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

Supporting information

Bio-inspired fabrication of high perm-selectivity and anti-fouling membranes based on zwitterionic polyelectrolyte nanoparticles

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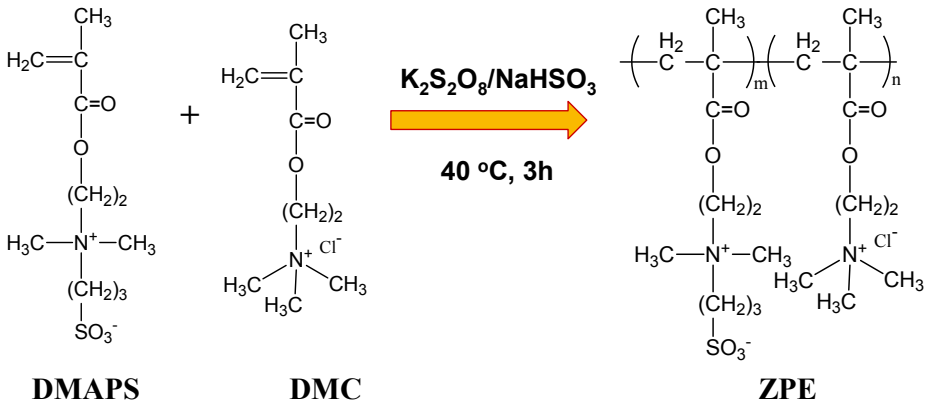


Fig. S1 Schematic diagram for preparing zwitterionic polyelectrolyte, ZPE.

Table S1 Chemical composition of ZPE characterized with XPS.

Polyelectrolyte	C(1s)	N(1s)	O(1s)	S(2p)	[a]S/C	DMAPS mol%
ZPE0	73.56	9.02	17.42	0	0	0
ZPE1	74.79	5.02	17.59	2.59	0.0346	33.5
ZPE2	73.00	8.08	15.75	3.17	0.0434	42.8
ZPE3	69.06	5.55	20.93	4.47	0.0647	66.9

[a]S/C: molar ratio of sulfur to carbon in ZPE copolymers.

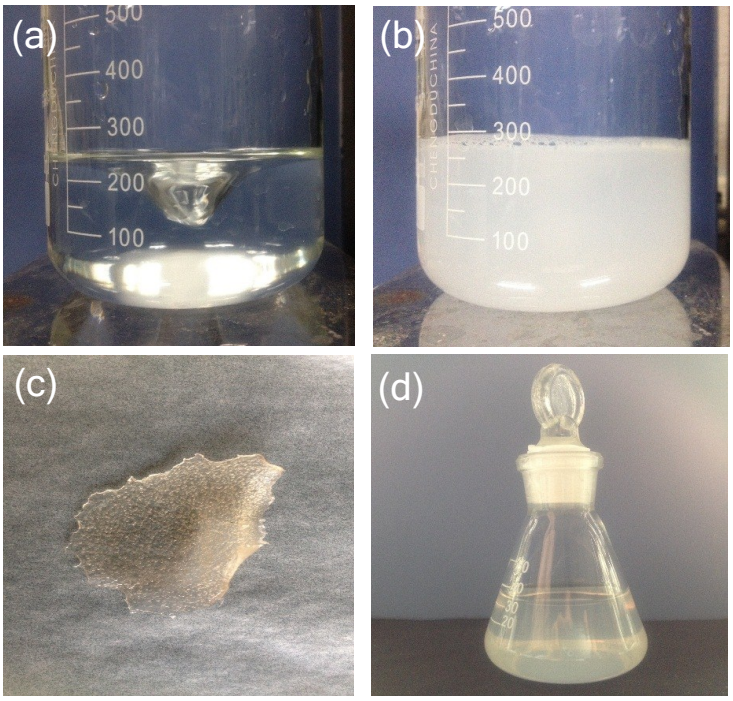


Fig. S2 Photographs of (a) aqueous CMCNa solution, (b) aqueous mixture of CMCNa and ZPE3, (c) ZPNP3 solid, and (d) 0.1 wt% aqueous ZPNP3 solution (pH = 12.0).

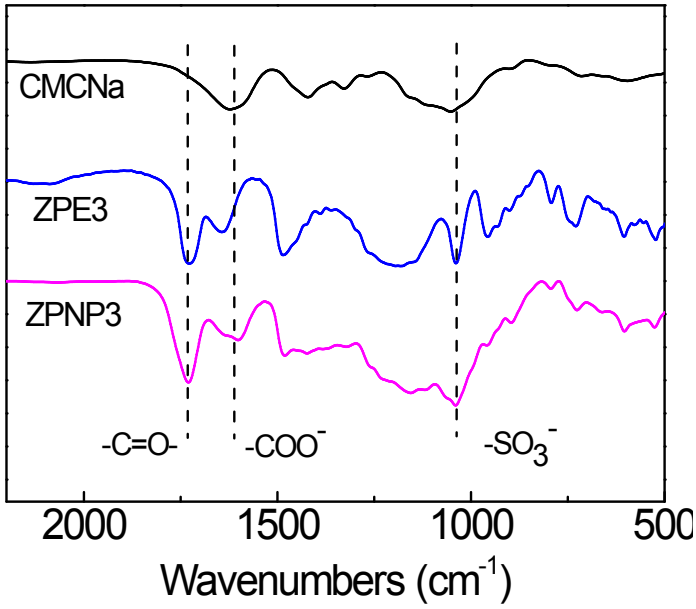


Fig. S3 FTIR spectra of CMCNa, ZPE3, and ZPNP3.

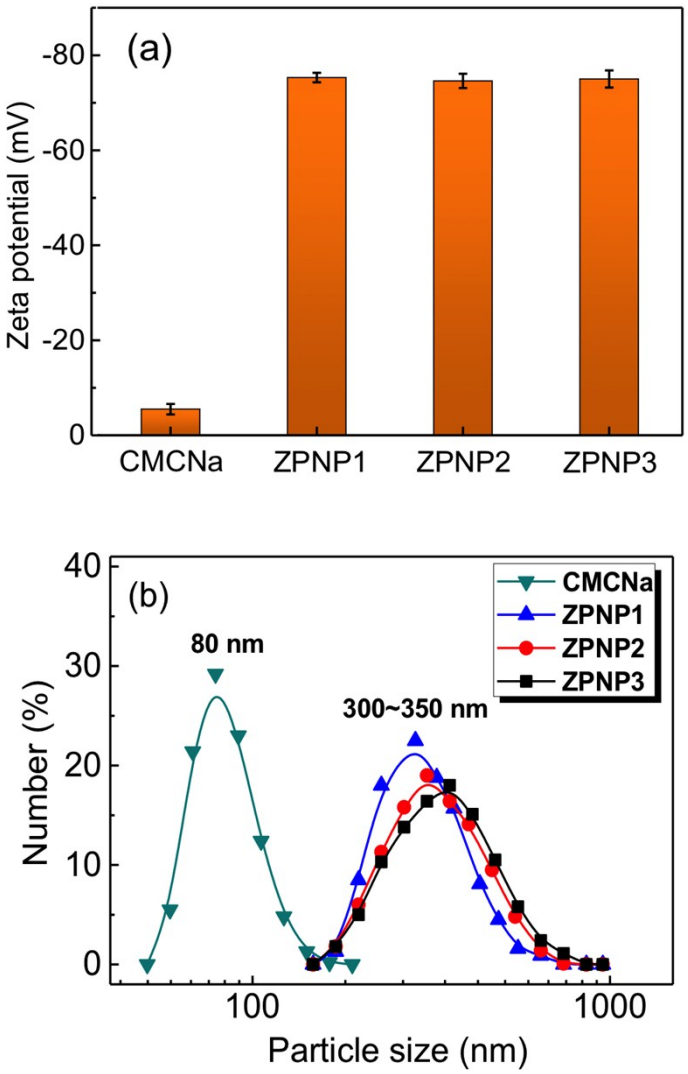
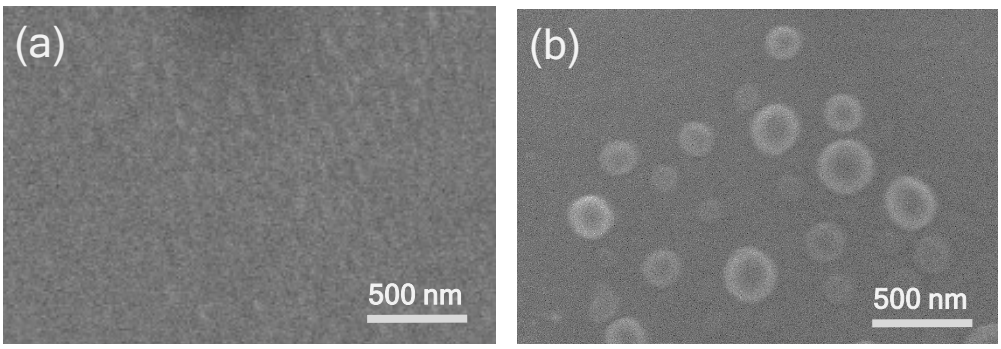


Fig. S4 (a) Zeta potential, and (b) particle size distribution of CMCNa, ZPNP1, ZPNP2, and ZPNP3 in 0.01 wt% aqueous solution at 25 °C.



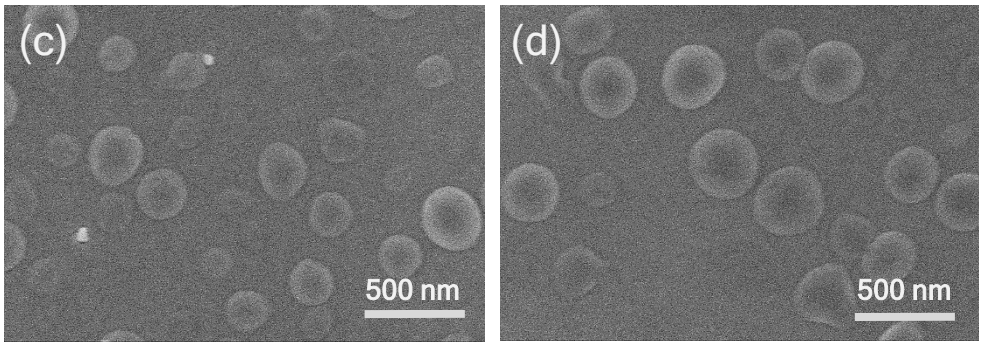


Fig. S5 FESEM morphology of (a) CMCNa, (b) ZPNP1, (c) ZPNP2, and (d) ZPNP3 in 0.005 wt% dispersion self-assembled on silicon wafers at 25 ^{o}C.

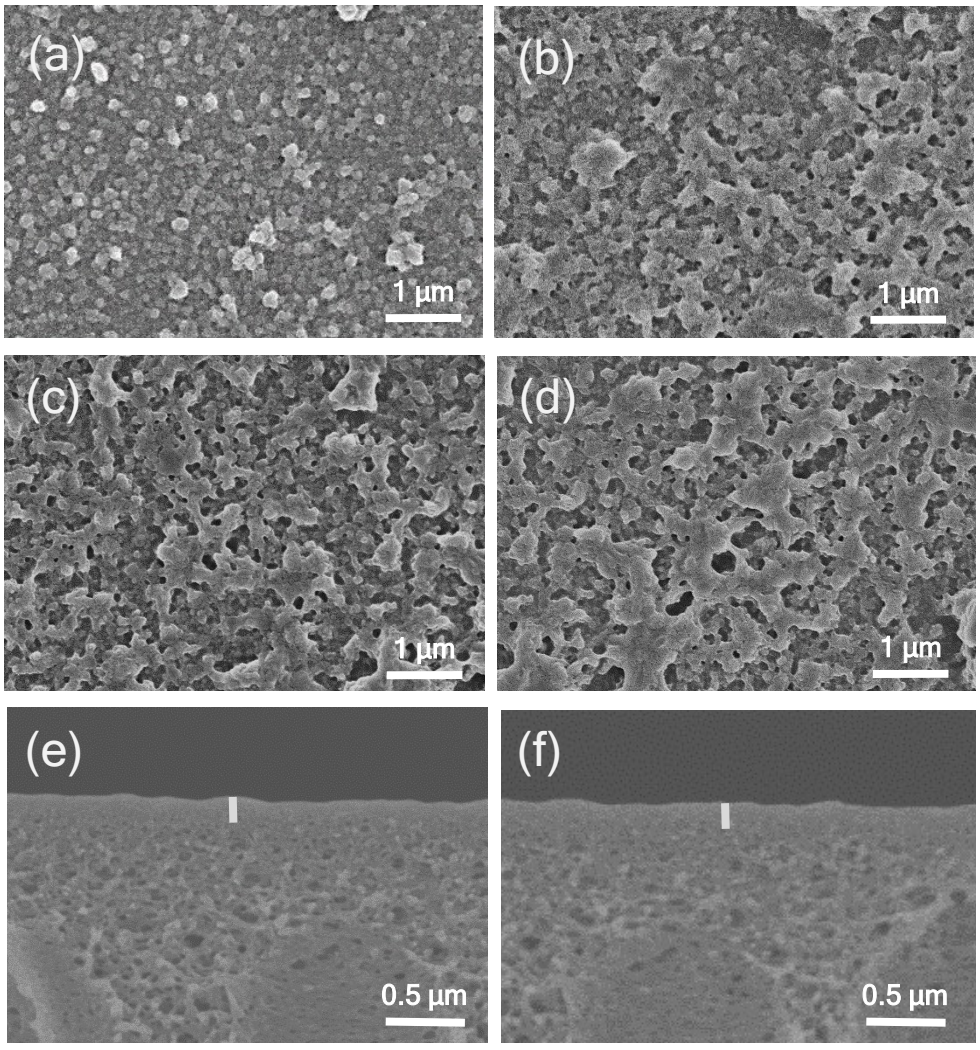


Fig. S6 Surface SEM morphology of (a) TFC, (b) TFN-ZPNP1, (c) TFN-ZPNP2, and (d) TFN-ZPNP3 membranes; cross-sectional SEM morphology of (e) TFC and (f) TFN-ZPNP3 membranes.

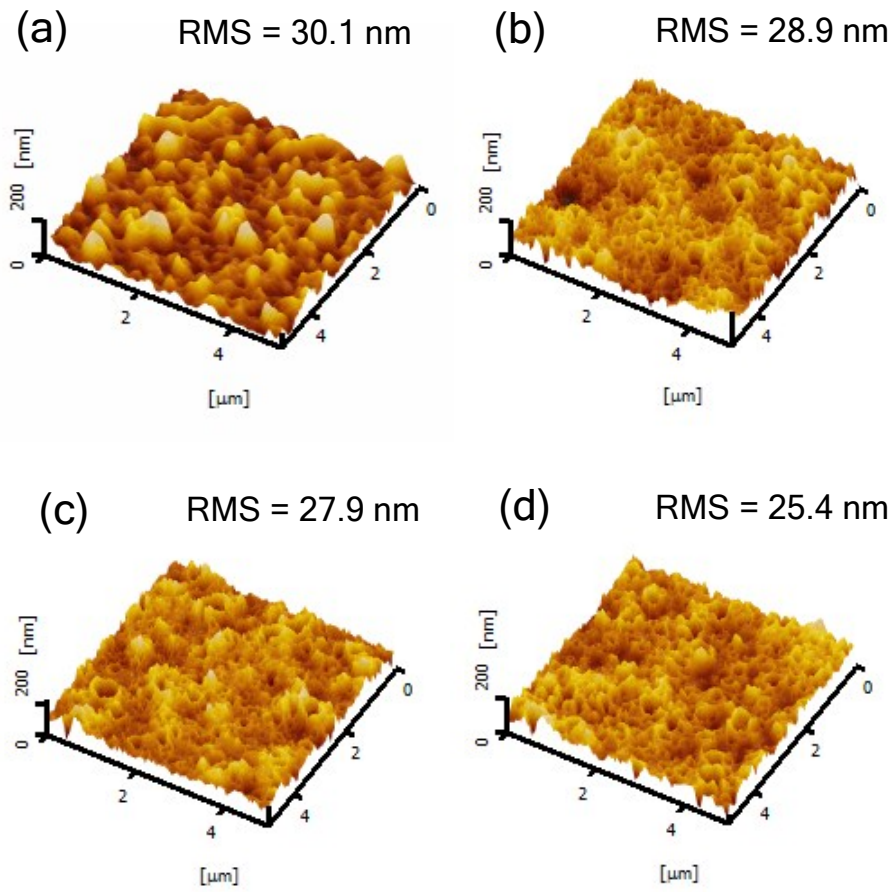


Fig. S7 Surface AFM morphologies of (a) TFC, (b) TFN-ZPNP1, (c) TFN-ZPNP2, and (d) TFN-ZPNP3 membranes.

Table S2 Chemical composition of TFC and TFN-ZPNP membranes characterized with XPS.

Membrane	C (%)	N (%)	O (%)	[a]C/N
TFC	76.6	14.21	9.18	5.39
TFN-ZPNP1	76.66	12.95	10.39	5.92
TFN-ZPNP2	76.94	12.94	10.12	5.95
TFN-ZPNP3	77.02	12.93	10.05	5.96

[a]C/N: molar ratio of carbon to nitrogen in TFC and TFN-ZPNP membranes.

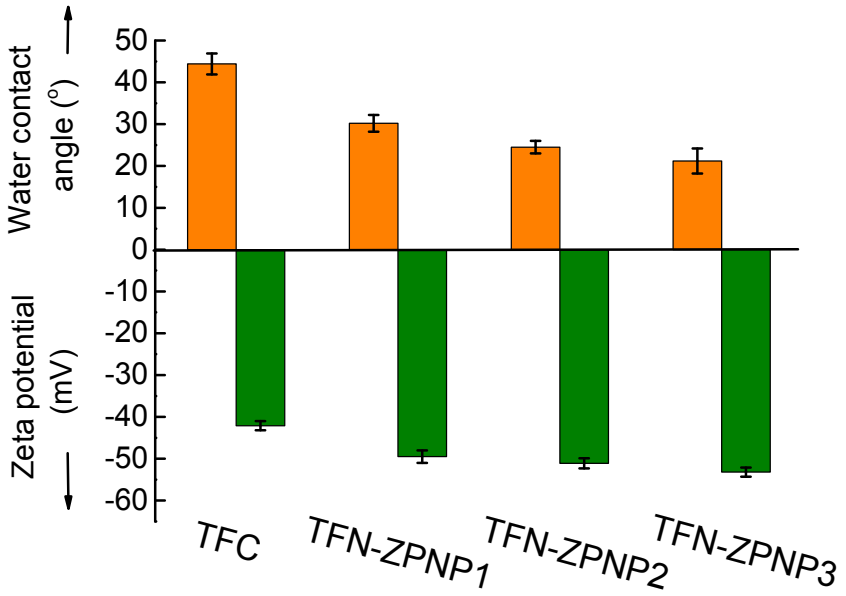


Fig. S8 Water contact angle and zeta potential of TFC and TFN-ZPNP membranes.

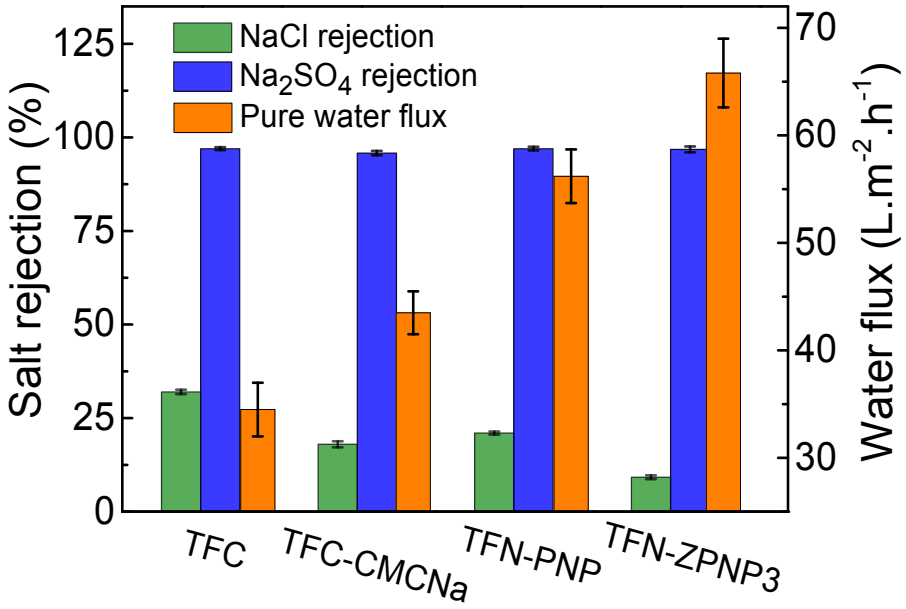


Fig. S9 Separation performance of TFC, TFC-CMCNa, TFN-PNP, and TFN-ZPNP3 membranes tested with pure water and 1g.L^{-1} aqueous Na_2SO_4 and NaCl solutions (pH = 7.0) at 25 °C and 0.6 MPa.

Table S3 Comparison of mono/divalent salt selectivity and water permeability of different polyamide membranes in the literature and this work.

Membranes	Salt selectivity	Water permeability ($L.m^{-2}.h^{-1}.MPa^{-1}$)	Testing condition	Ref.
TFN-ZPNP3	28.4	109.7	1.0 $g.L^{-1}$ Na_2SO_4 / NaCl solution 0.6 MPa, 25 ^oC.	This work
TFC	22.7	57.5	1.0 $g.L^{-1}$ Na_2SO_4 / NaCl solution 0.6 MPa, 25 ^oC.	This work
PIP/ TMC	6.5	35.0	2.0 $g.L^{-1}$ $MgSO_4$ / NaCl solution 0.3 MPa, 25 ^oC.	1
PPD/ TMC	5.4	16.0	2.0 $g.L^{-1}$ $MgSO_4$ / NaCl solution 0.3 MPa, 25 ^oC.	1
PIP-AEPPS/ TMC	24.6	75.8	1.0 $g.L^{-1}$ Na_2SO_4 / NaCl solution 0.6 MPa, 25 ^oC.	2
PIP-mMSN/ TMC	3.5	40.5	0.8 $g.L^{-1}$ Na_2SO_4 / NaCl solution 0.6 MPa, 25 ^oC.	3
PAMAM/SiO_2-TMC	12.5	24.0	1.0 $g.L^{-1}$ Na_2SO_4 / NaCl solution 0.5 MPa, 25 ^oC.	4
TEOA-MWCNT/ TMC	-	7.8	0.8 $g.L^{-1}$ Na_2SO_4 solution 0.6 MPa, 25 ^oC.	5
MPD-HOMCs/TMC	5.2	4.6	2.0 $g.L^{-1}$ Na_2SO_4 / NaCl solution 1.4 MPa, 23 ^oC.	6
MPD-GO/TMC	4.0	14.7	2.0 $g.L^{-1}$ $MgSO_4$ / NaCl solution 1.5 MPa, 15 ^oC.	7
Desal-5	12.5	47.1	1.0 $g.L^{-1}$ $MgSO_4$ / NaCl solution 1.0 MPa, 25 ^oC.	8
UTC-60	15.0	47.3	1.0 $g.L^{-1}$ $MgSO_4$ / NaCl solution 1.0 MPa, 25 ^oC.	8
NS-300	13.6	49.3	5.0 $g.L^{-1}$ Na_2SO_4 / 1.0 $g.L^{-1}$ NaCl solution 1.4 MPa, 25 ^oC.	9
NF-40	11.0	43.0	1.0 $g.L^{-1}$ $MgSO_4$ / NaCl solution 1.0 MPa, 25 ^oC.	9
NF-70	15.0	71.7	1.0 $g.L^{-1}$ $MgSO_4$ / NaCl solution 0.6 MPa, 25 ^oC.	10
NTR-7250	25.0	62.5	1.0 $g.L^{-1}$ $MgSO_4$ / NaCl solution 1.0 MPa, 25 ^oC.	8
NTR-7450	6.1	92.0	1.0 $g.L^{-1}$ Na_2SO_4 / NaCl solution 1.0 MPa, 25 ^oC.	10

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