Supporting Information for

Polymeric Ionic Liquid Functionalized Temperature-responsive Composite Membrane with Tunable Responsive Behavior

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■ SUPPORTING RESULTS:

1.

Table S1. Pure water flux and rejections to PEG 10000, PEG 20000 of BPPO supporting membranes.

BPPO supporting membrane	Pure water flux ($L/m^2 \cdot h \cdot bar$)	Rejection (%)	
		PEG 10000	PEG 20000
Performance	59.3	48	69

2.

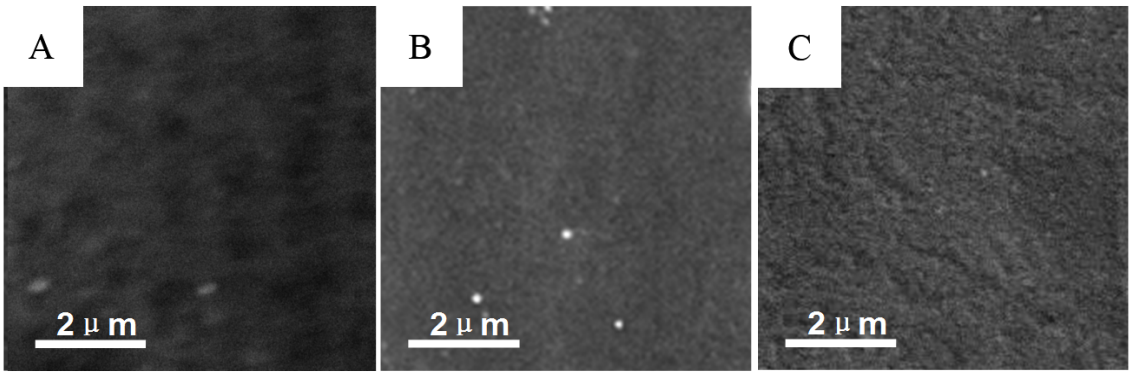

Fig. S1 SEM images of BPPO supporting membrane (A), PNV-BPPO (B) and PNIL-BPPO (C).

3.

The adsorption of membrane was determined gravimetrically and calculated from the amount change of the dye before and after membrane with certain weight immersing into 1 g/L TB or COG aqueous with certain volume for 24h. When the membrane was taken out of the aqueous, it was washed with certain volume of deionized water which was also collected to calculate as the remaining dye amount. Adsorption amount per unit gram of dry membrane was calculated based on the formula as the following equation:

$$W_{ad} = \frac{W_{a1} - W_{a2}}{W_m} \times 100\%$$

Where W_{a1} and W_{a2} are the amount of dye before and after the membrane immersed into 1 g/L TB or COG aqueous for 24h, W_m is the weight of dry membrane.

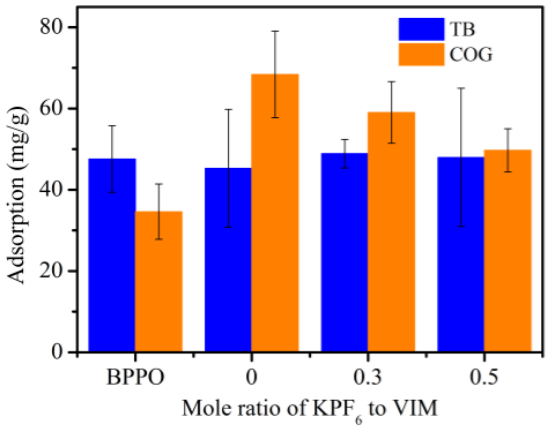

Fig. S2 TB and COG adsorption tests of BPPO supporting membrane and PNIL-BPPO prepared with mole ratio of KPF_6 to VIM of 0, 0.3, 0.5.

4.

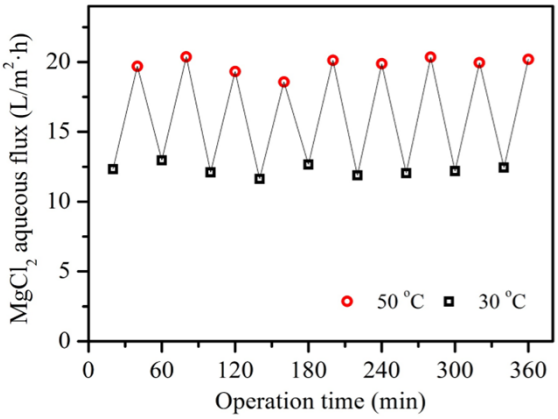

Fig. S3 Reversible temperature-responsive change of $MgCl_2$ aqueous (5 mmol/L) flux of PNIL-BPPO prepared with mole ratio of KPF_6 to VIM of 0.5.

5.

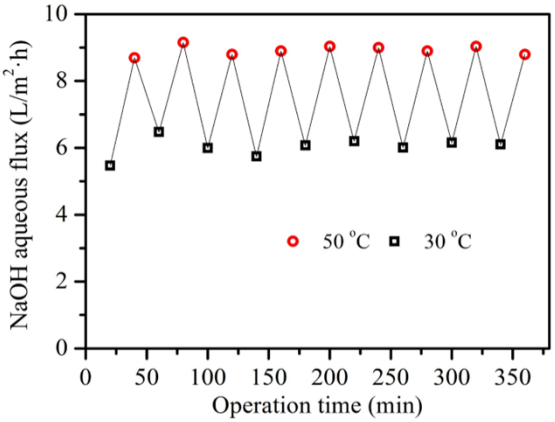

Fig. S4 Reversible temperature-responsive change of NaOH aqueous (pH 10) flux of PNIL-BPPO prepared with mole ratio of KPF_6 to VIM of 0.5.

6.

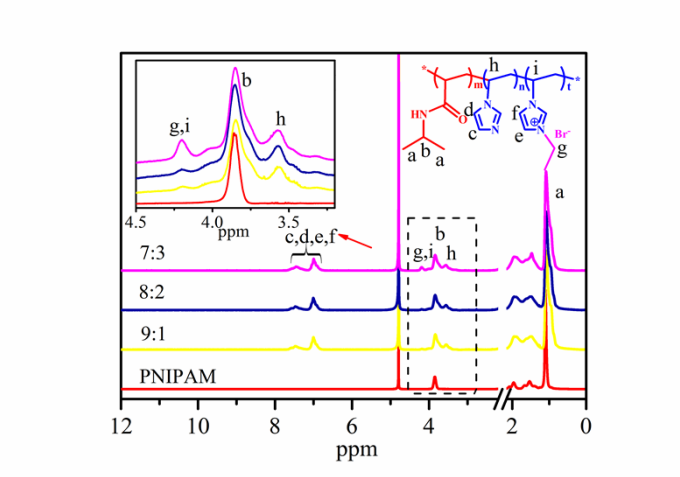

Fig. S5 ^{1}H NMR spectra (D_2O, 25 °C) of *in situ* produced polymers PNIPAM and PNIL prepared with weight ratio of NIPAM to VIM of 9:1, 8:2 and 7:3.

7.

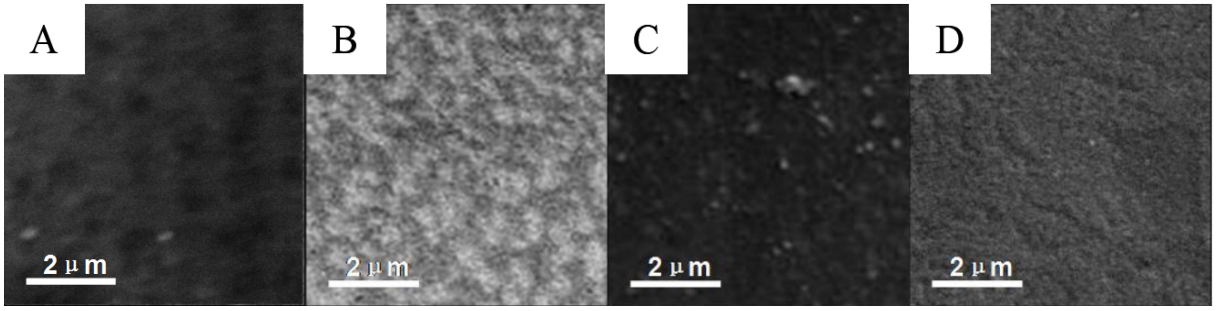

Fig. S6 SEM images of BPPO supporting membrane (A) and PNIL-BPPO prepared with weight ratio of NIPAM to VIM of 9:1 (B), 8:2 (C) and 7:3 (D).

8.

Table S2. Pure water flux of composite membranes prepared with different weight ratios of NIPAM to VIM at 20 °C and 0.2 MPa.

Mole ratio of NIPAM to VIM	9:1	8:2	7:3
Pure water flux/(L/m^2·h)	59.3	31.3	16.8

*****Preparation condition: The concentration of total comonomers in deionized water is 15 mg/ml and the mole ratio of VIM to EtBr is 1:2.

9.

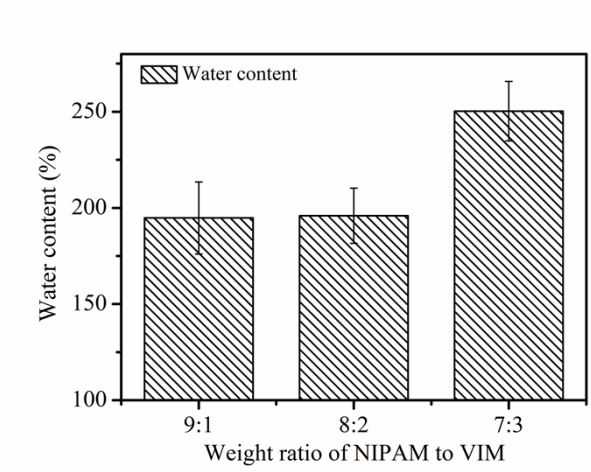

Fig. S7 Water content of PNIL-BPPO prepared with weight ratio of NIPAM to VIM of 9:1, 8:2 and 7:3.

10.

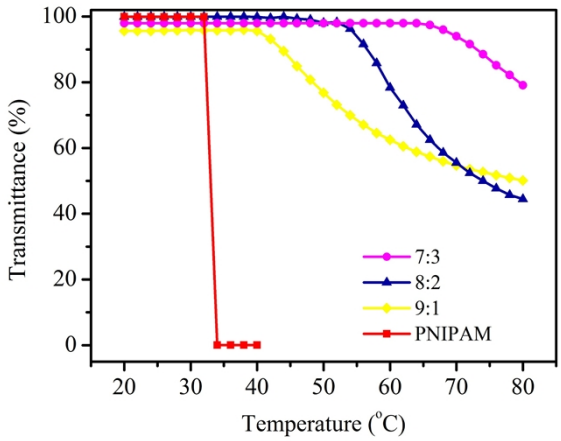

Fig. S8 Turbidity measurement of *in situ* produced polymers PNIPAM and PNIL prepared with weight ratio of NIPAM to VIM of 9:1, 8:2 and 7:3.

11.

Table S3. Pure water flux of composite membranes prepared with different mole ratios of VIM to EtBr at 20 °C and 0.2 MPa.

Mole ratio of VIM to EtBr	1:0.5	1:1	1:2
Pure water flux/(L/m^2·h)	8.5	10.4	16.8

*Preparation condition: The weight ratio of NIPAM to VIM is 7:3, the concentration of total comonomers in deionized water is 15 mg/ml.

12.

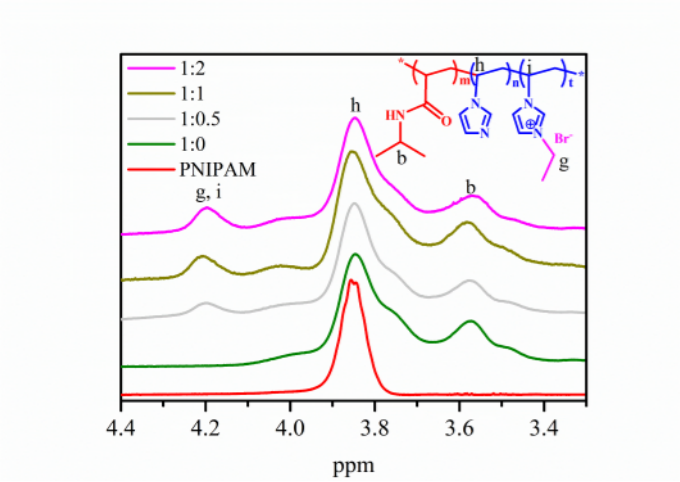

Fig. S9 ^{1}H NMR spectra (D_2O, 25 °C) of *in situ* produced polymers PNIPAM, PNV (1:0) and PNIL prepared with mole ratio of VIM to EtBr of 1:0.5, 1:1 and 1:2.

13.

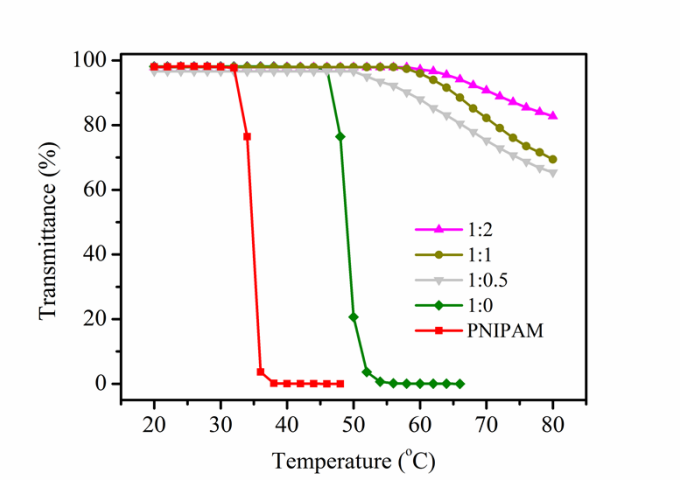

Fig. S10 Turbidity measurement of *in situ* produced polymers PNIPAM, PNV (1:0) and PNIL prepared with mole ratio of VIM to EtBr of 1:0.5, 1:1 and 1:2.

14. Table S4. Pure water flux of composite membranes prepared with different reactant concentrations at 20 °C and 0.2 MPa.

Reactant concentration (mg/ml)	5	15	25
Pure water flux/(L/m^2·h)	94.1	11.1	3.2

*Preparation condition: The weight ratio of NIPAM to VIM is 7:3 and the mole ratio of VIM to EtBr is 1:1.

15.

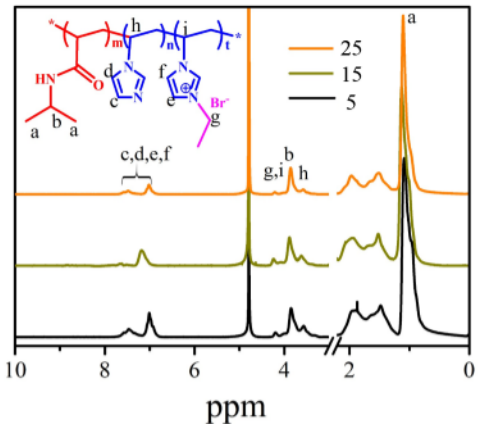

Fig. S11 ^{1}H NMR spectra (D_2O, 25 °C) of in situ produced polymers PNIL prepared with reactant concentration of 5, 15 and 25 mg/ml.