Supporting Information

Enhanced desulfurization performance of PDMS membranes by incorporating silver decorated dopamine nanoparticles

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1. The literature data of pervaporation desulfurization

It is necessary to compare the pervaporation performance in this study to the literature data in recent years. So pervaporation performance of pervaporative desulfurization in the literatures is listed in **Table S1**. The comprehensive properties of the permeation flux and enrichment factor in this study were superior to those in many other studies.

Table S1. Pervaporation desulfurization performance in the literatures.

Membrane	Active layer thickness (μm)	Feed	T (^{o}C)	Permeate pressure (Pa)	Sulfur content (ppm)	Flux (kg/(m^2 h))	Enrichment factor	Publication year	Ref.
PDMS–PEI	4	Thiophene /*n*-heptane	80	200	147	0.8	7.6	2010	[1]
PDMS/ceramic	8	Thiophene /*n*-octane	30	210	400	5.37	4.22	2010	[2]
PEG–CuY	-	Thiophene /hydrocarbon	110	130	1190	3.19	2.95	2010	[3]
PDMS-Ag^+/TiO_2	15	Thiophene /*n*-octane	40	-	571	4.14	8.56	2011	[4]
PDMS-Ag^+/SiO_2	13–16	Thiophene /*n*-octane	-	330	495	7.76	4.3	2012	[5]
PEG-b-PAN	10	Thiophene /*n*-heptane	82	-	1000	0.189	2.82	2012	[6]
PTFEP	13–16	Thiophene /heptane	85	300	400	0.089	9.7	2012	[7]
EC/C_{60}	-	five-component mixture[a]	75	-	300	2.73	5.03	2012	[8]
PDMS-SiO_2	-	Thiophene /*n*-octane	30	-	500	7.36	4.98	2012	[9]
PDMS-dopamine/Cu	16.0-23.0	Thiophene /*n*-octane	30	-	570	7.42	4.81	2013	[10]
Cl-PBPP	12.4	Thiophene	85	300 Pa	400	1.38	5.6	2013	[11]

		/heptane							
CuO/AMPSF	20	Thiophene /*n*-heptane	40	<800 Pa	1500	1.2	3.9	2013	[12]
PEBAX /PVDF	11	Thiophene /*n*-heptane	40	500 Pa	381	3.8	4.0	2014	[13]
Copolyimide- /glycidyl- POSS	28-32	Benzothio phene /*n*- dodecane	100	19-30 mbar	3000	1.1	2.41	2014	[14]
PMePP/Mn	15	Thiophene / *n*-heptane	85	<300 Pa	294	2.1	6.5	2014	[15]
PDMS-DAAg	16.0-25.0	Thiophene /*n*-octane	30	-	500	8.22	5.03		This study

[a]Mixture consists of *n*-heptane, cyclohexane, cyclohexene, toluene, and thiophene.

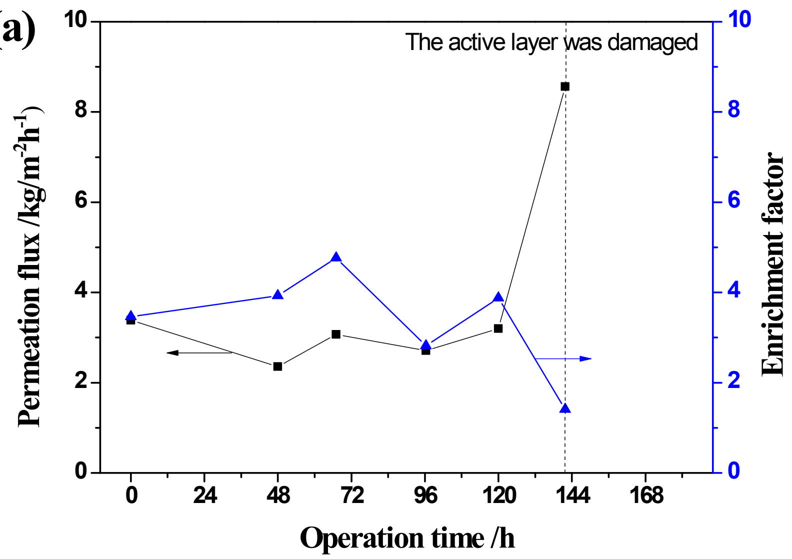
References:

1. J. Chen, J. Li, R. Qi, H. Ye and C. Chen, *Appl Biochem Biotechnol*, 2010, **160**, 486.
2. R. Xu, G. Liu, X. Dong, Wanqin and Jin, *Desalination*, 2010, **258**, 106.
3. L. Lin, Y. Zhang and H. Li, *J Colloid Interface Sci*, 2010, **350**, 355.
4. W. Liu, B. Li, R. Cao, Z. Jiang, S. Yu, G. Liu and H. Wu, *Journal of Membrane Science*, 2011, **378**, 382.
5. R. Cao, X. Zhang, H. Wu, J. Wang, X. Liu and Z. Jiang, *J Hazard Mater*, 2011, **187**, 324.
6. F. Lu, Y. Kong, H. Lv and J. Yang, *Petroleum Science and Technology*, 2012, **30**, 1232.
7. Z. Yang, W. Zhang, J. Li and J. Chen, *Separation and Purification Technology*, 2012, **93**, 15.
8. S. Sha, Y. Kong and J. Yang, *Journal of Membrane Science*, 2012, **415-416**, 835.
9. B. Li, W. Liu, H. Wu, S. Yu, R. Cao and Z. Jiang, *Journal of Membrane Science*, 2012, **415-416**, 278.
10. W. Liu, Y. Li, X. Meng, G. Liu, S. Hu, F. Pan, H. Wu, Z. Jiang, B. Wang, Z. Li and X. Cao, *Journal of Materials Chemistry A*, 2013, **1**, 3713.
11. Z.-J. Yang, Z.-Q. Wang, J. Li and J.-X. Chen, *Separation and Purification Technology*, 2013, **109**, 48.
12. Y. Xia, G. L. Han, Q. G. Zhang, Y. Gong, I. Broadwell and Q. L. Liu, *Journal of Applied Polymer Science*, 2013, **130**, 3718.
13. K. Liu, C.-J. Fang, Z.-Q. Li and M. Young, *Journal of Membrane Science*, 2014, **451**, 24.
14. R. Konietzny, T. Koschine, K. Rätzke and C. Staudt, *Separation and Purification Technology*, 2014, **123**, 175.
15. Z. Yang, W. Zhang, T. Wang and J. Li, *Journal of Membrane Science*, 2014, **454**, 463.

2. Long-term operation stability of the membrane

The long-term operation stability is a vital index to confirm the potentia of the membranes for practical application. The PDMS control and PDMS-DAAg/5 membrane were used to perform the long-term operation test for a feed of 500 ppmw sulfur in *n*-octane at around 30 °C with a flow rate of 40 L/h. As shown in **Figure S1**, the active layer of PDMS control membrane was damaged after 144 h. The enrichment factor was approximate 1 at 144 h, which suggested thiophene and *n*-octane permeated through the membrane without significant difference. At around 168 h, part of the active layer peeled from the PSF substrate, so no data obtained afterwards. While the permeation flux and enrichment factor of PDMS-DAAg/5 membrane did not obviously decrease during the entire test for more than 190 h. Therefore, the stability of the PDMS-DAAg/5 membranes was favorable for pervaporation desulfurization.

(a)



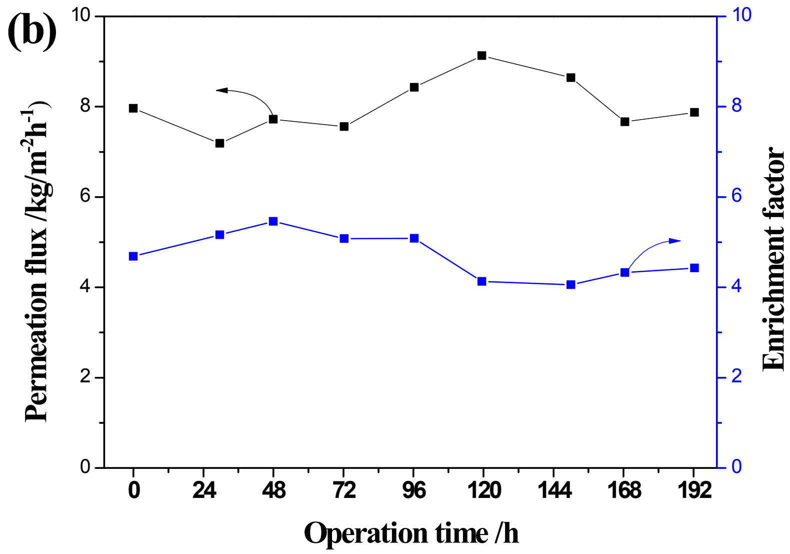


Figure S1. Long-term operation test of (a) PDMS control membrane and (b) PDMS-DAAg/5 membranes.