Supplementary Materials

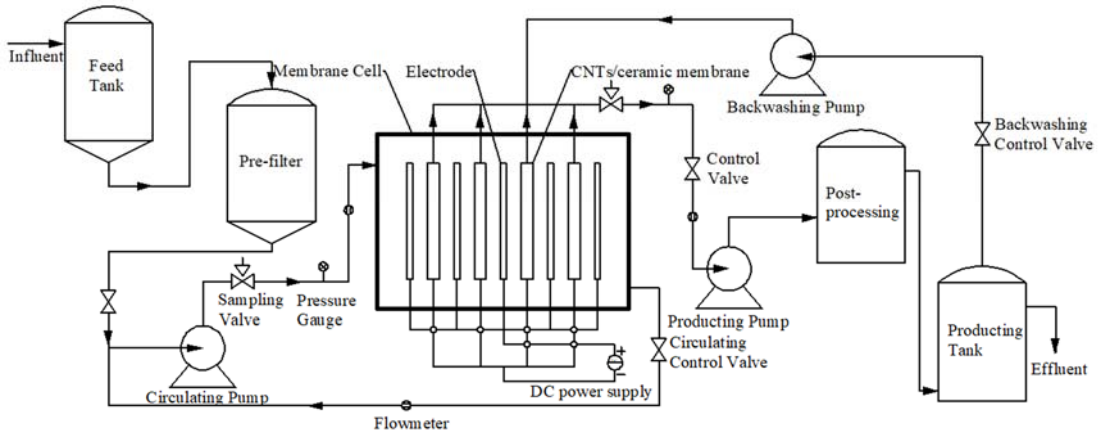

Fig. S1 Schematic diagram of the CNTs-Flat sheet ceramic membrane experimental set-up

Fig. S2 The digital picture of cross-linked and non-cross-linked CNTs/ceramic membrane after 30 min ultrasonic shock

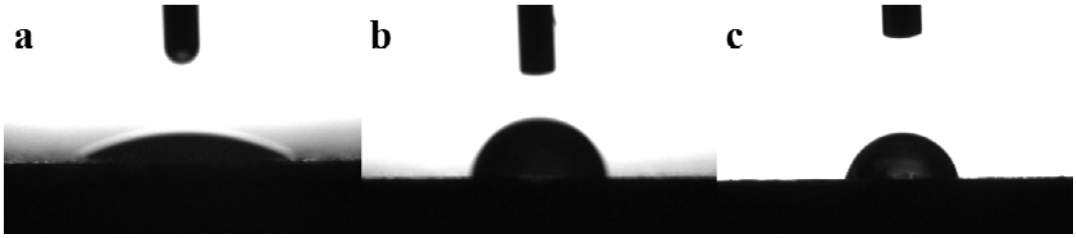

Fig. S3 Pure water contact angles of (a) pristine ceramic membrane (b) CNTs/ceramic membrane before heat treatment (c) CNTs/ceramic membrane after heat treatment

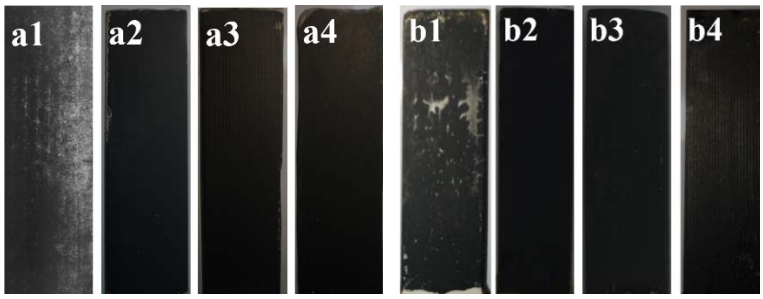

Fig. S4 (a) the digital picture of 2, 4, 8 and 16 g/m^2 CNTs loadings fabricated CNTs/ceramic membranes, (b) the digital picture of 10, 20, 40 and 60 min cross-linking time fabricated CNTs/ceramic membranes after ultrasonic shock

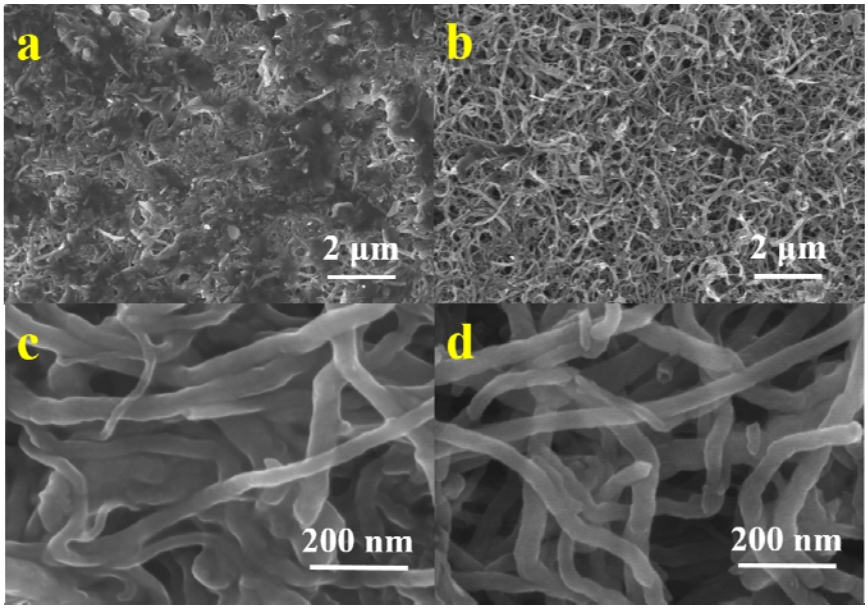

Fig. S5 SEM image of CNTs/ceramic membrane (a) (c) before heat treatment and (b) (d) after heat treatment

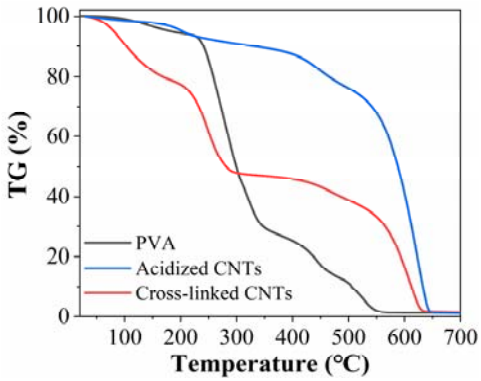

Fig. S6 Thermogravimetric curve (TG) of PVA, CNTs and CNTs/ceramic membrane

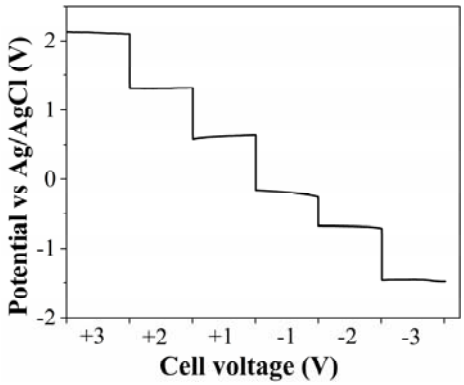

Fig. S7 Open circuit voltage of different operating voltage

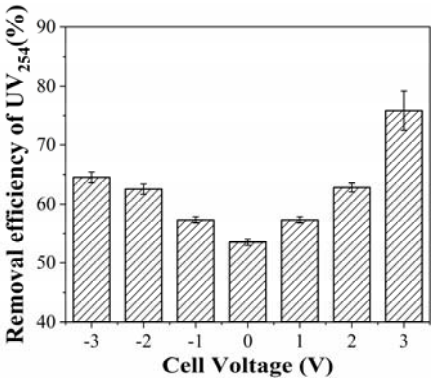

Fig. S8 Removal efficiency of UV_{254} at different applied cell voltages

Table S1 Parameters of the reservoir water

Parameters	Values
TOC (mg/L)	14.65
pH	6.85
Turbidity (NTU)	3.65
Temperature (℃)	5.40
Total bacteria (CFU/L)	$> 1.90 \times 10^5$
Conductivity (μS/cm)	615.00
Zeta potential (mV)	–24

The energy consumption was calculated by:

$$E = \frac{P_e}{Q} \quad \text{(S1)}$$

where E is the energy consumption of the filtration process (kWh/m^3), P_e is the rate power of electro-assisted membrane filtration equipment (kW), Q is the water production of different membranes (m^3/h).

The rated power of the electro-assisted membrane filtration equipment without DC power supply is 0.19 kW. The water production of CNTs/ceramic membrane without electro-assistance and the commercial membrane are 0.22 and 0.07 m^3/h, respectively. So the energy consumption is 0.89 and 2.59 kWh/m^3, respectively. The average power of the DC power supply is 0.11 kW. The rated power of the electro-assisted membrane filtration equipment with DC power supply is 0.30 kW. The water production of CNTs/ceramic membrane with electro-assistance is 0.39 m^3/h, so the energy of CNTs/ceramic membrane with electro-assistance is 0.77 kWh/m^3.