

CO₂-responsive low molecular weight polymer with high osmotic pressure as a draw solute for forward osmosis

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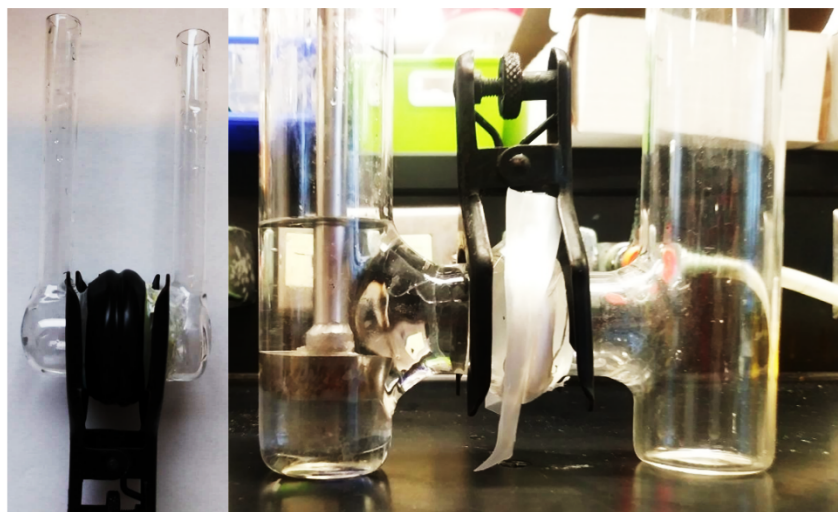


Figure S1. Glassware apparatus used to measure the flux of PDMAAm solutions.

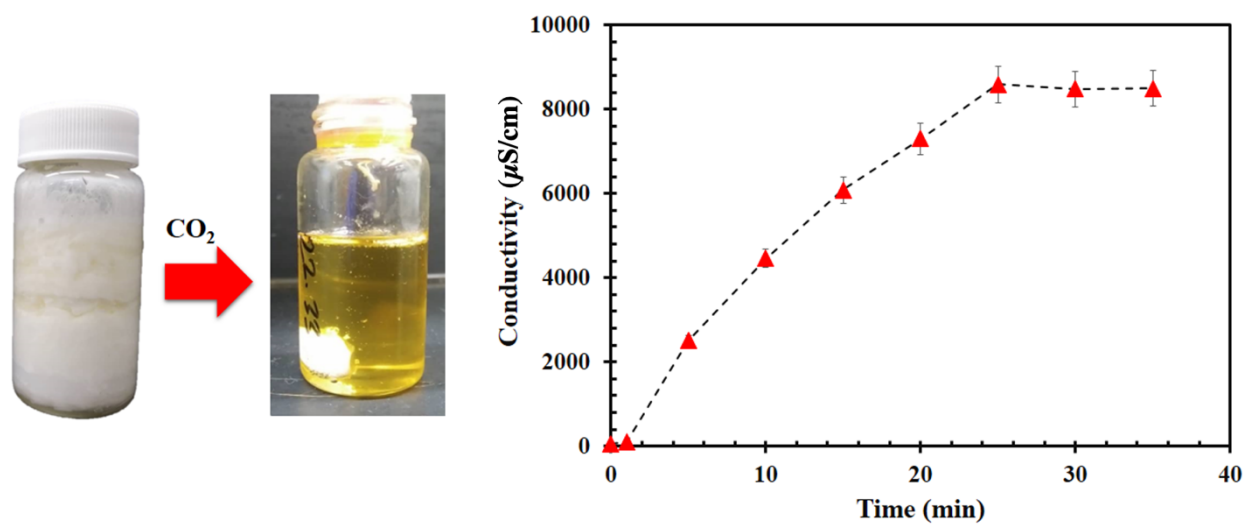


Figure S2. Conductivity of a 35 wt% low-molecular-weight PDMAAm/water mixture during CO_2 addition.

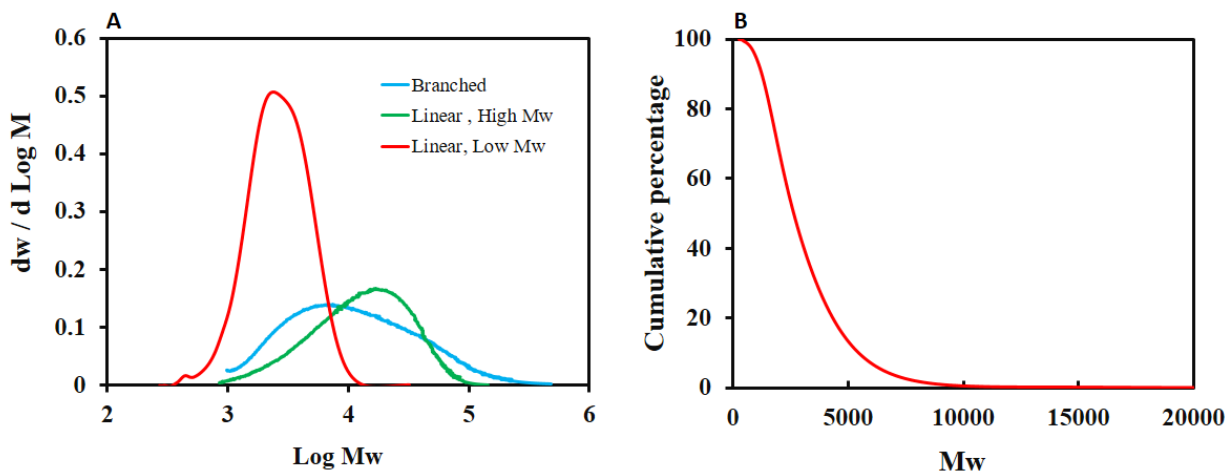


Figure S3. (A) Molecular weight distributions of linear and branched poly(N,N-dimethylacrylamide), (B) Cumulative percentage of the slice Mw height from the total of all Mw slice heights for the low molecular weight polymer.

Table S1 : LCST of the thermoresponsive polymers/polyelectrolytes in water.

Polymers	LCST (°C)	Ref.
PEO _x ^a	65	1
PNnPAM ^b	37	2
PNIPAM-SA ^c	20	3
PiBuCPMA ^d	13	4
PiPA ^e	32	5
PnPA ^f	34	5
PEG ^g	150	6
PDEAEMA ^h	35	7
nBu-TAEA ⁱ	37	8
PNMm ^j	22	9
PNAGA ^k	36	10
PNIPAM ^l	32	11
PNIPAM-SSS ^m	33	12
PNVCL ⁿ	33	13

^a PEO_x= poly(ethylene oxide).

^b PNnPAM = poly(N-n-propylacrylamide).

^c PNIPAM-SA= poly(N-isopropylacrylamide-sodium acrylate).

^d PiBuCPMA=poly(N-(N'-isobutylcarbamido)propyl methacrylamide).

^e PiPA = poly(isopropylacrylamide).

^f PnPA= poly(N-n-propylacrylamide).

^g PEG= polyethylene glycol.

^h PDEAEMA= poly(2-(diethylamino)ethyl methacrylate).

ⁱ nBu-TAEA= poly(n-butyl tetra(ethylene glycol) acrylate-co-2-aminoethyl methacrylate).

^j PNMm= poly(N-(2-methoxy-1,3-dioxan-5-yl) methacrylamide).

^k PNAGA= poly(N-acryloyl glycinamide).

^l PNIPAM = poly(N-isopropylacrylamide).

^m PNIPAM-SSS = poly(sodium styrene-4-sulfonate-co-n-isopropylacrylamide).

ⁿ PNVCL = poly(N-vinylcaprolactam).

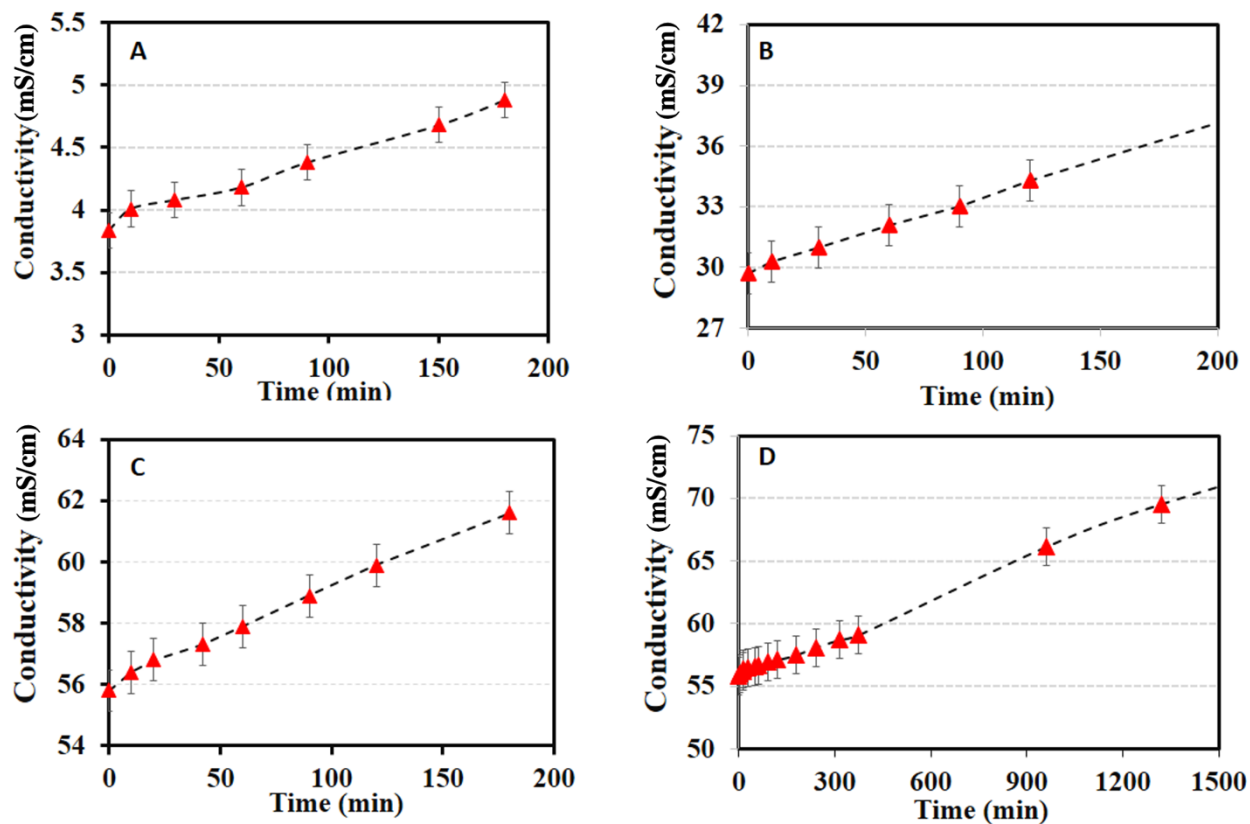


Figure S4: Conductivity as a function of time during the FO test after 3 h of (A) 0.2 wt% (B) 1.75 wt%, (C) 3.5 wt% of NaCl feed solution and (D) 3.5 wt% after 21 h.

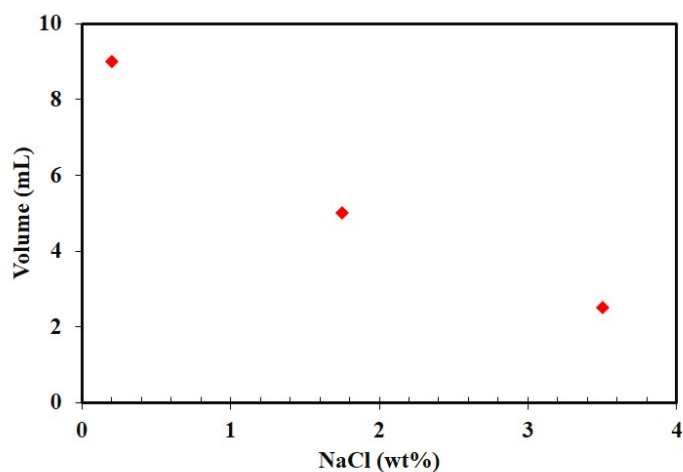


Figure S5: Volume of water passed through the membrane during the FO process with different initial feed NaCl concentrations using the small scale apparatus. After 3 h, 9.0 mL, 5.0 ml and 2.5 mL of water permeated from 0.2 wt%, 1.75 wt% and 3.5 wt% NaCl feed solutions into the draw solution.

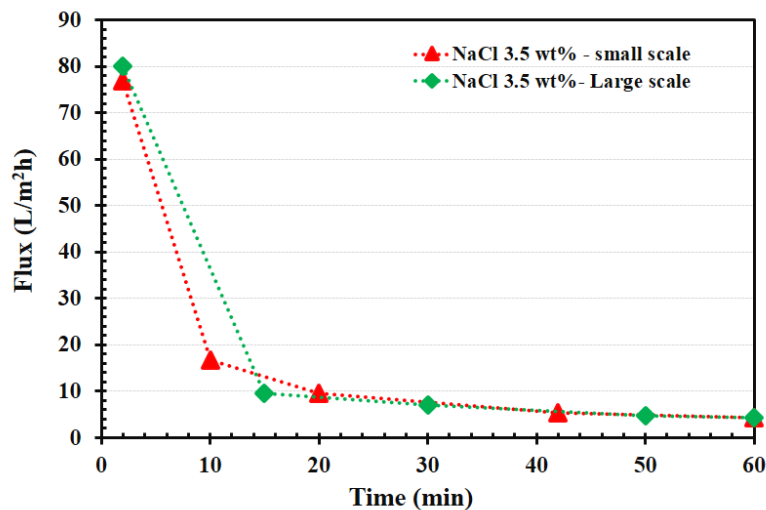


Figure S6: Water flux (LMH) over the time using different scale FO apparatus (large scale: 45 g polymer and small scale: 7.5 g polymer). In all cases, the draw solution was 50 wt% PDMAAm (low Mw) in carbonated water.

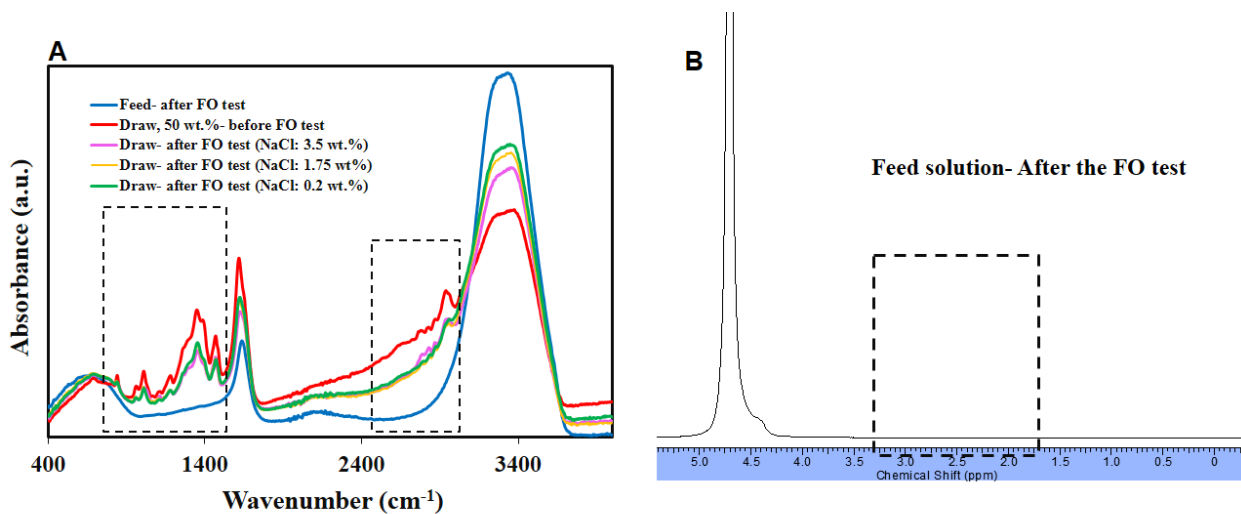


Figure S7. (A) IR spectrum of the draw agent solution before and after FO test and (B) ^1H NMR spectrum of the feed solution of 3.5 wt% after the FO test (all three feed solutions showed only the water peak in NMR and IR spectrum after the FO process).

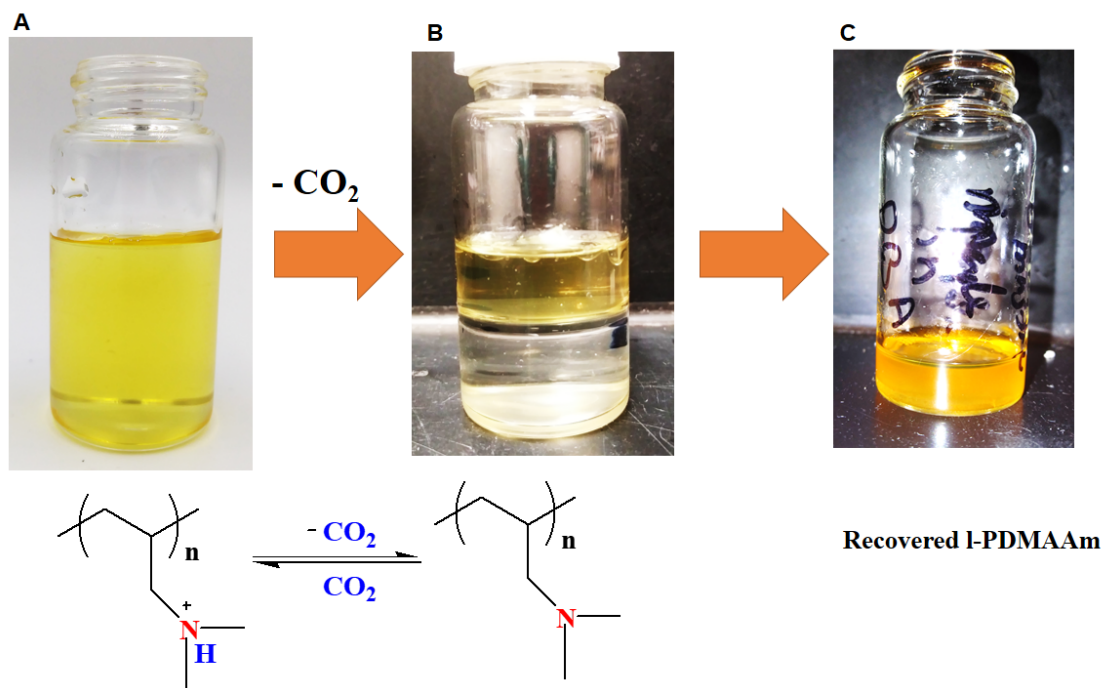


Figure S8. (A) Diluted draw solution after the FO test, (B) phase separation after removing CO₂ from the mixture, (C) recovered I-PDMAAm.

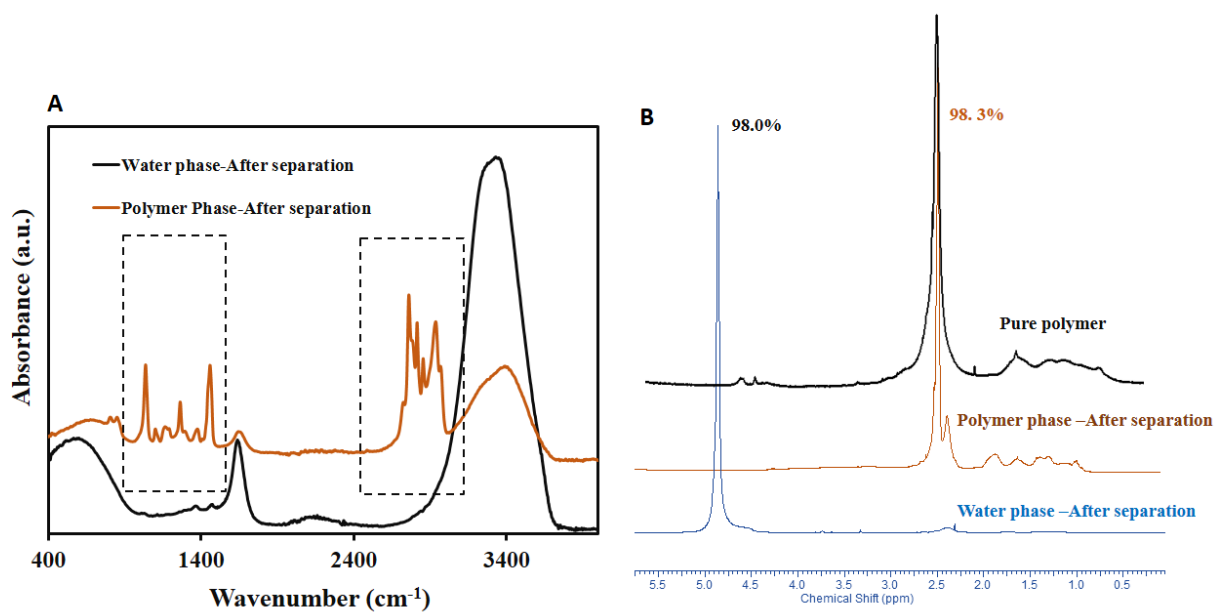


Figure S9. (A) FTIR spectra and (B) ¹H NMR spectra of the polymer-rich phase (i.e. the separate polymer phase) and the water-rich phase after the removal of the CO₂ from the diluted draw solution.

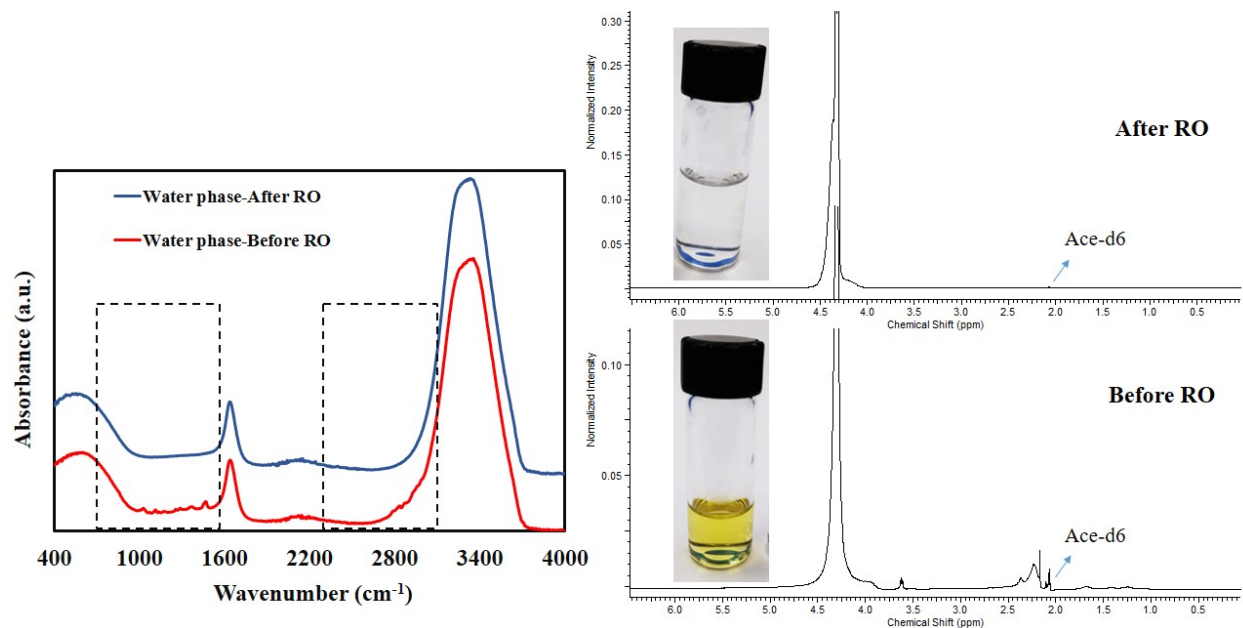


Figure S10. FTIR and ^1H NMR of the water-rich phase after the removal of the CO_2 and precipitated polymer from the diluted draw solution.

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