Supporting Information

Two-dimensional Ti_2CT_x MXene membranes with integrated and ordered nanochannels for efficient solvent dehydration

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Fig. S2 The structure of HPEI molecule

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Fig. S5 SEM images of PAN substrate

Fig. S6 Digital photos of (a) DI water, (b) MXene-HPEI mixture (0.150mg/mL), (c) MXene-HPEI mixture after stirring for 20 min (0.150mg/mL)

Fig. S7 SEM images of cross-section on (a) Ti_2CT_x membrane, (b) Ti_2CT_x-HPEI membrane, (c) Ti_2CT_x-HPEI/TMC membrane，corresponding to Fig. 3 (a)-(c)

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Fig. S11 AFM images of Ti_2CT_x-HPEI/TMC membrane with different MXene deposition (a) 54.16 mg/m^2, (b) 72.21 mg/m^2, (c) 144.43 mg/m^2, (d) 216.65 mg/m^2 , (e) 361.08 mg/m^2 , (f)-(j) corresponding 3D images

Fig. S12 AFM images of $Ti_3C_2T_x$-HPEI/TMC membrane with different MXene deposition (a) 54.16 mg/m^2, (b) 72.21 mg/m^2, (c) 144.43 mg/m^2, (d) 216.65 mg/m^2 , (e) 361.08 mg/m^2 , (f)-(j) corresponding 3D images

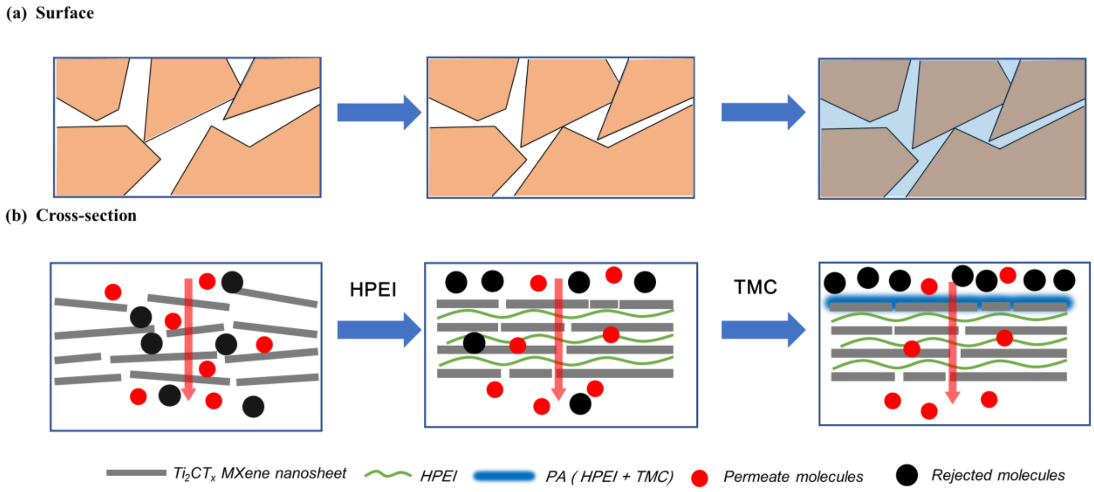
Fig. S13 Performance on isopropanol dehydration by pervaporation of $Ti_3C_2T_x$-based membranes (feed: 10 wt% water/isopropanol mixture, 50 ℃, MXene deposition 72.21 mg/m^2)

Fig. S14 Effect of MXene loading on $Ti_3C_2T_x$-HPEI/TMC membrane and Ti_2CT_x-HPEI/TMC membrane for isopropanol dehydration by pervaporation at 50 °C (feed: 10 wt% water/isopropanol mixture)

Fig. S15 Effect of (a and b) temperature on isopropanol dehydration by pervaporation for Ti_2CT_x-HPEI/TMC membrane at 50 °C, (b) the Arrhenius graph equation between water and isopropanol permeance and feed temperature(feed: 10 wt% water/isopropanol mixture, MXene loading 72.21 mg/m^2)

Fig. S16 Effect of feed concentration on isopropanol dehydration by pervaporation for Ti_2CT_x-HPEI/TMC membrane at 50 °C, (MXene loading 72.21 mg/m^2)

Fig. S17 XRD patterns of nylon-supported Ti_2CT_x-HPEI/TMC membrane before and after immersing into 10 wt% water/isopropanol mixture for 120 h



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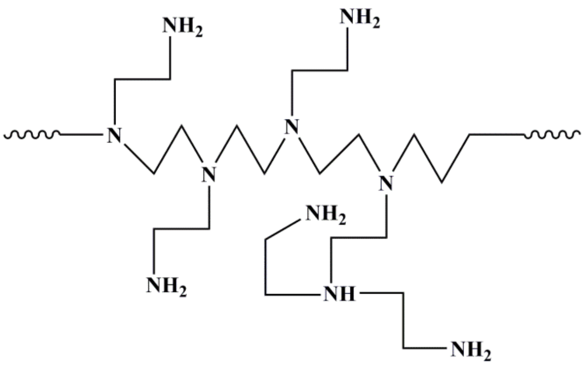

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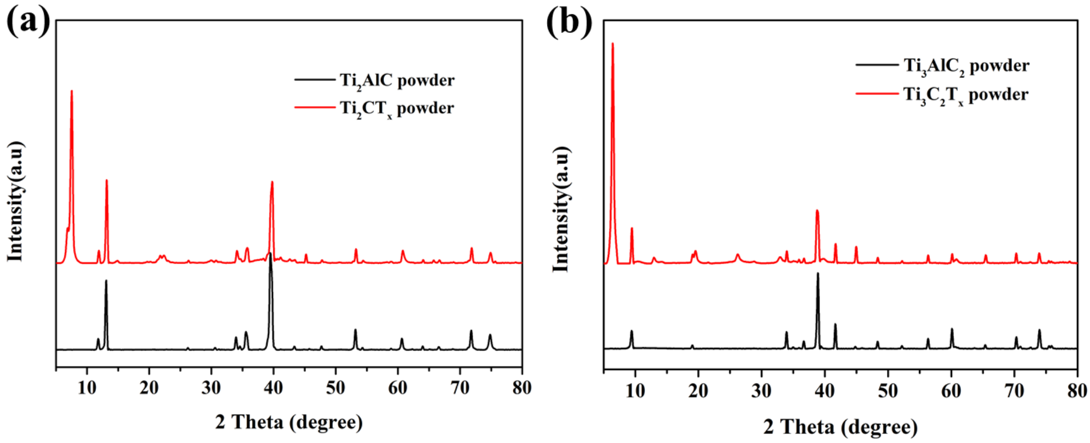

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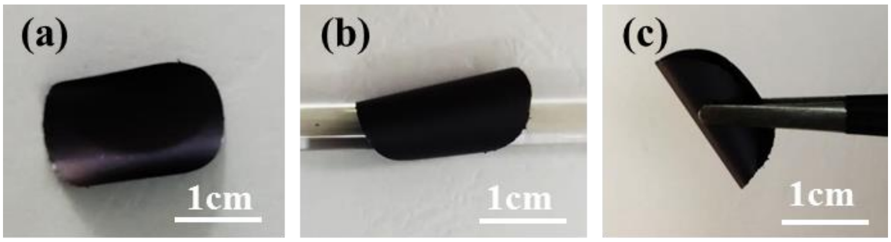

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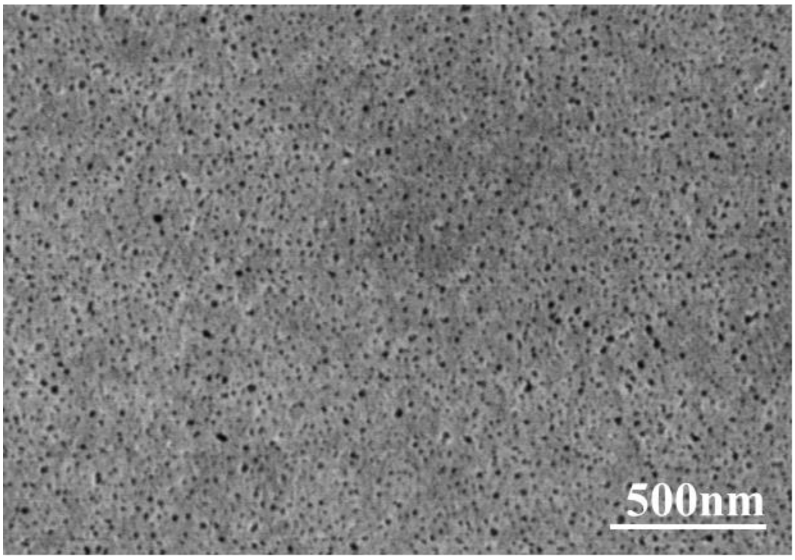

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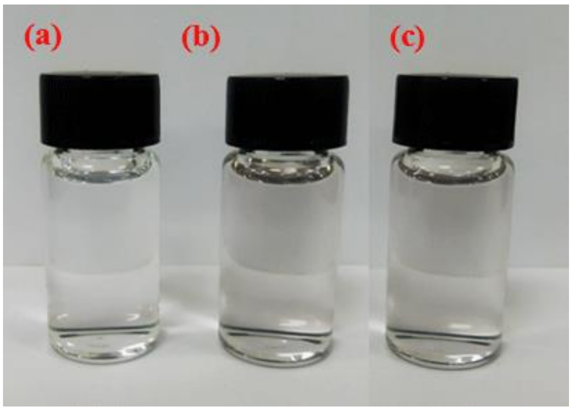

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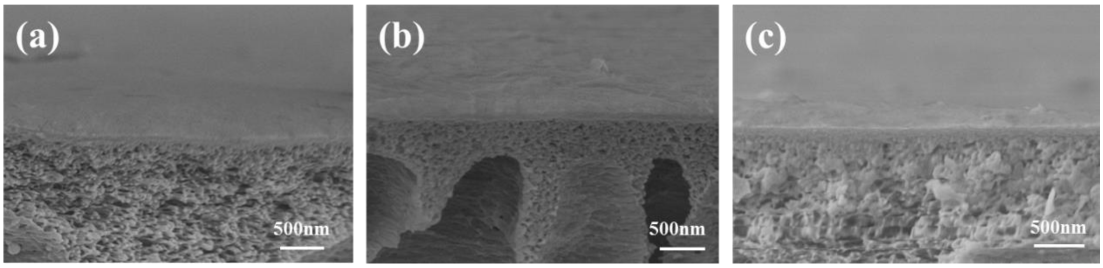

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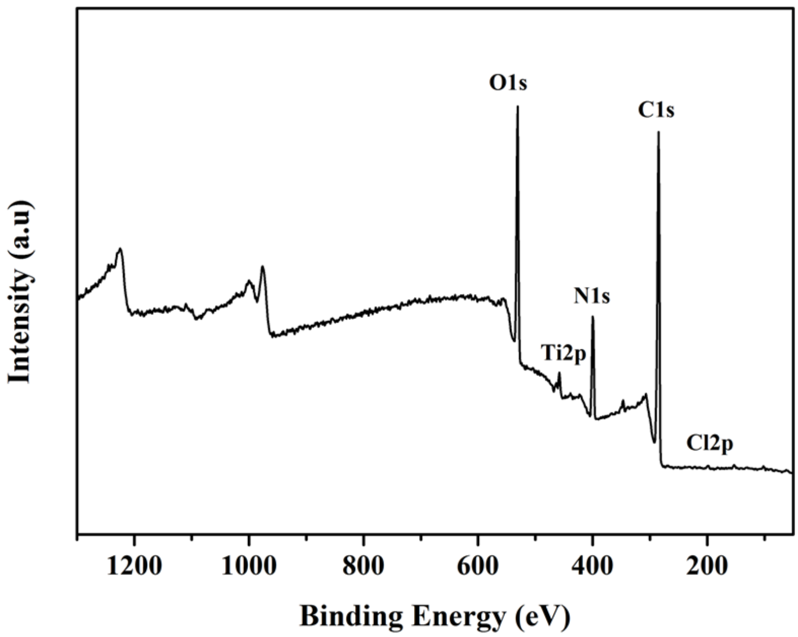

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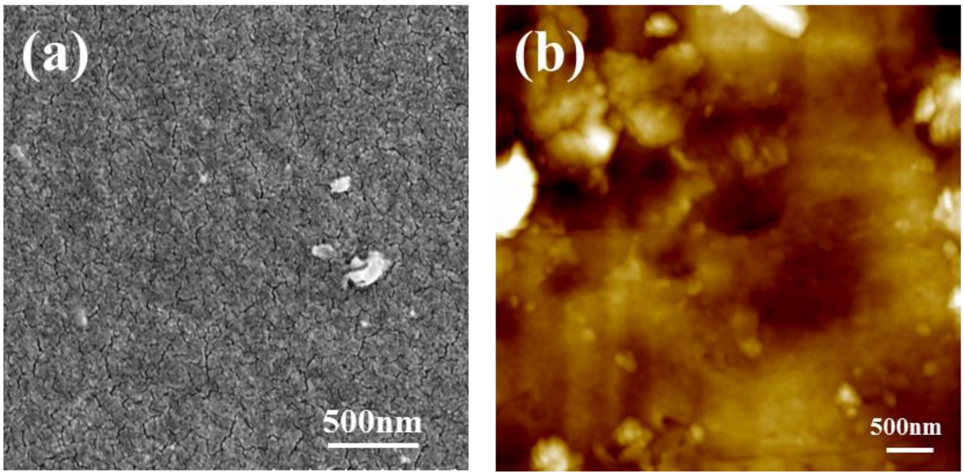

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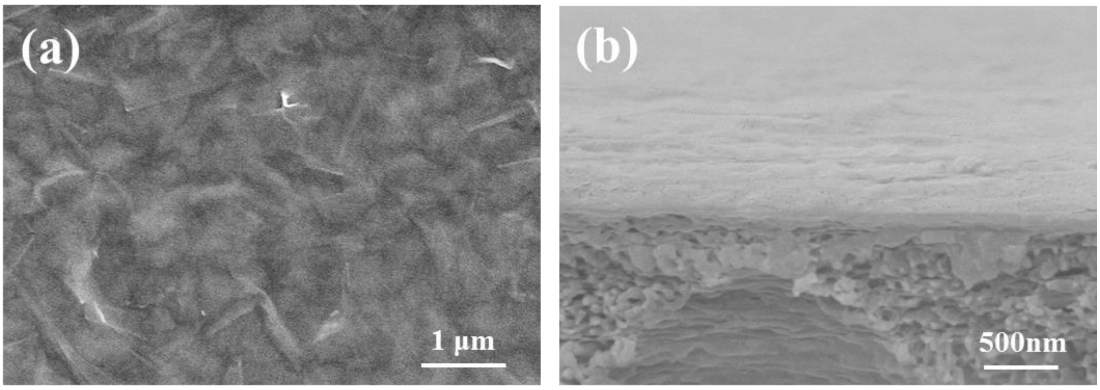

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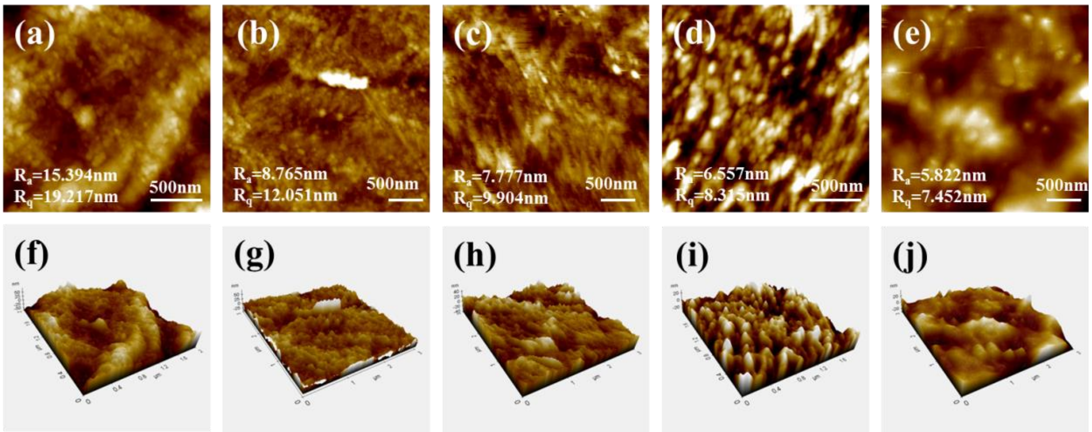

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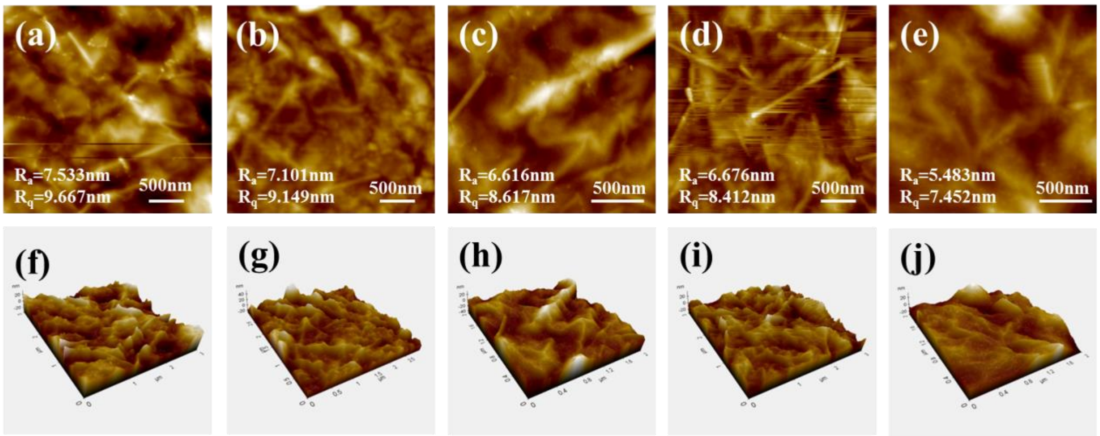

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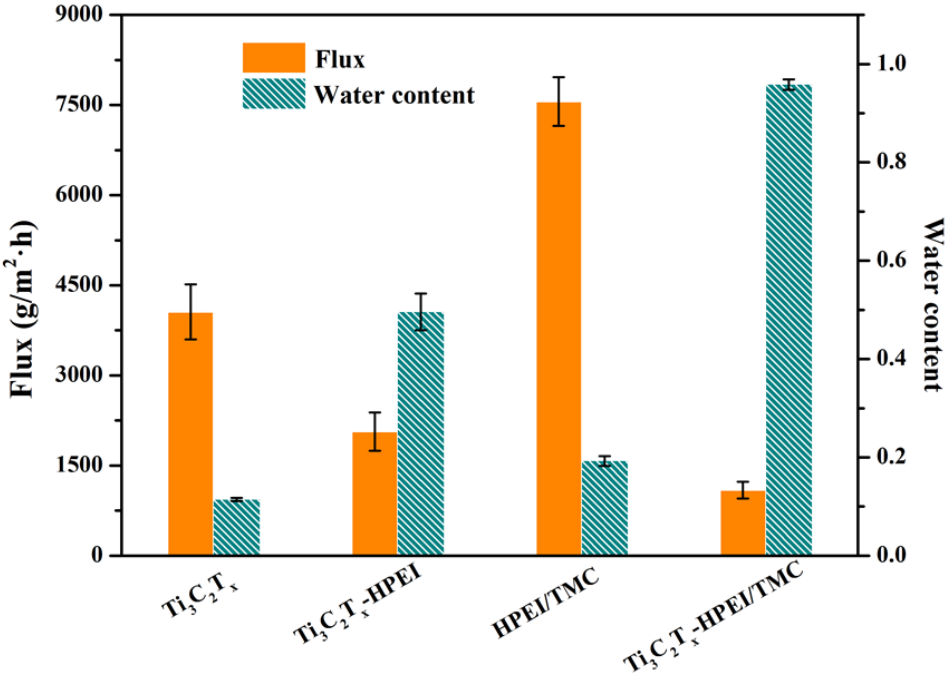

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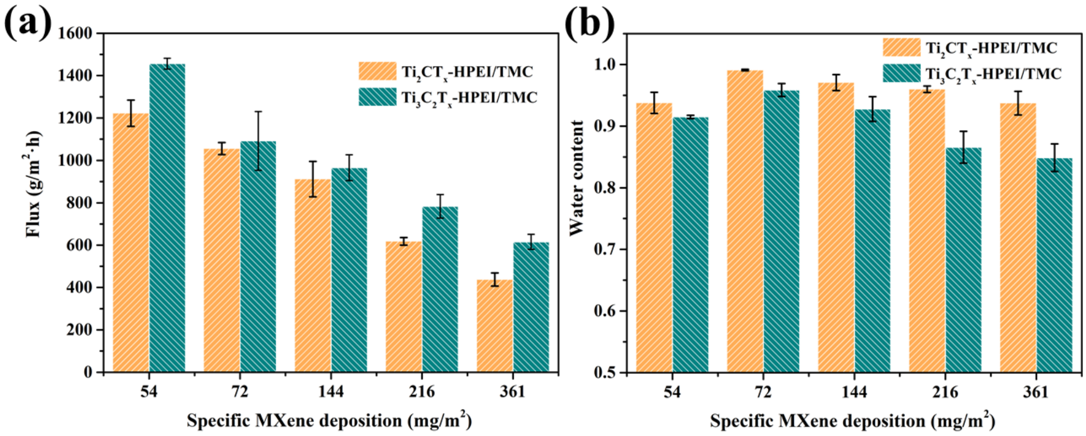

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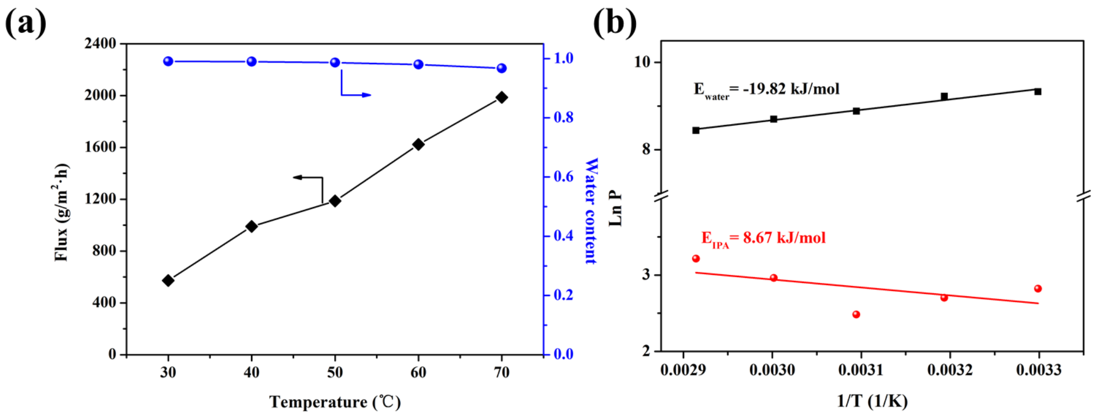

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For the sake of understanding the relationship between flux and temperature, we used Arrhenius equation to reveal it.

$$P_i = \frac{J_i}{p_{i0}-p_{il}} = \frac{J_i}{\gamma_{i0}x_{i0}\,p_{i0}^{sat}-p_{il}}$$

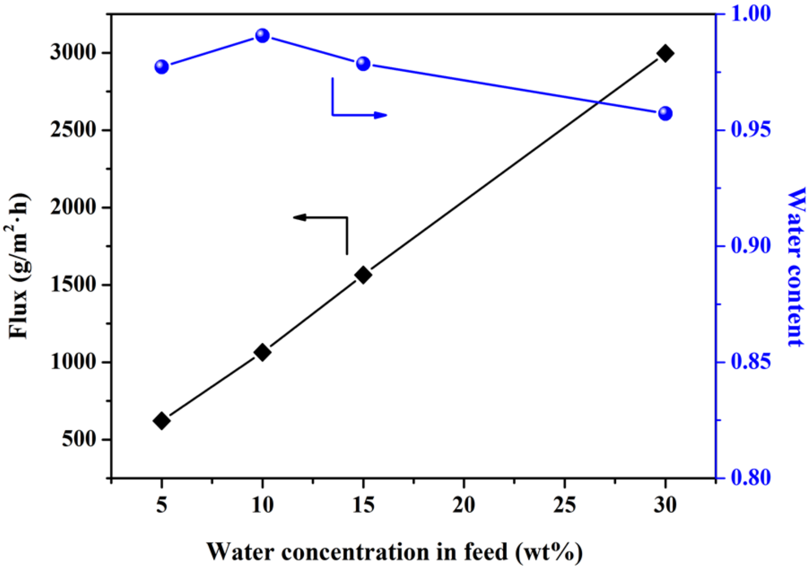
(1)

$$Pi = Aexp(-\frac{Ea}{RT})$$

(2)

Where *Pi* represents the permeance of individual component *i* (GPU), J_i is the permeation flux of component *i* (g m^{-2} h^{-1}), p_{i0} and p_{il} are the partial pressure of component *i* in the feed side and permeate side (Pa), γ_{i0} is the activity coefficient of component i in the feed side. x_{i0} is the mole fraction of component i in the feed side. p_{i0}^{sat} is the saturated vapor pressure of pure component *i*. *A* is the preexponential factor (g m^{-2} h^{-1}), *Ea* stands for the activation energy (kJ mol^{-1}), *R* belongs to the gas constant (kJ mol^{-1} K^{-1}) and T refers to the feed temperature (K).

From Fig. S12a, the activation energy of water and isopropanol were calculated as -19.82 and 8.67 kJ/mol, respectively.



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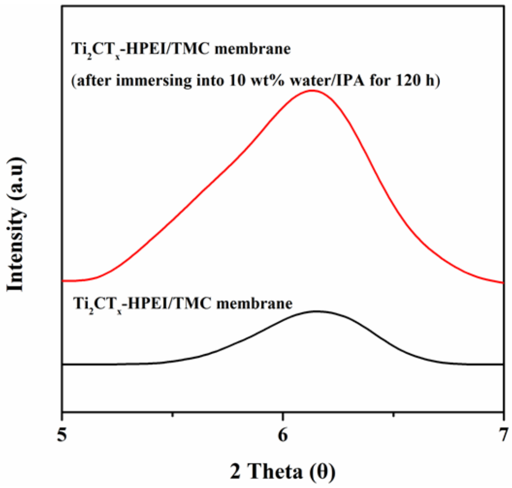

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