Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Fabrication of PP hollow fiber membrane via TIPS using environment-friendly diluents and its CO_2 degassing performance

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Experimental

PP flat-sheet membrane preparation

The PP flat-sheet membranes were prepared using the steps as follows: firstly, blending to obtain homogeneous casting solutions consisting PP and binary diluents, shortly after quenching into solidification in liquid nitrogen, later compression moulding to acquire the flat sheet shape, eventually extracting the binary diluents before the final membrane formation.

Firstly, a PP solution was mixed with proper amounts of soybean oil and castor oil, was loaded into 100 mL flat-bottomed glass flask, and stirred with a Teflon stirring rod for 90 min. The experiments were performed at a constant temperature of 190^{o}C in an oil bath. After static de-aeration for 60 min, the flask with homogeneous casting solution was soon quenched into liquid nitrogen to solidify. The membrane preparation conditions were listed in Table S1. Subsequently, a small portion of solid sample (about 3.0 g) was placed in a square polyimide framework inside an empty square with 11 cm ×11 cm between a pair of polyimide film with 0.2 mm thick, and then the section similar to a sandwich was inserted between a pair of steel flat plates to ensure flat-sheet shape. The overall section was placed on a preheated hot stage at 200^{o}C for 15 min to ensure that the sample was in the molten state, after being pressured for 10 min at 2 MPa, it was immediately quenched in a water bath at about 15^{o}C. The binary diluents in the membranes were extracted by ethanol for 24 h and n-hexane for 12 h alternately to remove the diluents, and lastly air-dried.

Table S1 Proportions of the components in the solid sample mixture[a].

Sample	S1	S2	S3	S4	S5	S6
PP concentration (wt%)	10	16	22	28	34	40

[a] The mass ratio of CO/SO was 16/84 in all the solid sample mixture.

PP Hollow fiber membrane preparation

The PP HFM fabrication methods are as follows. A certain mass ratio of SO/CO was mixed to obtain a homogeneous solution as diluents. The diluents and PP were added to the spinning kettle, heated to 179^{o}C, and stirred for 2 h under a nitrogen atmosphere, and then de-aeration for 1.5 h. The bore liquid was heated to 142^{o}C. After the casting solution passed through the filter, it was sent to the spinneret by a gear metering pump, at the same time, the bore liquid was introduced into the inner tube of the spinneret to make a lumen of the hollow fiber, and then casting solution passed through the air gap of a certain distance, and entered the coagulation bath to form HFMs. The mass ratio of SO/CO was 90/10 in both bore liquid and outer coagulation both. The PP HFMs were taken out by a godet wheel, wound up by a winder, and extracted by ethanol for 24 h and n-hexane for 12 h alternately to remove the diluents, and lastly air-dried.

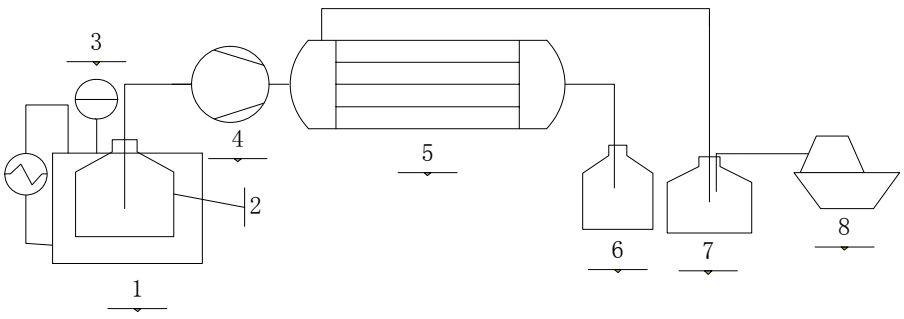

Fig. S1. Experimental setup for CO_2 degassing using the PP membrane module： 1,

thermostatic water bath; 2, feed water tank; 3, temperature indicator; 4, peristaltic pump; 5, PP hollow fiber membrane module; 6, outlet water tank; 7, buffer tank; 8, circulating water vacuum pump.

Table S2 Comparisons of mechanical properties with literature data.

Membrane	Loading force/N	Tensile strength/MPa	Young's modulus/MPa	Breaking elongation/%	Ref.
PSF	-	0.7	-	-	[1]
PVDF	-	0.25	-	-	[2]
PVDF	-	2.7	-	-	[3]
PVDF	-	2.3	-	38	[4]
PP	-	1.2	19	70	[5]
PP	6.78±0.23	4.38±0.15	123.7±19.7	27.89±3.9	This work

Table S3 The other properties of fabricated PP hollow fiber membranes.

Parameters	WCA/°	LEP/MPa	Porosity/%	Gas permeability/mL/(m^2.s.Pa)
Value	117.1±1.8	0.34±0.01	59.2±0.07	0.9241±0.15

References

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