Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting information

Evaluation of membrane performance

Permeation fluxes of membranes were obtained as follows:

$F=V/(S\times t)$ (1)

where F is the permeation flux of membrane ($L/(m^2\ h)$), V is the volumetric flow rate of permeate (L), S is the active area of membrane (m^2), and t is the time (h).

PEG-20000 rejection of membrane was defined as:

$R(\%)=(1-C2/C1)\times 100$ (2)

where R is the PEG-20000 rejection, and $C1$, $C2$ represent PEG-20000 concentrations in the feed and permeate, respectively. The $C1$ and $C2$ were determined through the absorbance at 510 nm after iodine staining, which has been pre-calibrated as shown in fig. S6.

Volume fraction of CNTs inside the composite membrane

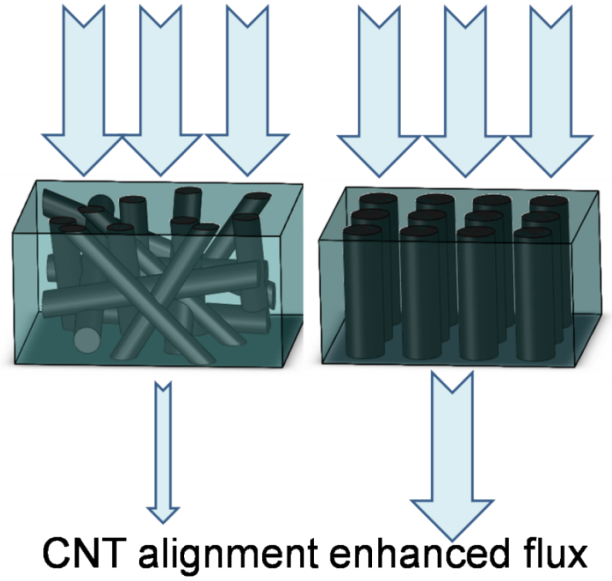
Based on the SEM images we estimated the density of the CNT array around $1\times10^{10} \pm 5\times10^{9}$ cm^{-2}. Therefore the volume fraction of CNT array in the membrane is calculated to be $1.8\%\pm0.9\%$.($CNT\%=1\times10^{10}\times3.14\times R^2_{CNT}$)

Porosity measurement

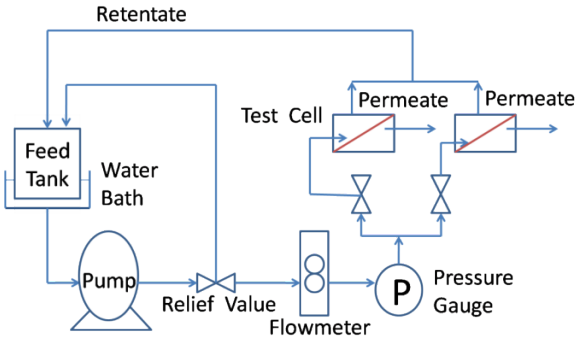
The membrane maintained in distilled water was weighed after mopping superficial water with filter paper. Then the wet membrane was placed in an air-circulating oven at 60 °C for 24 h and then further dried in a vacuum oven at 80 °C for 24 h before measuring the dry weight. From the two weights (wet sample weight and dry sample weight), the porosity of membrane was calculated using formula (3) as

$P=(Q2-Q1)/\rho AH$ (3)

P is the porosity of the PES membrane
Q2 is the wet sample weight (g)
Q1 is the dry sample weight (g)
ρ is the density of water (g/cm^3)
A is the surface of the membrane (cm^2)
H is the thickness of the membrane (cm)



Scheme S1 Schematic representation of the enhanced water transportation in different CNT blended membrane



Scheme S2 Schematic diagram of the device for the permeation tests.

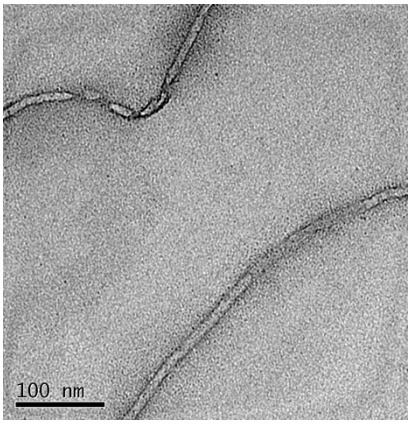


Figure S1 TEM images of as-prepared CNTs through conventional CVD methods

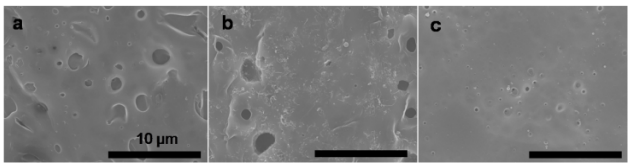


Figure S2 SEM images of the surface morphology of three type of CNT/PES membranes: a) VA-CNT/PES, b)R-CNT/PES, c) Pure PES

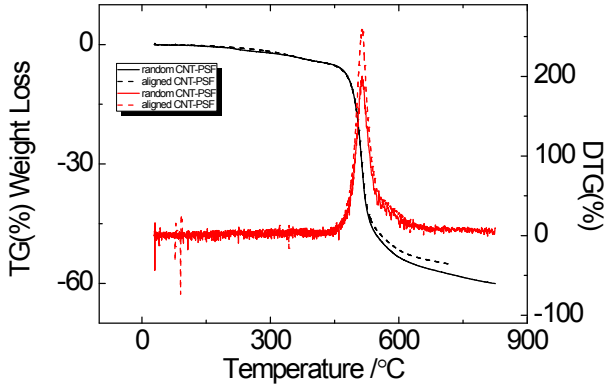


Figure S3 TGA (black curves) and SDT (red curves) analysis of R-CNT/PES film (solid curve) and VA-CNT/PES film (sdot line)

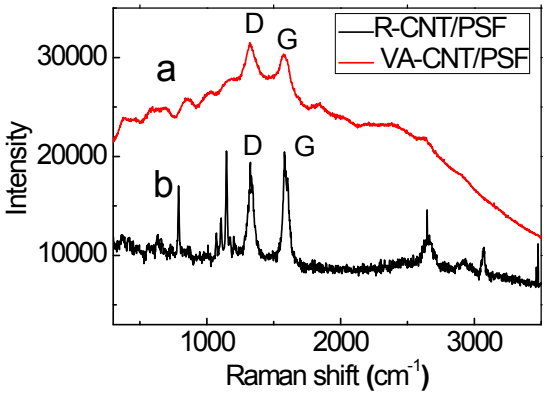


Figure S4 Raman spectra of the blend membrane composed of VA-CNT/PES (a) and R-CNT/PES (b)

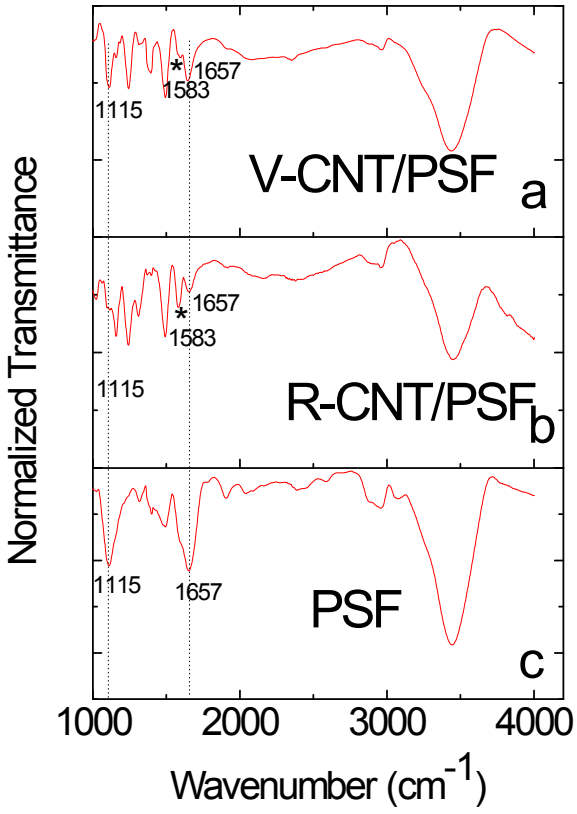


Figure S5 FT-IR spectra of the blend membrane composed of (a) VA-CNT/PES, (b)R-CNT/PES and (c)pure PES film

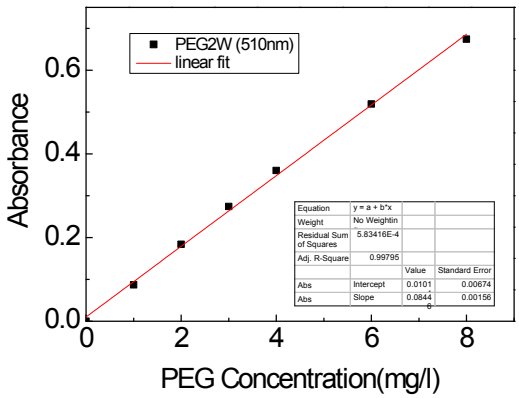


Figure S6 Standard curves of PEG 20000 with the iodine staining