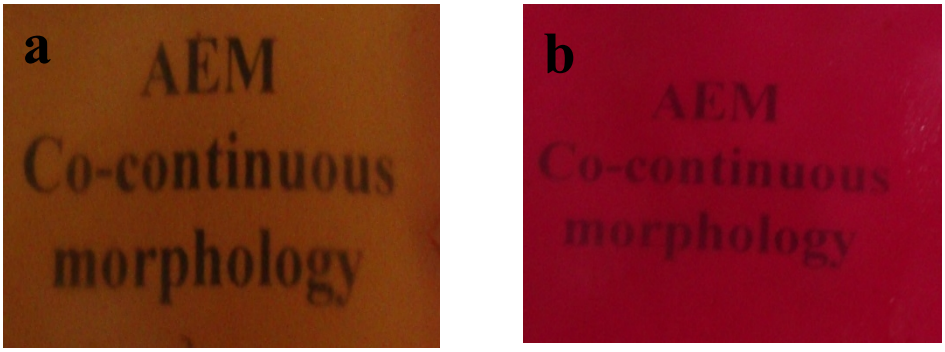

Fig. S6 Photographs of (a) AEM-2 in water wet state and (b) Rose Bengal dye adsorbed AEM-2 in water wet state.

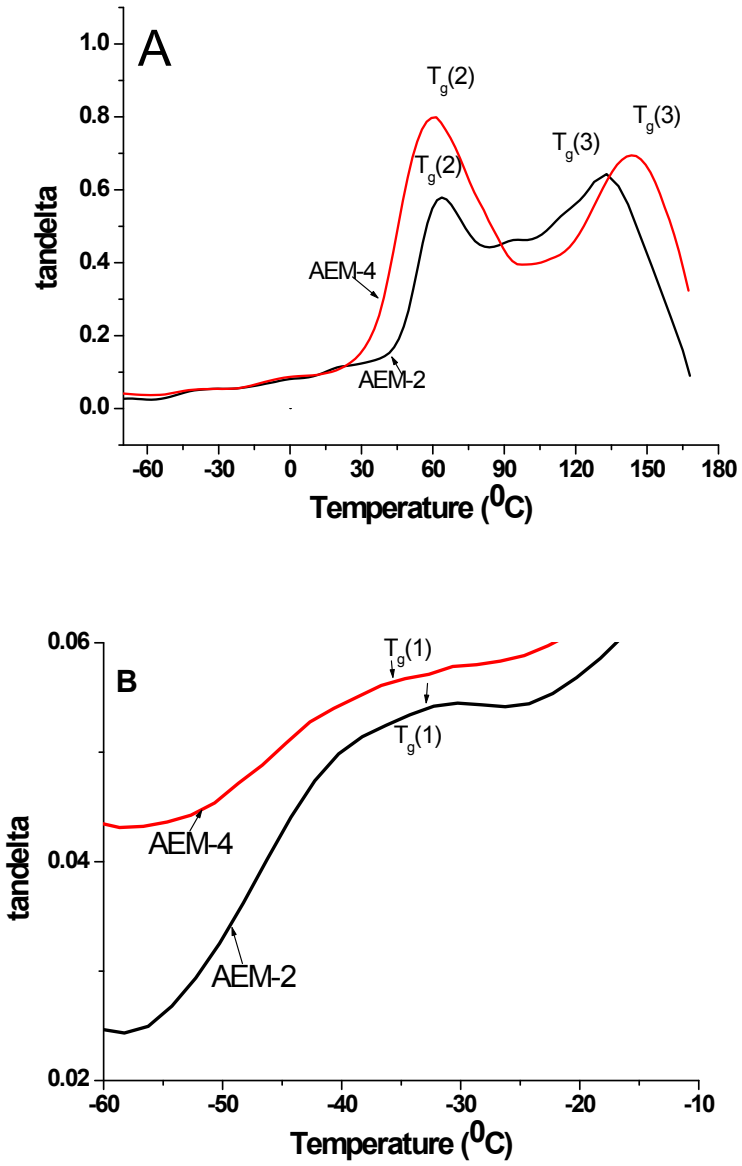

Fig. S7 (A) Tan delta vs temp plots for AEM-2 and AEM-4 and (B) tan delta vs temp plots in enlarged scale from -60^{0}C to -10^{0}C for AEM-2 and AEM-4.

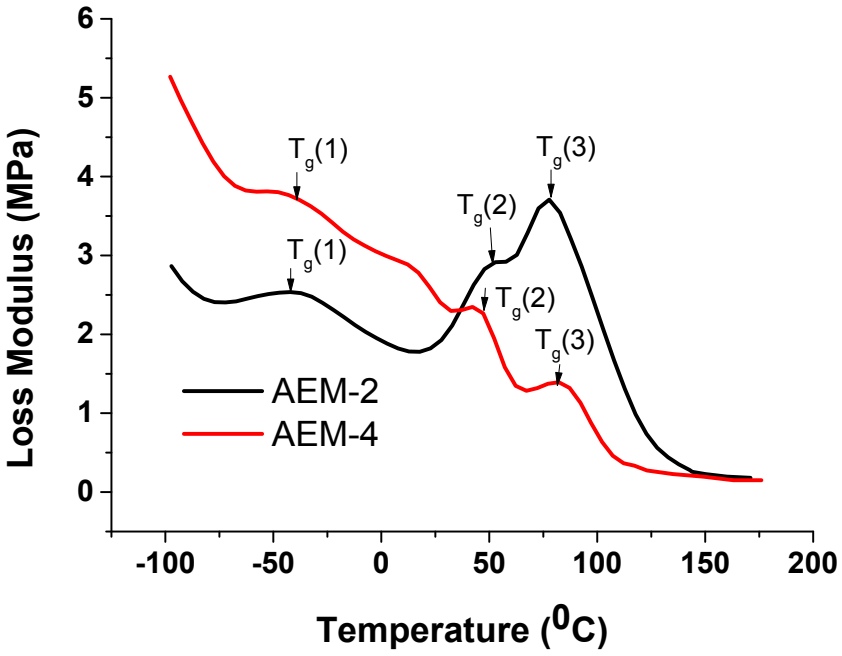

Fig. S8 Loss modulus vs temperature plots of AEM-2 and AEM-4 after subjected to extraction with DMF for 3 days.

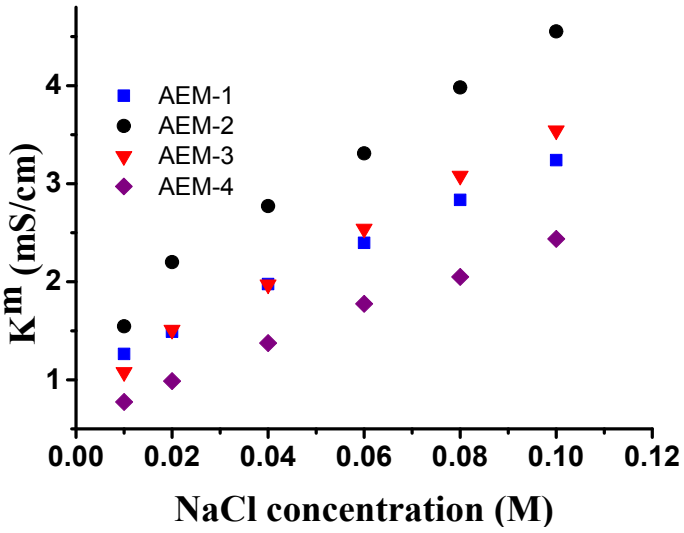

Fig. S9 K^m vs NaCl concentration plots for AEM-1, AEM-2, AEM-3 and AEM-4.

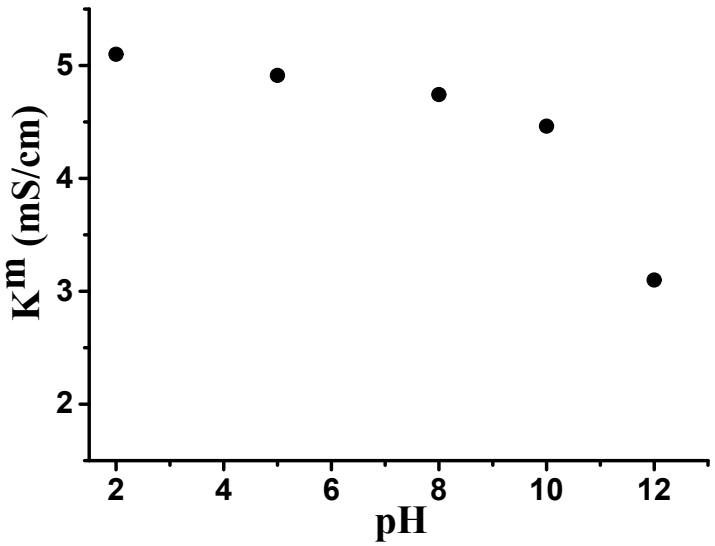

Fig. S10 Change of K^m of AEM-2 after subjected to expose in water (containing NaCl 2000 mg/L) at different pH for 24h at room temperature.

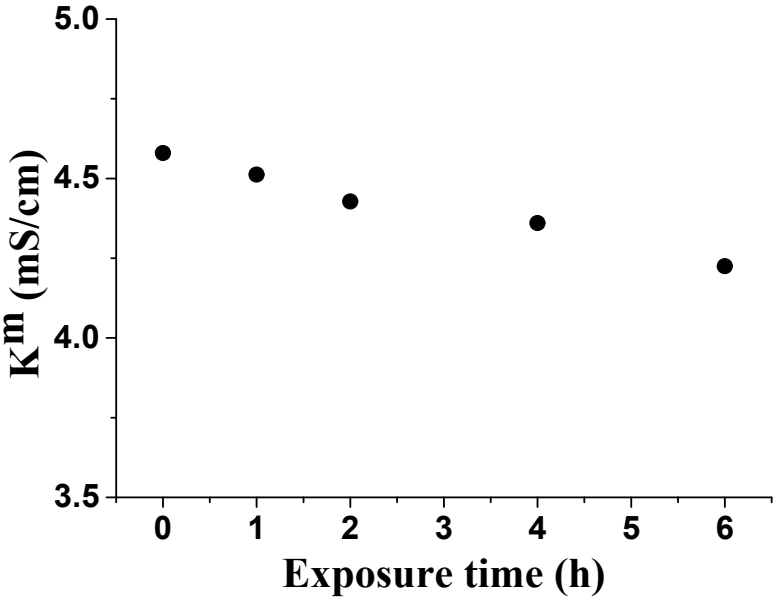

Fig. S11 Change of K^m of AEM-2 with different exposure time in water (containing NaCl concentration 2000 mg/L) at temperature 55 ^{0}C .

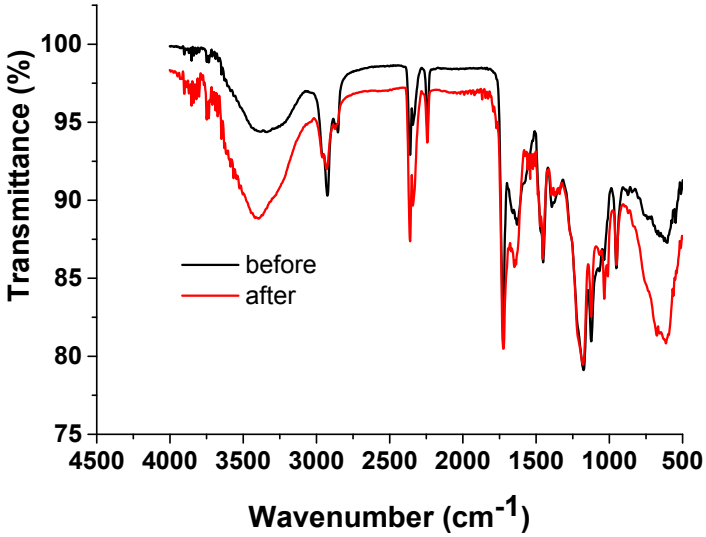

Fig. S12 ATR-IR spectra of AEM-2 taken before and after subjected exposure with Fenton's reagent at 80^0C for 10h.

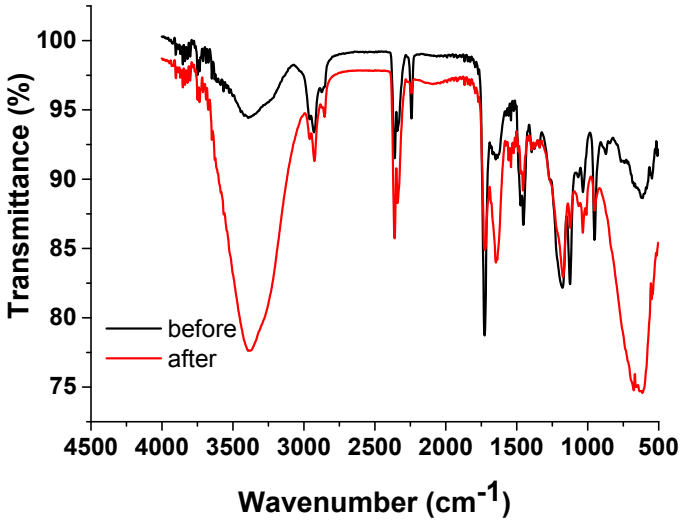

Fig. S13 ATR-IR spectra of AEM-4 taken before and after subjected to exposure with Fenton's reagent at 80 ^{0}C for 10 h.

Table S1. Water uptake, W and CE values of different membranes reported in the literatures.

Entry	Type of AEM	Water uptake (%)	W ($KWhKg^{-1}$)	CE (%)	Reference (main text)
1	PE/PSt interpolymer	15	0.808	85.4	15
2	PVC/PSt heterogeneous	12	0.784	87.9	15
3	PVA-PVP	28.6	4.29	80	19
4	PVA/PAN-co-PDMA	22-36	10.29-8.90	80.14-92.64	21
5	PE/PSt interpolymer	-	5.38	60.5	18
6	FAB from FumaTech GmbH, Germany	-	2.13	57	17
7	PVA/ VTMS-co-PDMA	35.3-55.5	6.01-4.77	70.5-78.4	20
8	PAN-co-PDMA-a	19	1.15	80	23
9	PAN-co-PDMA-b	30	1.32	72	23

Table S2. Summary of W, CE and J values of different AEMs evaluated during desalination of water (NaCl concentration 5000mg/L) by ED at different applied potential.

Type of membrane	W ($KWhKg^{-1}$)		CE (%)		$(JX10^4)Kg/m^2sec$	
	1.5 volts/cell pair	2 volts/cell pair	1.5 volts/cell pair	2 volts/cell pair	1.5 volts/cell pair	2 volts/cell pair
AEM-1	1.25	1.34	65	71	1.55	2.95
AEM-2	0.73	0.99	88	92	1.75	3.2
AEM-3	1.28	1.39	63	69	1.53	2.92
PAN-co-PDMA-a[23]	1.07	1.35	65	68	1.60	2.09
PAN-co-PDMA-b[23]	1.23	1.53	58	61	1.51	1.92
IONSEP-HC-A (commercial)	1.02	1.28	69	88	1.65	2.85

Table S3. Physical and electrochemical properties of AEM-R1 and AEM-R2.

Membrane	Water Uptake (%)	IEC (meq g^{-1})	t^-	K^m (mS/cm)
AEM-R1	17	1.50	0.91	4.60
AEM-R2	37	1.57	0.87	4.87

Table S4: W and CE values evaluated with AEM-R1 during desalination of water (NaCl concentration 2000 mg/L) by ED at different applied potential.

Applied volts/cell pair	W ($KWhKg^{-1}$)	CE(%)
1.5	0.67	91
2.0	0.98	93

Table S5. Change of K^m, weight and IEC of AEM-1 to AEM-4 after exposure with Fentons reagent at 80^0C for 10 h.

Membranes	K_m loss (%)	Weight loss (%)	IEC loss (%)
AEM-1	9.8	8.8	3.5
AEM-2	8.0	7.6	2.9
AEM-3	5.3	6.1	2.1
AEM-4	4.9	5.7	1.9
PAN-co-PDMA-a[23]	14	12	6