

## Supporting Information

### **One-step Enhancement of Solvent Transport, Stability and Photocatalytic Properties of Graphene oxide/polyimide Membranes with Multifunctional Cross- linker**

Mei-Ling Liu,<sup>a,b,c</sup> Jia-Lin Guo,<sup>a,b,c</sup> Susilo Japip,<sup>d</sup> Tian-Zhi Jia,<sup>a,b,c</sup> Dan-Dan Shao,<sup>a,b,c</sup>  
Sui Zhang,<sup>d</sup> Wen-Jie Li,<sup>a,b,c</sup> Jue Wang,<sup>a,b,c</sup> Xue-Li Cao,<sup>a,b,c</sup> Shi-Peng Sun<sup>a,b,c</sup>\*

<sup>a</sup>State Key Laboratory of Materials-Oriented Chemical Engineering,

<sup>b</sup>Jiangsu National Synergetic Innovation Center for Advanced Materials

<sup>c</sup>College of Chemical Engineering, Nanjing Tech University, Nanjing 210009, China

<sup>d</sup>Department of Chemical and Biomolecular Engineering, National University of  
Singapore, Singapore 117582, Singapore

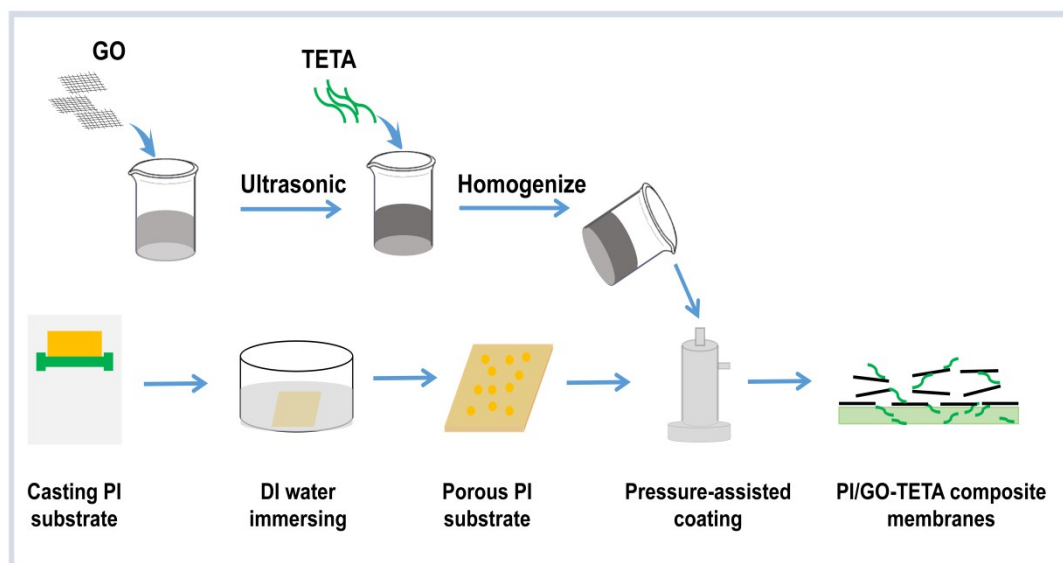
\*Corresponding author

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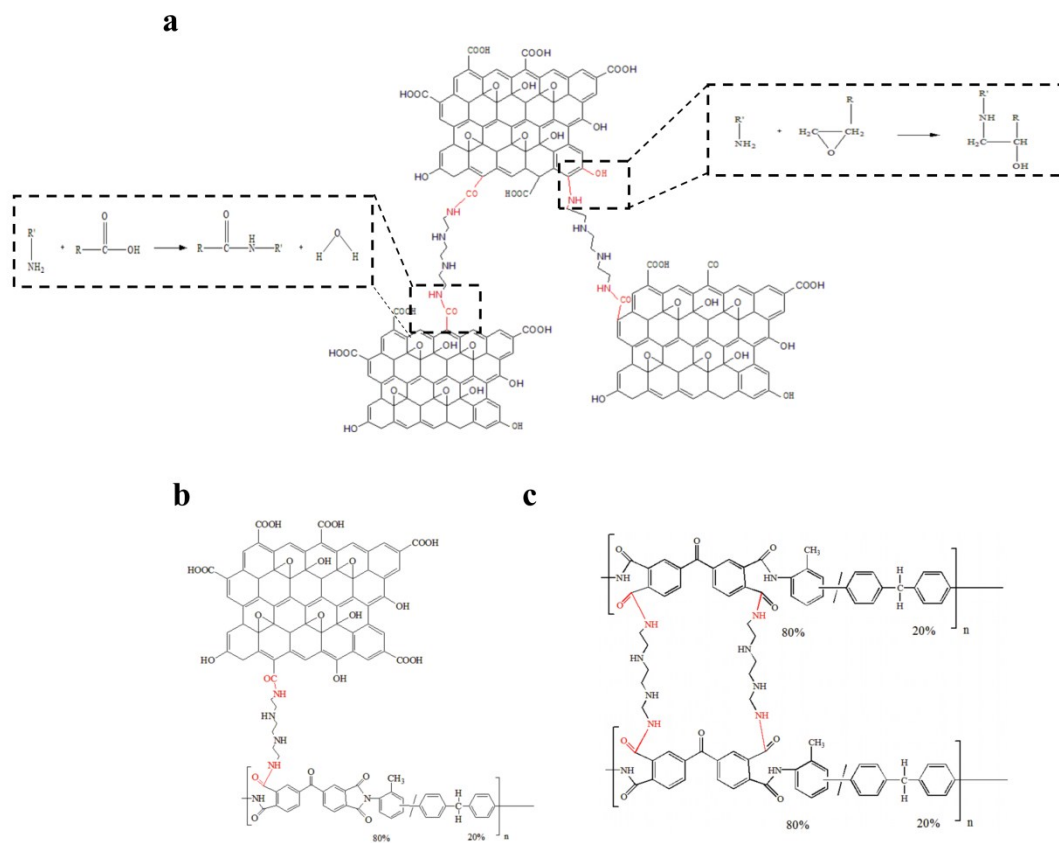
Prof. Shi-Peng Sun: [ssp@njtech.edu.cn](mailto:ssp@njtech.edu.cn) ; [ssp@live.com](mailto:ssp@live.com)

Tel: +86-25-83587560

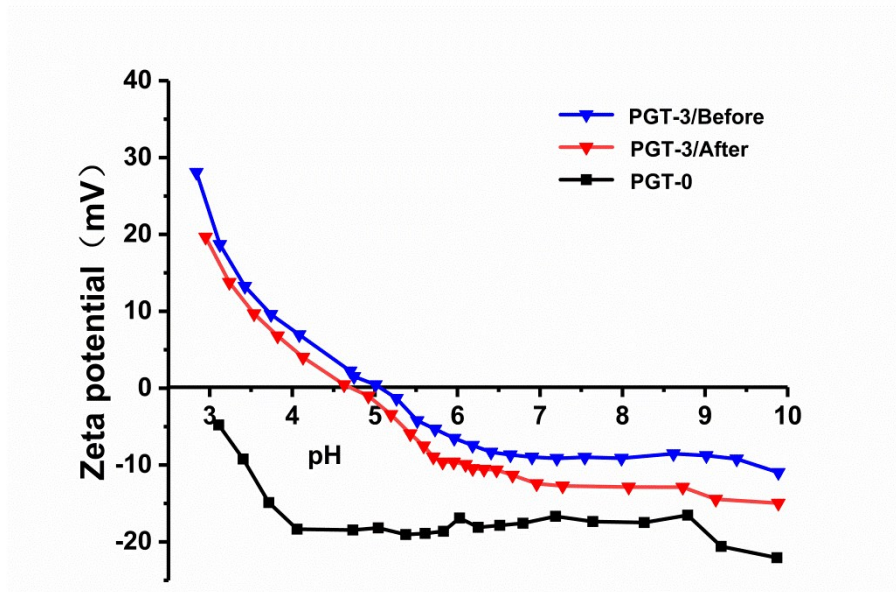
Comprising 22 pages: 3 tables and 19 figures.



**Fig S1.** The fabrication process of PI/GO-TETA composite membranes.



**Fig S2.** Chemical structures of a possible product of TETA cross-linked a) GO, b) GO and PI, and c) PI.



**Fig S3.** Zeta potentials of PGT-3 membrane before and after immersing in water 48 h and filtering pure water for 6h.

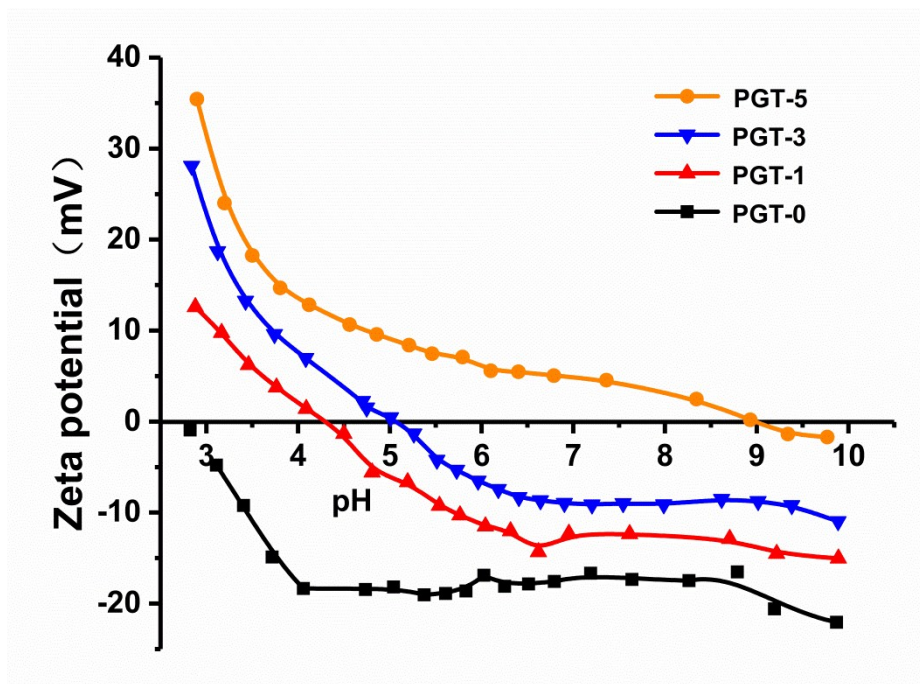
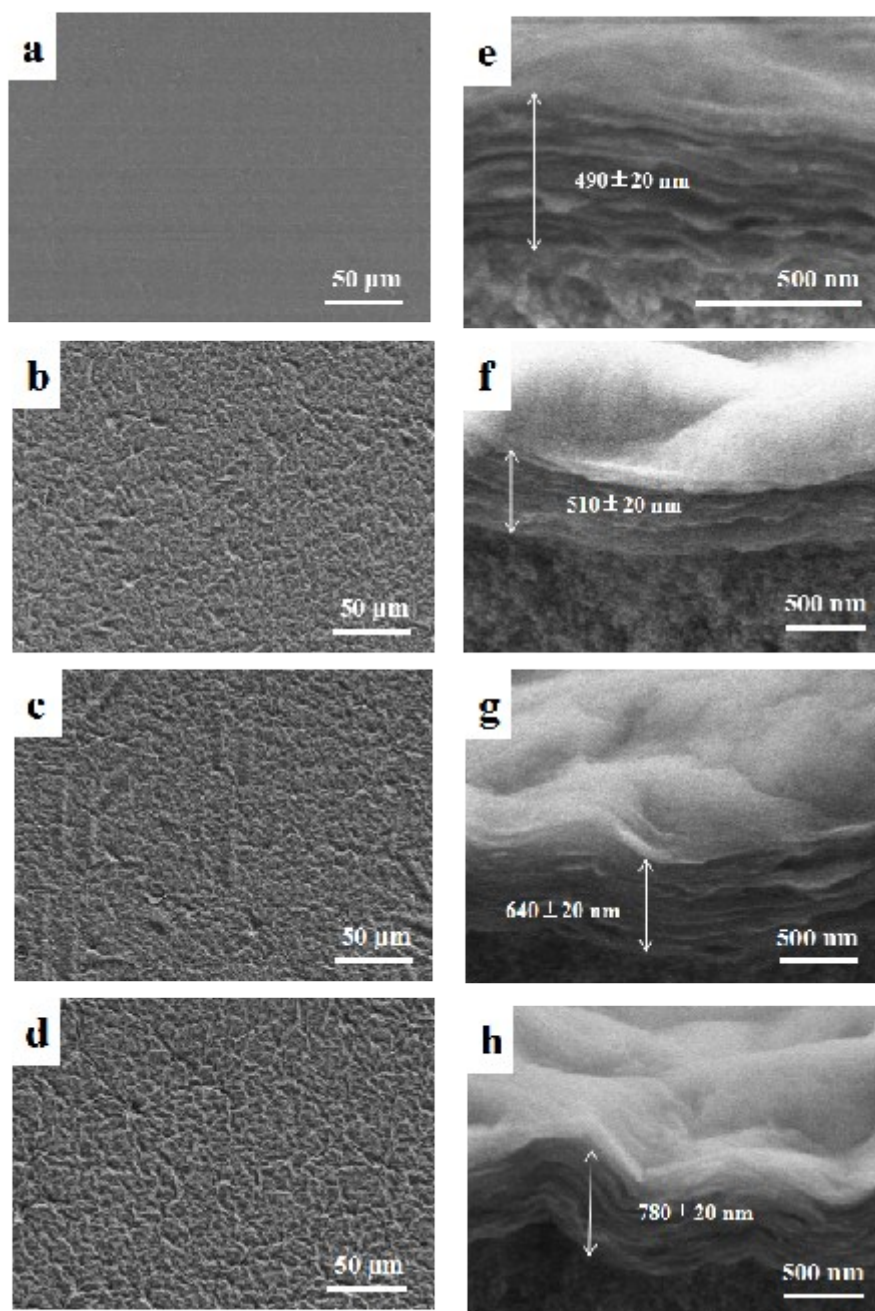
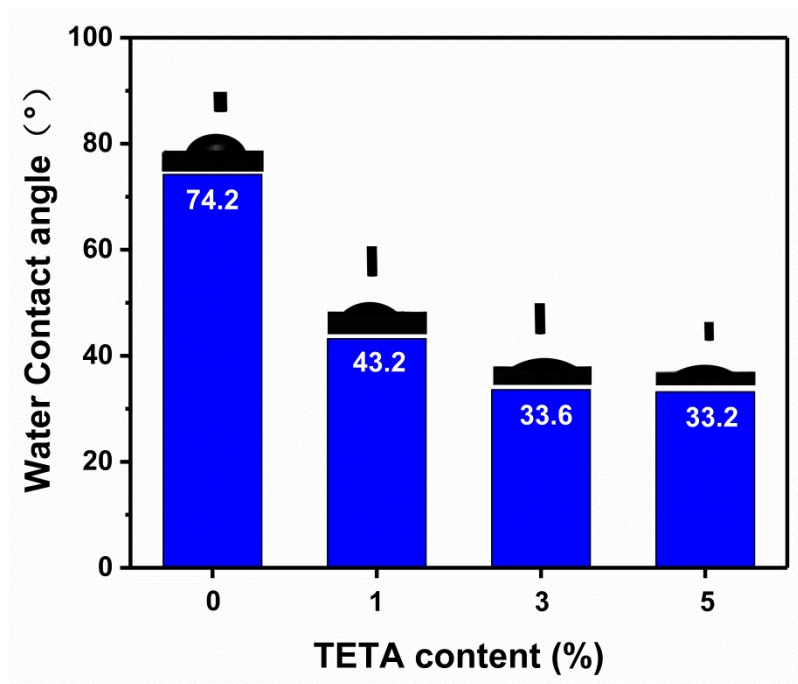


Fig S4. Zeta potentials of PGT-0/1/3/5 membranes respectively.



**Fig S5.** SEM image of PGT membranes with different TETA content. a-d) Top surface and e-h) cross-sections morphology of the PGT-0/1/3/5, respectively;



**Fig S6.** Contact angles measured by water on PGT-0/1/3/5 membranes surfaces.

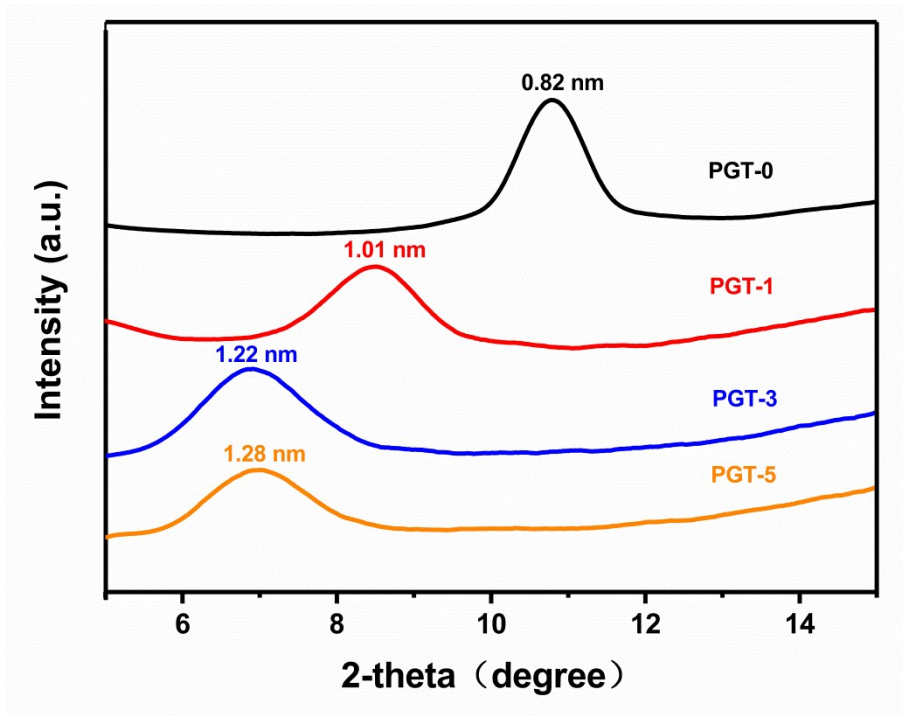
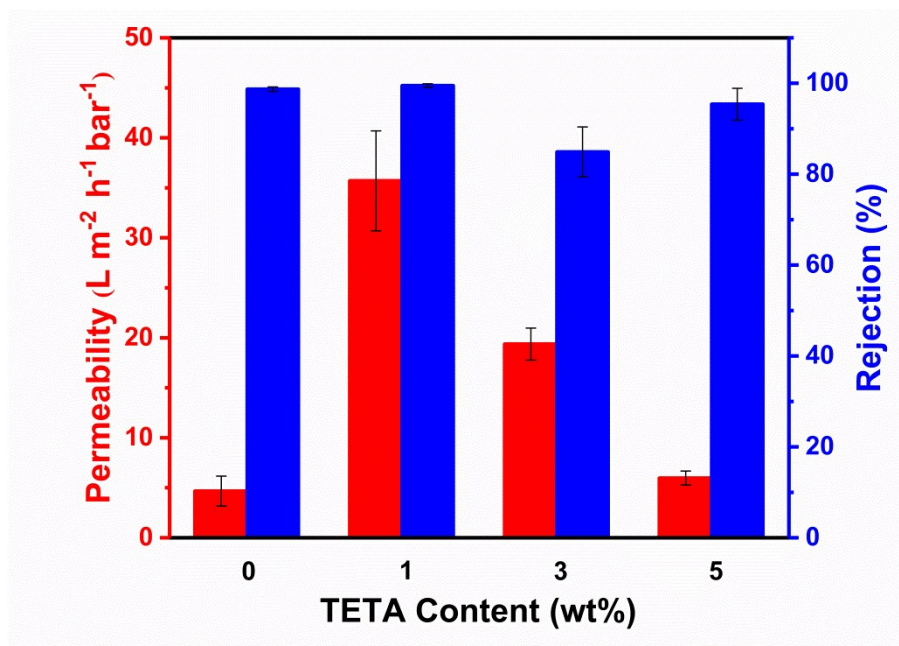
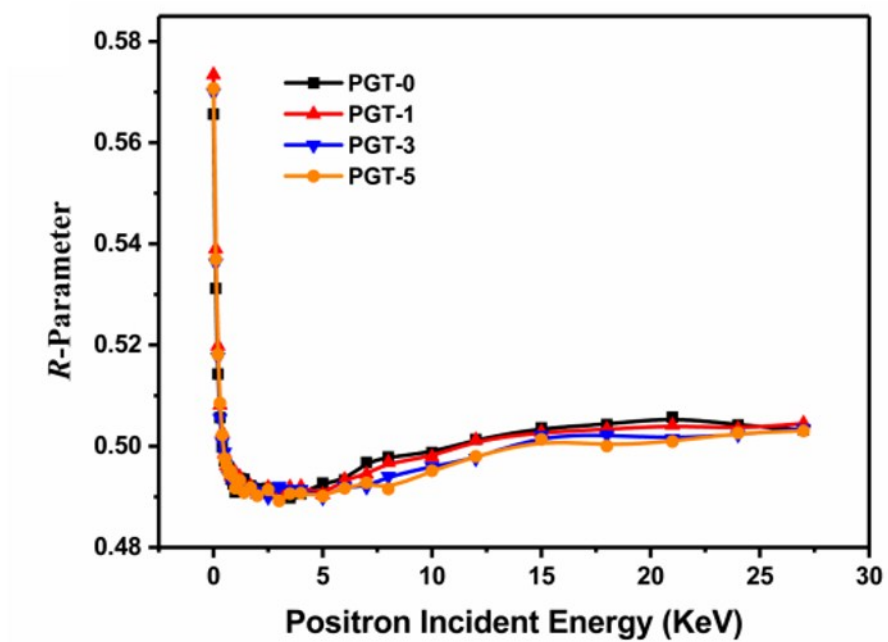


Fig S7. XRD spectra of the PGT-0/1/3/5 membranes.

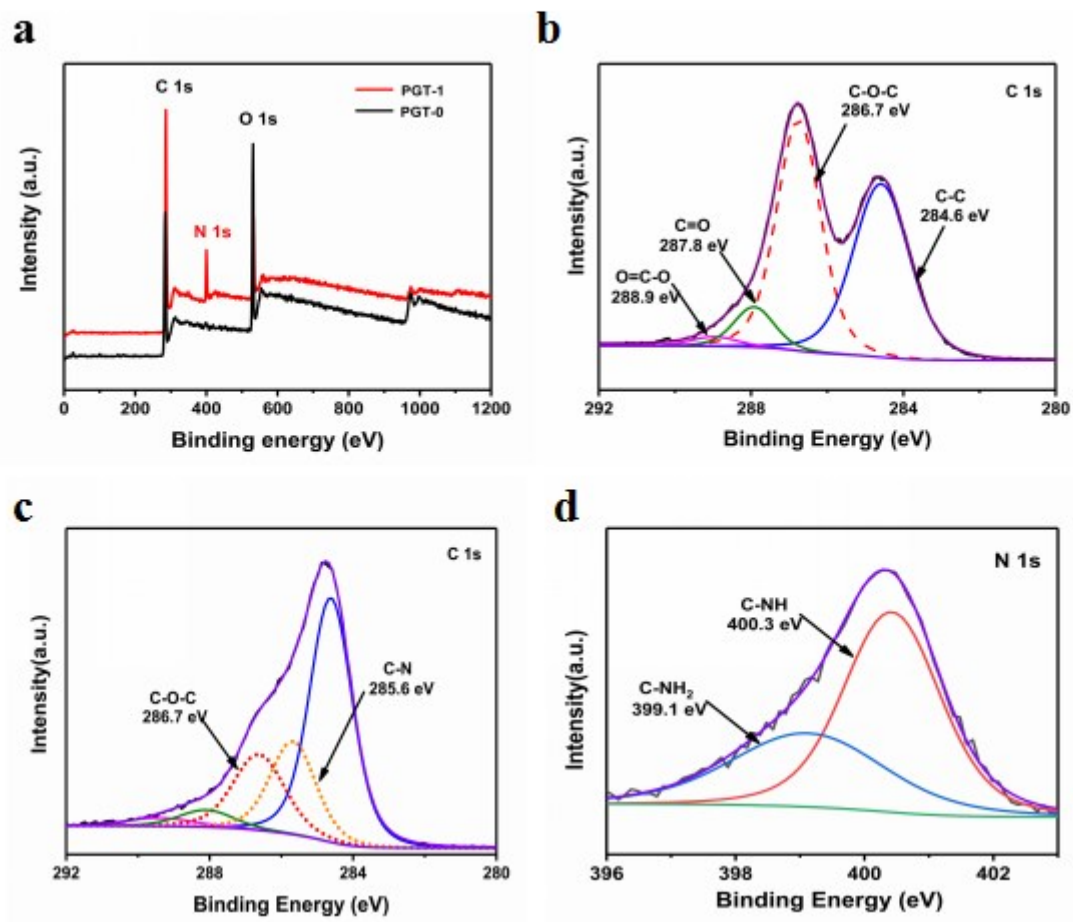




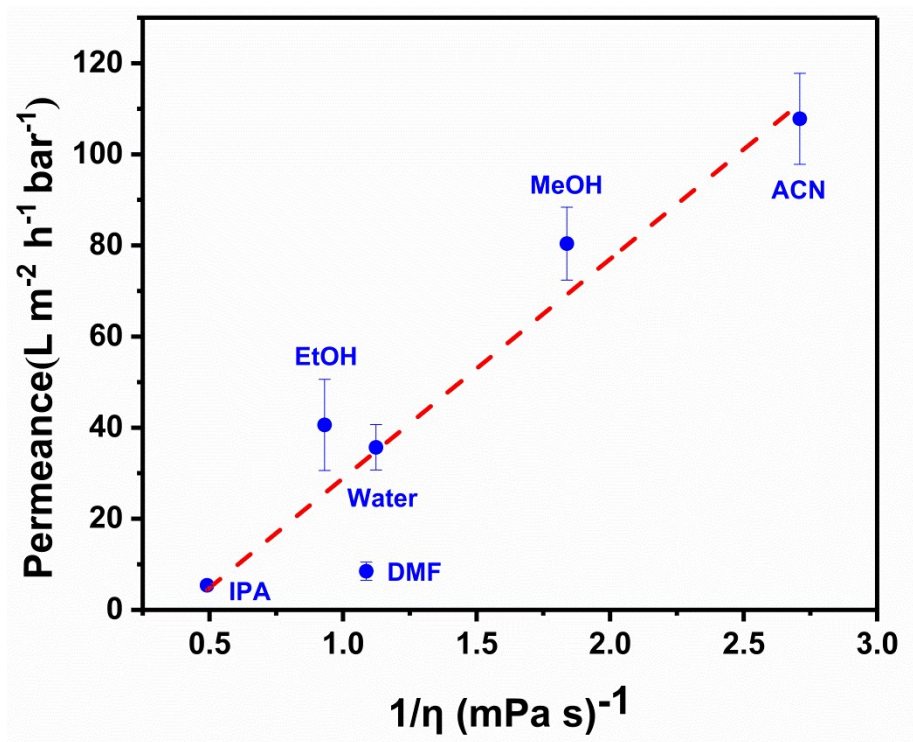
**Fig S8.** Pure water permeability and rejection of RBss molecules of PGT-0/1/3/5 membranes respectively.



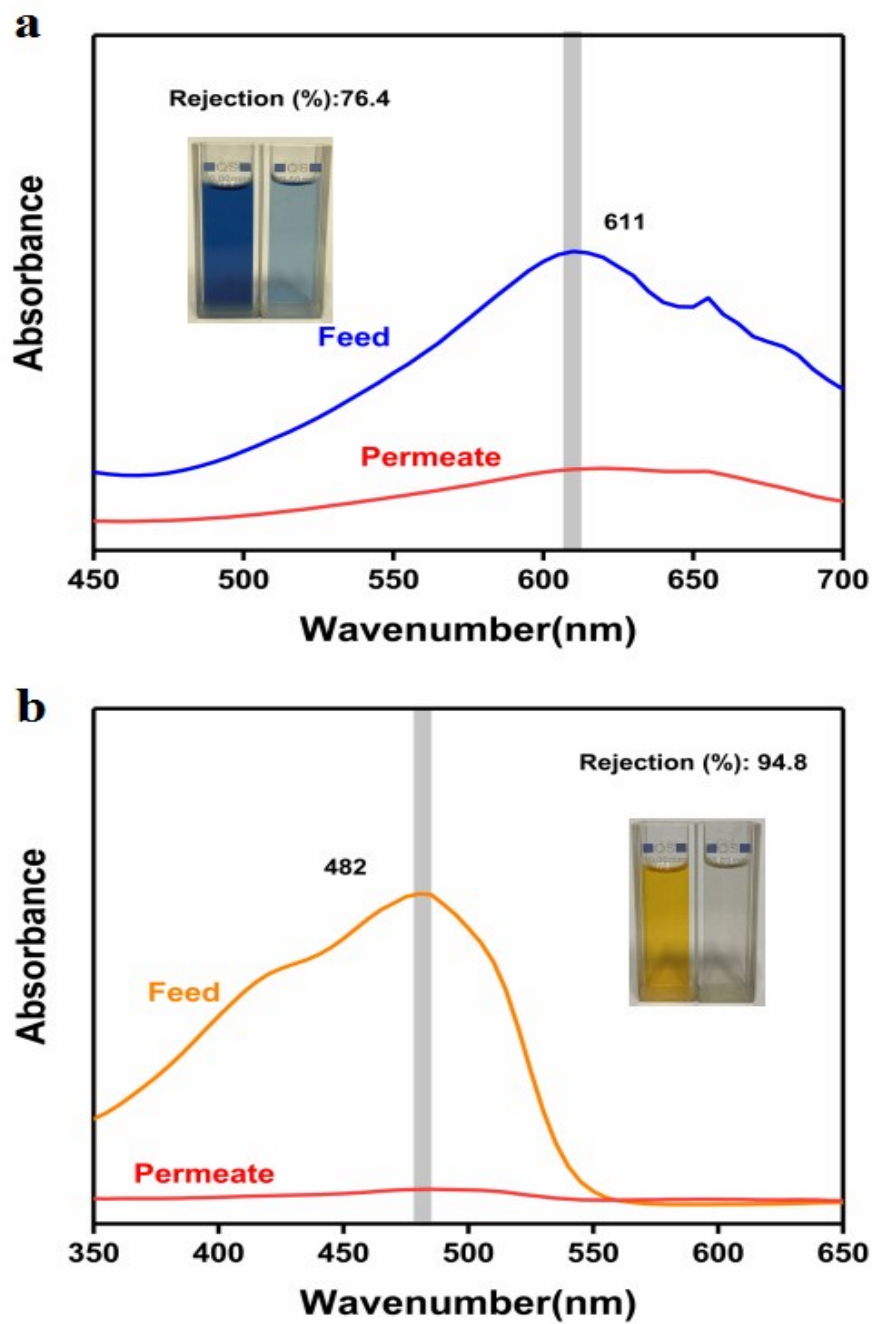
**Fig S9.** *R*-parameter as a function of positron incident energy of PGT-0/1/3/5 membranes respectively.



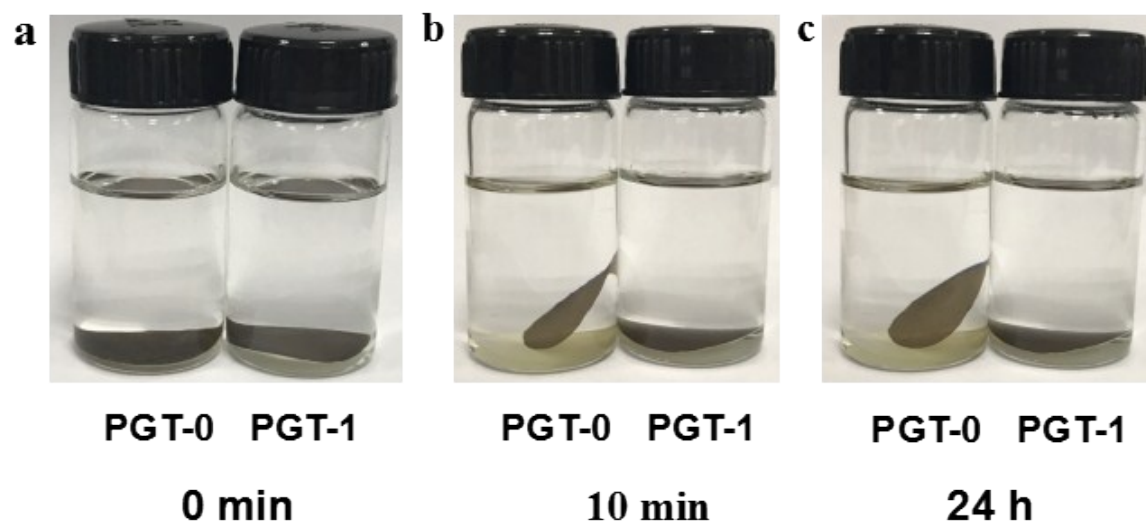
**Fig S10.** XPS spectra for synthesized GO membranes. a) The atomic concentration of PGT-0 and PGT-1 membrane. C 1s XPS spectra of the b) PGT-0 and c) PGT-1 membrane; d) N 1s XPS scan for PGT-1 membrane.



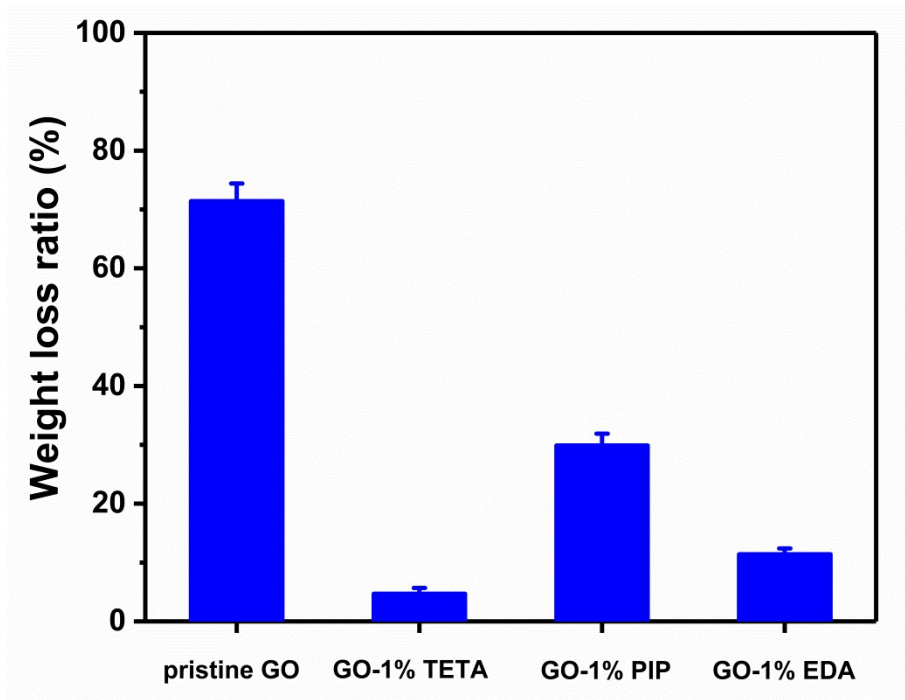
**Fig S11.** Permeance of pure organic solvents through PGT-1 membrane as a function of their inverse viscosity. Dashed line is a best linear fit.



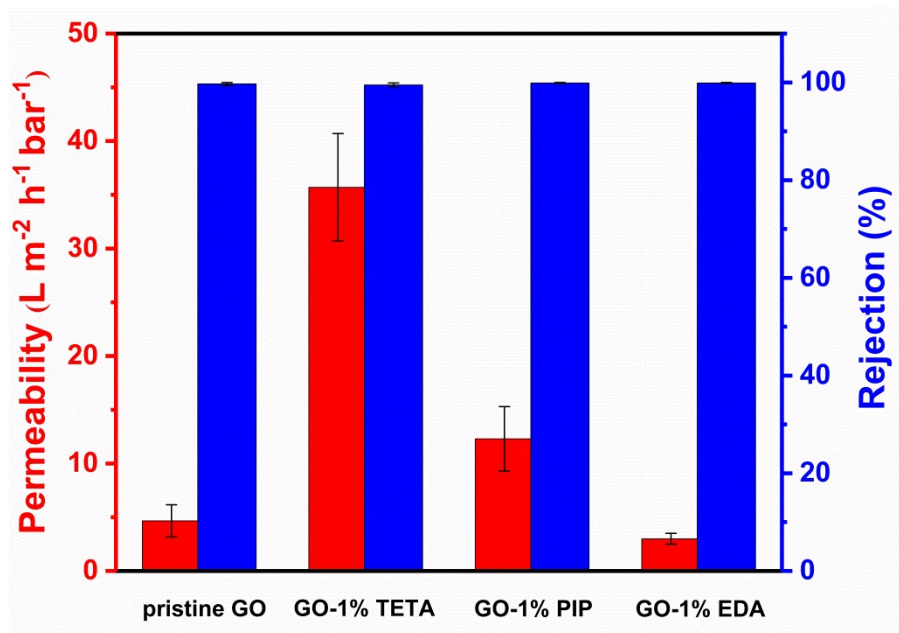
**Fig S12.** UV absorption spectra and (Inset) photographs of a) the 20ppm JGB/acetonitril, b) the 20ppm OII/acetonitril feed and permeate solutions.



**Fig S13.** Photographs of PI/GO and PI/GO-TETA membranes immersed in DMF for various durations: a) 0 min, b) 10 min, c) 24 h.

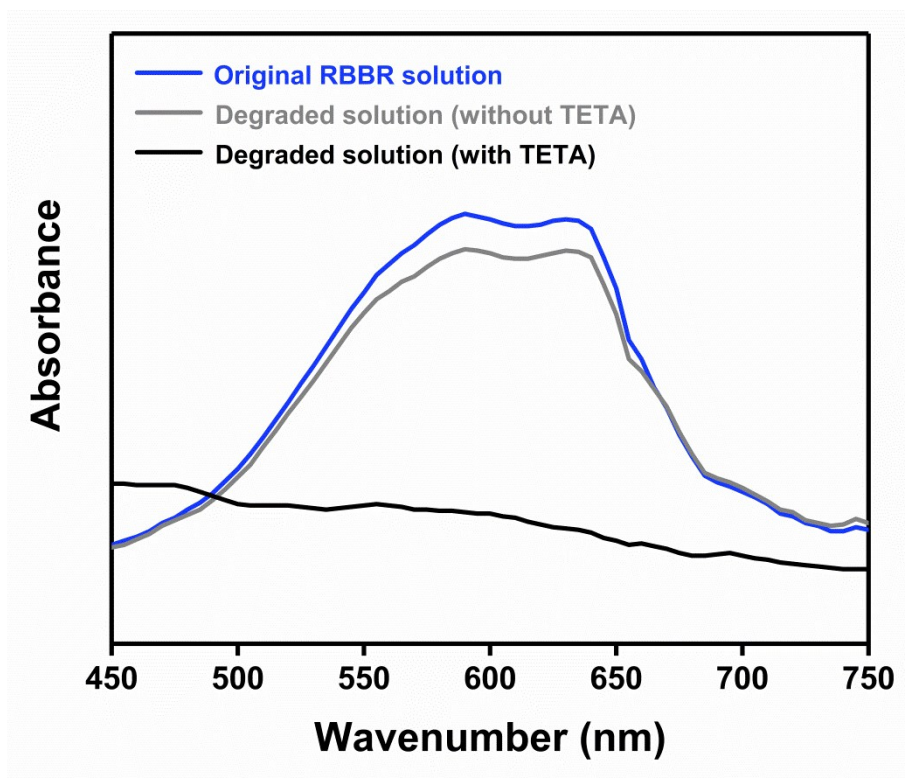


**Fig S14.** Weight loss ratio of different composite membranes immersed in DMF for 24h.

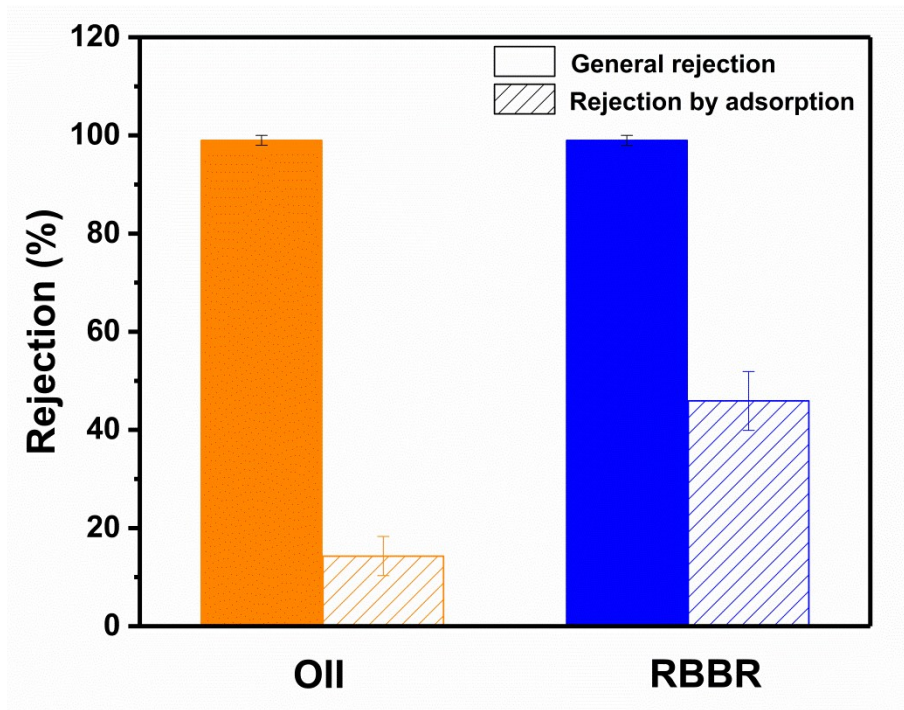


**Fig S15.** Water permeability and rejection of RBss molecules for different composite membranes.

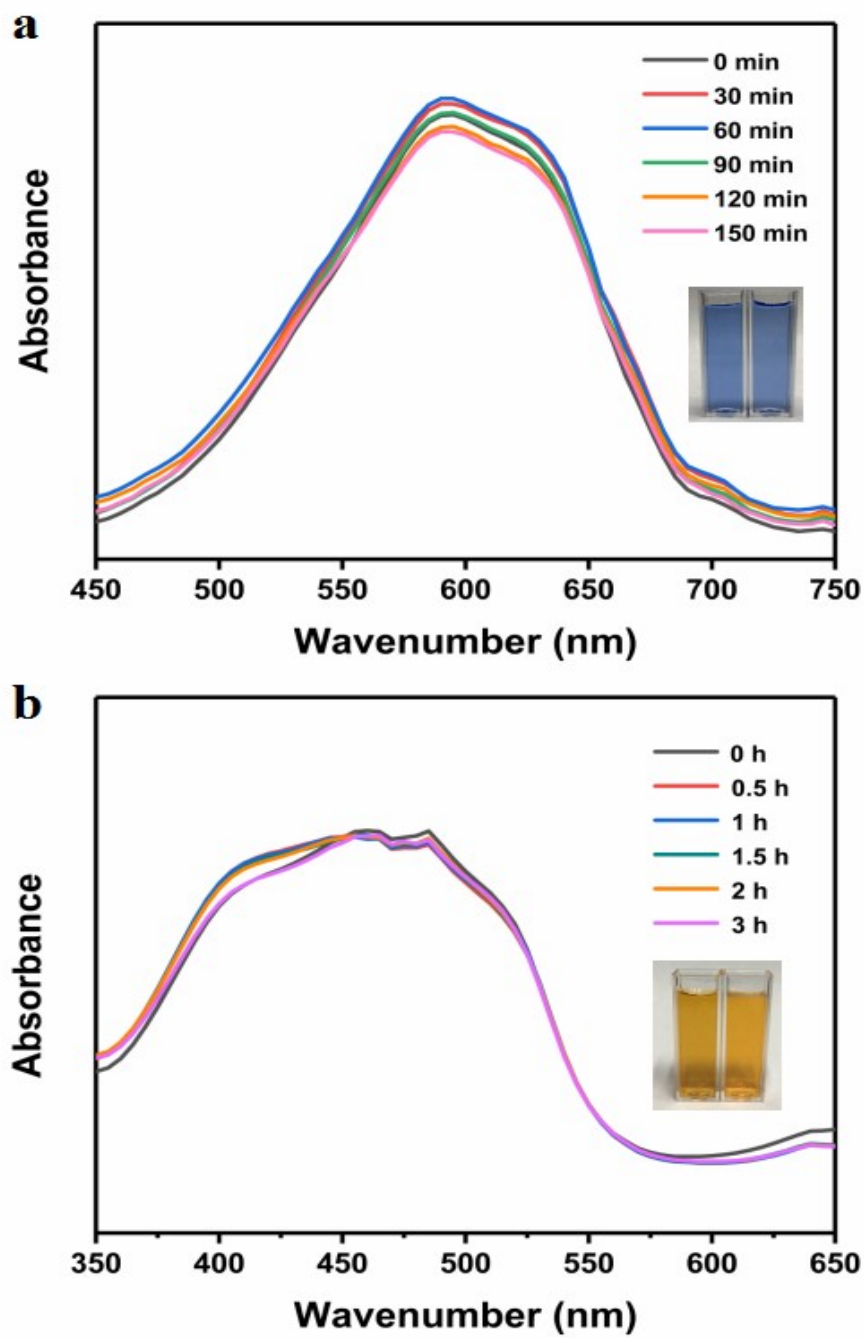




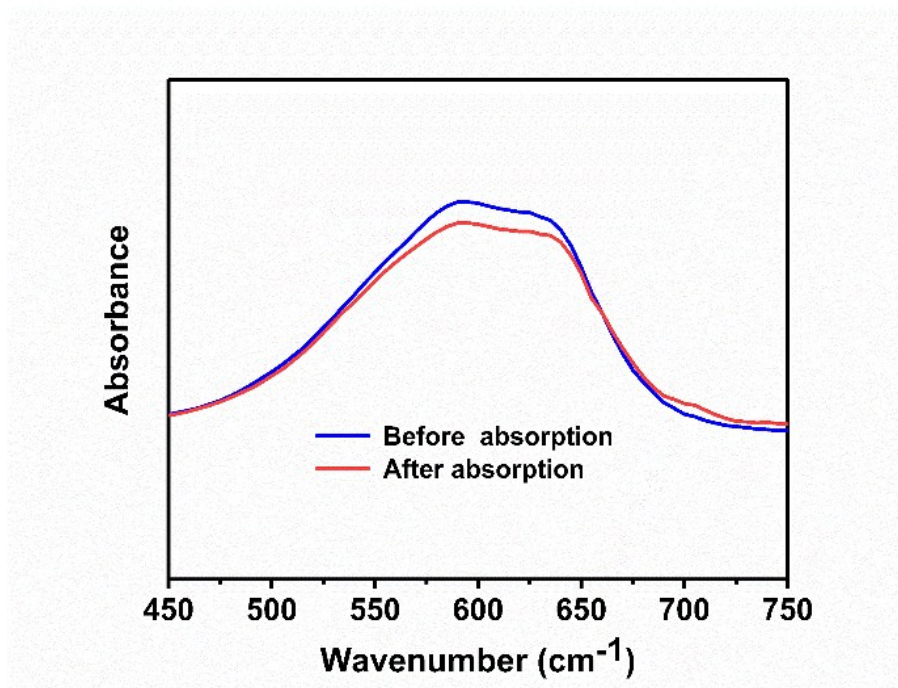
**Fig S16.** The degradation effect of TETA on RBBR solution. 1 ml TETA was added into 20 ml RBBR solution (20ppm). Then the mixed homogeneous blue solution was completely discolored only after being irradiated under a 500 W Xe lamp for 2 minutes, while the color of pure RBBR solution still maintain the original state.



**Fig S17.** The general and adsorption rejection of the PGT-1 membrane for the organic solutes (OII, RBBR) in water (under 4 bar of pressure).

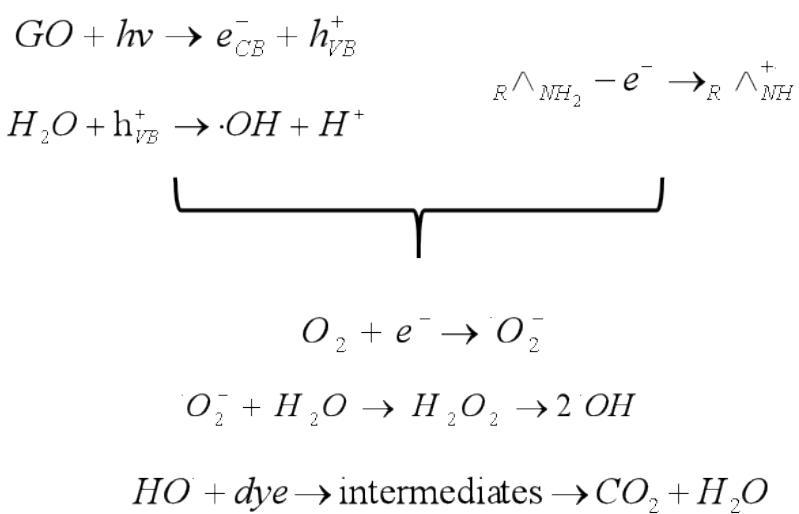


**Fig S18.** The UV spectra and color change (inset) after illuminating a) RBBR and b) OII without PGT membrane.

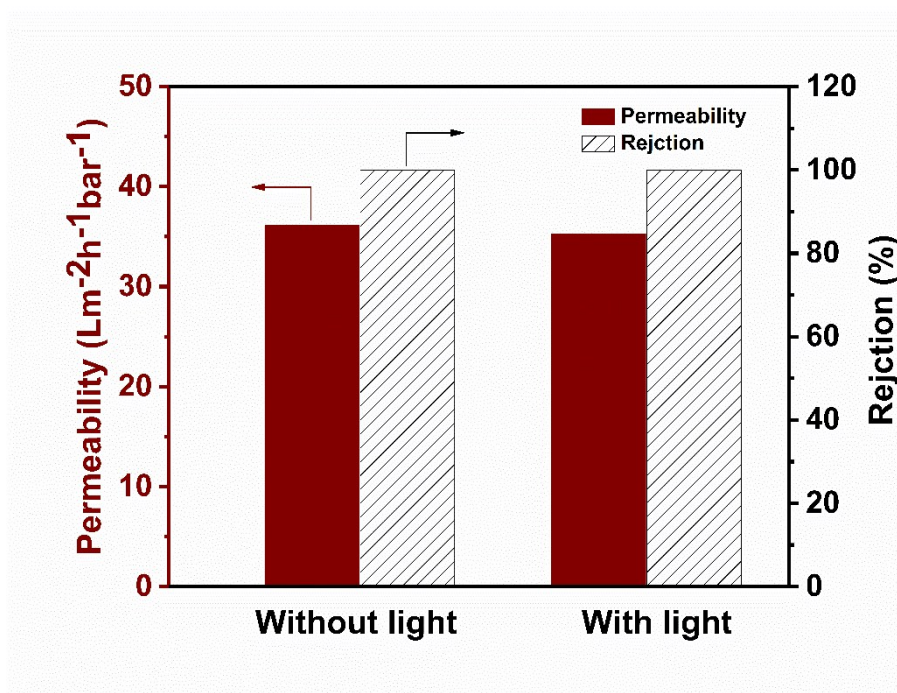


**Fig S19.** The adsorption effect of PGT-1 membrane on RBBR molecule in pure water. The UV spectra of 50 ppm RBBR solution before and after being placed with PTG-1 membrane in the dark up to 6 hours.

**mechanistic pathway 1:**      **mechanistic pathway 2:**



**Fig S20.** The proposed mechanism for degradation of dyes through photocatalytic.



**Fig S21.** Nanofiltration performance of the PGT-1 membrane with and without being illuminated under visible light.

**Table S1.** XPS analysis results of the atomic concentration of PGT-0 and PGT-1 membrane.

	C(%)	O(%)	N(%)	O/C(%)
PGT-0	69.3	30.7	0	44.3
PGT-1	80.6	10.2	9.2	12.6

**Table S2.** Physiochemical properties of selected organic solvents.

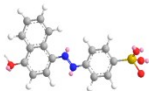


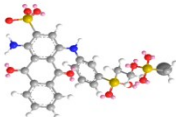
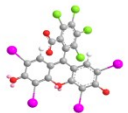
	<b>Viscosity (mPa.s)</b>	<b>Hansen solubility parameter(MPa<sup>1/2</sup>)</b>	<b>Kinetic diameter (nm)</b>	<b>polarity</b>
<b>ACN</b>	0.37	24.4	0.34	18
<b>MeOH</b>	0.54	29.7	0.38	12.3
<b>water</b>	0.89	47.8	0.27	16
<b>EtOH</b>	1.07	26.6	0.44	8.8
<b>DMF</b>	0.92	24.7	0.55	13.7
<b>IPA</b>	2.04	24.6	0.47	6.1

a) Solubility parameter of GO,  $\delta_{GO} = 25.4$  MPa<sup>1/2</sup>

b) Solubility parameter of P84,  $\delta_{p84} = 36.6$  MPa<sup>1/2</sup>



**Table S3.** Physicochemical properties of selected dye moleculars.

Dye name	Molecular formula	MW (gmol <sup>-1</sup> ) and charge characteristics	Molecular structure	Dimension (Å)
Orange II	C <sub>16</sub> H <sub>11</sub> N <sub>2</sub> NaO <sub>4</sub> S	350.32 ( -1 )		13.2×6.8×2.5
Rhodamine B	C <sub>28</sub> H <sub>31</sub> ClN <sub>2</sub> O <sub>3</sub>	479.01 ( +1 )		<b>15.5×11.4×5.8</b>
Janus Green B	C <sub>30</sub> H <sub>31</sub> ClN <sub>6</sub>	511.06 ( +1 )		<b>19.0×7.8×3.8</b>
Remazol Brilliant Blue R	C <sub>22</sub> H <sub>16</sub> N <sub>2</sub> Na <sub>2</sub> O <sub>11</sub> S <sub>3</sub>	626.54 ( -1 )		<b>17.9×9.9×2.9</b>
Rose Bengal sodium salt	C <sub>20</sub> H <sub>2</sub> Cl <sub>4</sub> I <sub>4</sub> Na <sub>2</sub> O <sub>5</sub>	1017.64 ( -2 )		<b>10.7×10.6×6.2</b>