Supplementary material

1. Experimental Section

The porosity (ε) was determined by gravimetric method and calculated by the following equation:

$$\varepsilon(100\%) = (W_w - W_d) / (\rho \times A \times L) \times 100$$

where W_w and W_d are the weight of wet and dry membrane (g), respectively; A is the effective area of the membrane (cm^2); ρ is the density of water; L is the wet membrane thickness (cm).

2. Figures and Tables

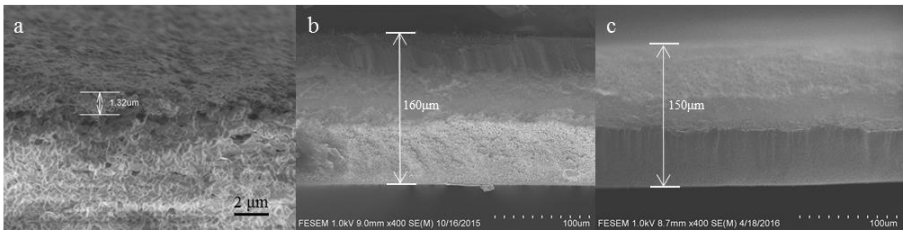

Fig. S1 Cross-section of the CNT-PVA selective layer (a), PVDF (b) and PES membrane (c).

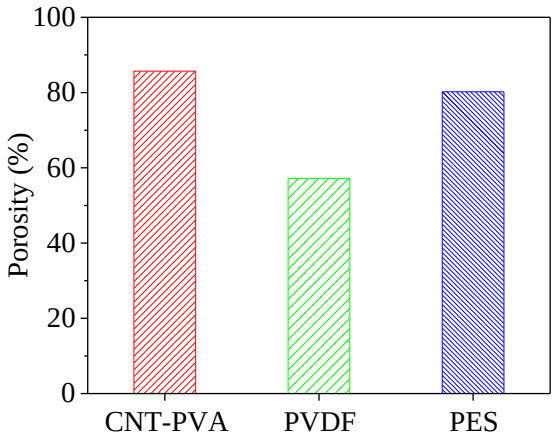

Fig. S2 The porosity of the CNT-PVA selective layer, PVDF and PES membrane.

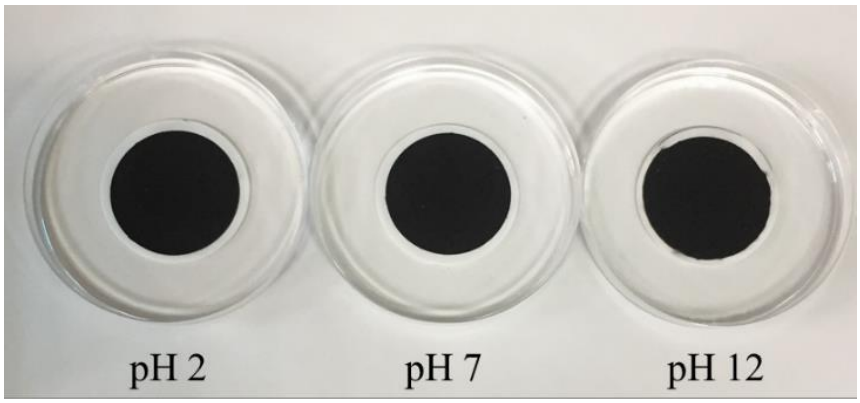

Fig. S3 CNT-PVA membrane is stable in acid, neutral and basic solution for at least 21 days.

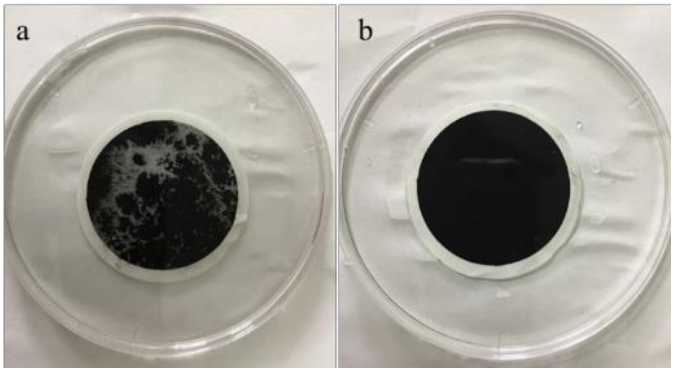

Fig. S4 After ultrasonic treatment: (a) CNT-PVA membrane without crosslinking and (b) CNT-PVA membrane with crosslinking.

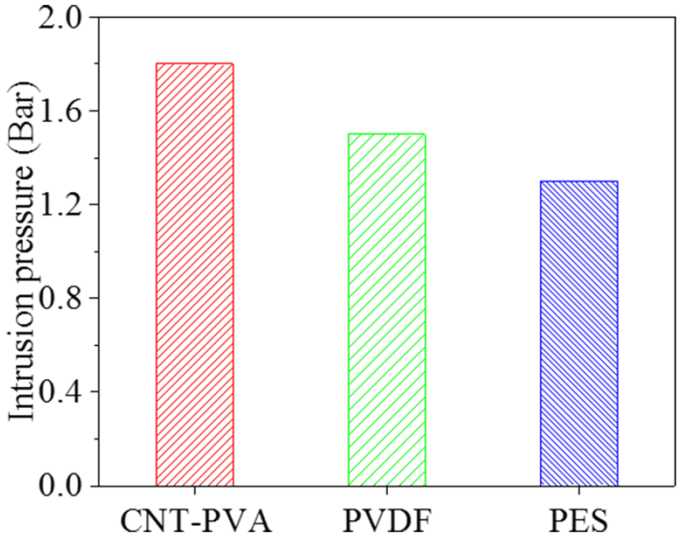

Fig. S5 The intrusion pressure of the CNT-PVA selective layer, PVDF and PES membrane.

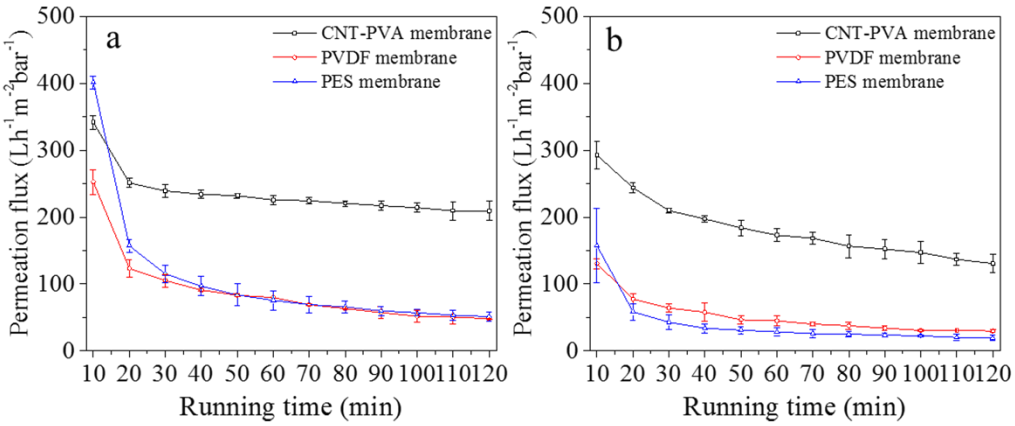

Fig. S6 Permeation flux for filtration of soybean oil-in-water emulsion under the pressure of 0.2 bar (a) and 0.5 bar (b), respectively.

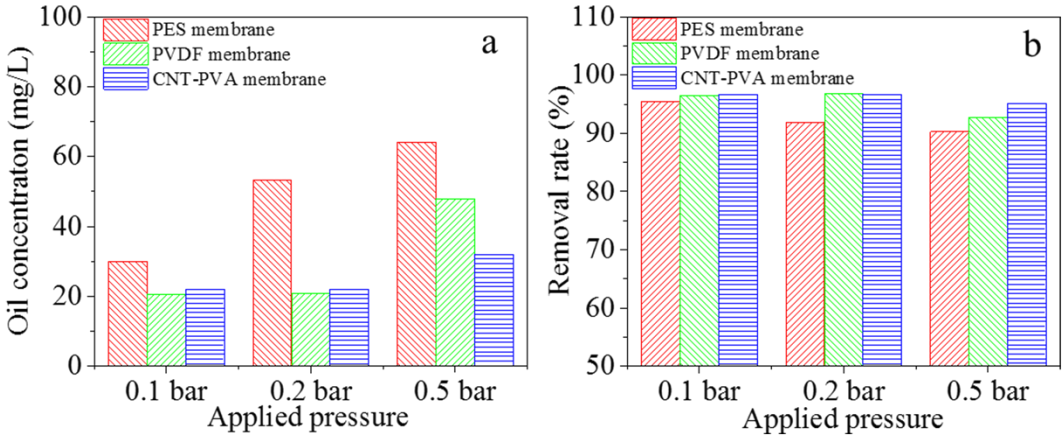

Fig. S7 Oil concentration in filtrate (a) and oil retention rate (b) of CNT-PVA membrane, PVDF membrane and PES membrane for filtration of soybean oil-in- water emulsion under different pressures.

Table S1 Comparison of the performance of CNT-PVA membrane with other membranes in previous reports

Membrane	Pore size (nm)	Oil concentration	Water permeability ($L/m^2/h/bar$)	Rejection rate (%)	Reference
Modified PES	70	200 ppm	770	99	[1]
Modified PVDF	136	500 ppm	20	99	[2]
Modified PS	680	1:99 (V/V)	500	99	[3]
Ceramic	200	30 ppm	300	95	[4]
Modified PES	80	1000 ppm	570	99	[5]
CNT-PVA	130	640 ppm	4200	97	This work

References

1. Prince J A, Bhuvana S, Anbharasi V, Ayyanar N, Boodhoo K V K, Singh G (2016). Ultra-wetting graphene-based PES ultrafiltration membrane–A novel approach for successful oil-water separation. Water Res, 103: 311-318

2. Zhu X, Tu W, Wee K-H, Bai R (2014). Effective and low fouling oil/water separation by a novelhollow fiber membrane with both hydrophilic and oleophobic surface properties. Journal of Membrane Science, 466: 36-44

3. Gao Q-L, Fang F, Chen C, Zhu X-Y, Li J, Tang H-Y, Zhang Z-B, Huang X-J (2016). A facile approach to silica-modified polysulfone microfiltration membranes for oil-in-water emulsion separation. RSC Advances, 6(47): 41323-41330

4. Abadi S R H, Sebzari M R, Hemati M, Rekabdar F, Mohammadi T(2011). Ceramic membrane performance in microfiltration of oily wastewater. Desalination, 265(1-3): 222-228

5. Jamshidi Gohari R, Halakoo E, Lau W J, Kassim M A, Matsuura T, Ismail A F (2014). Novel polyethersulfone (PES)/hydrous manganese dioxide (HMO) mixed matrix membranes with improved anti-fouling properties for oily wastewater treatment process. RSC Adv., 4(34): 17587-17596