Supplementary Captions

Figure S1. Experimental setup of the direct contact membrane distillation.

Figure S2. The effect of operating conditions on the permeate flux and the interception of COD_{Cr} (a) effect of feed temperature; (b) effect of cross flow velocity; (c) effect of membrane pore size.

Figure S3. Location of feed water sample collection for MD operation. Qinhuai River, 118°45'0.4163" E, 32°3'32.5808" N; Xuanwu Lake, 118°47'28.4567" E, 32°4'21.6073" N.

Figure S4. Sampling sites of membrane depositions for 3D-EEM analysis.

Figure S5. The SEM-EDS analysis of virgin PTFE membrane. (a) The SEM morphology of membrane surface; (b) The EDS membrane surface analysis.

Figure S6. Rarefaction curves of bacterial communities in initial feed solutions and MD-membrane biofilms. (Q-Initial represented the microbial community in initial Qinhuai River water; Q-24 h, Q-96 h and Q-360 h represented the microbial community in 24 h, 96 h and 360 h developed biofilms during the MD treatment of Qinhuai River water, respectively; X-Initial represented the microbial community in initial Xuanwu Lake water; X-24 h, X-96 h and X-360 h represented the microbial community in 24 h, 96 h and 360 h developed biofilms during the MD treatment of Xuanwu Lake water, respectively.)

Figure S7. Experimental setup for the temperature measurement of membrane surface during the membrane distillation operation process.

Table S1 Detail characteristics of the DCMD membrane.

Figure S1

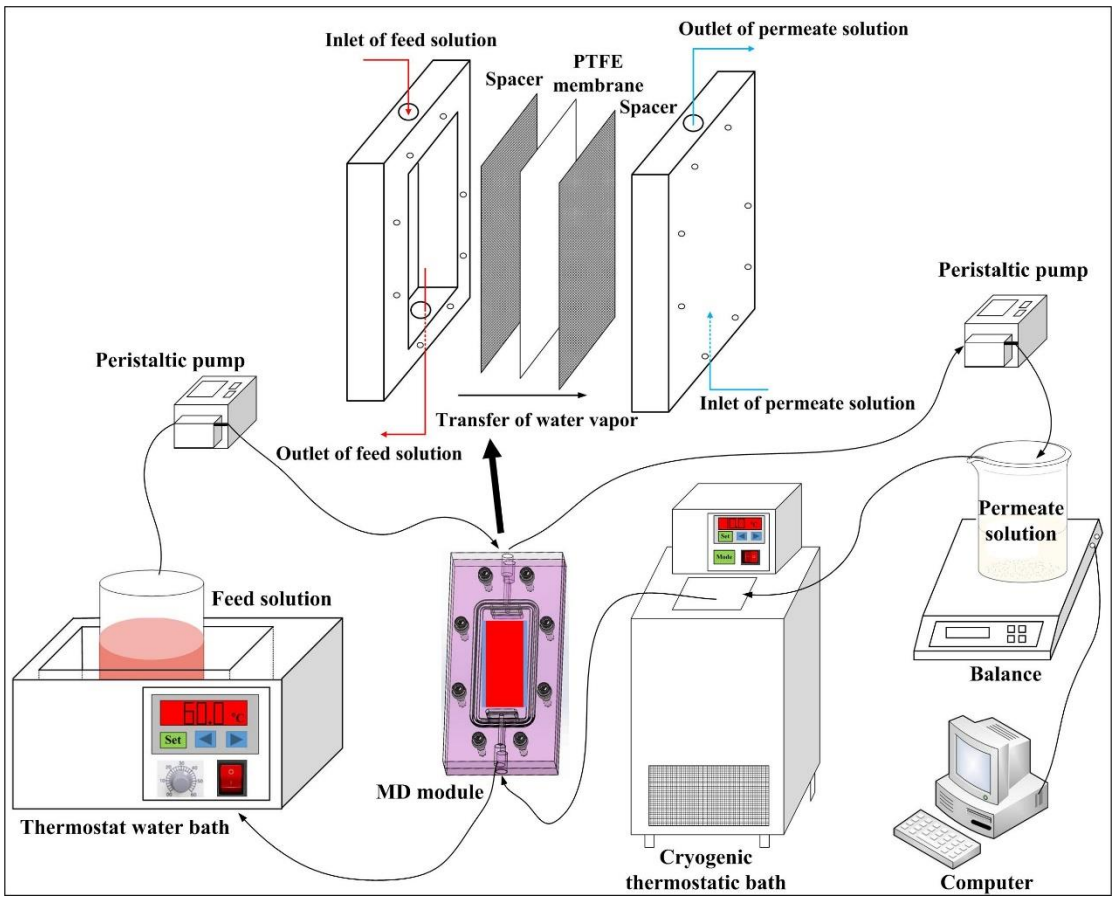

Figure S1. Experimental setup of the direct contact membrane distillation.

Figure S2

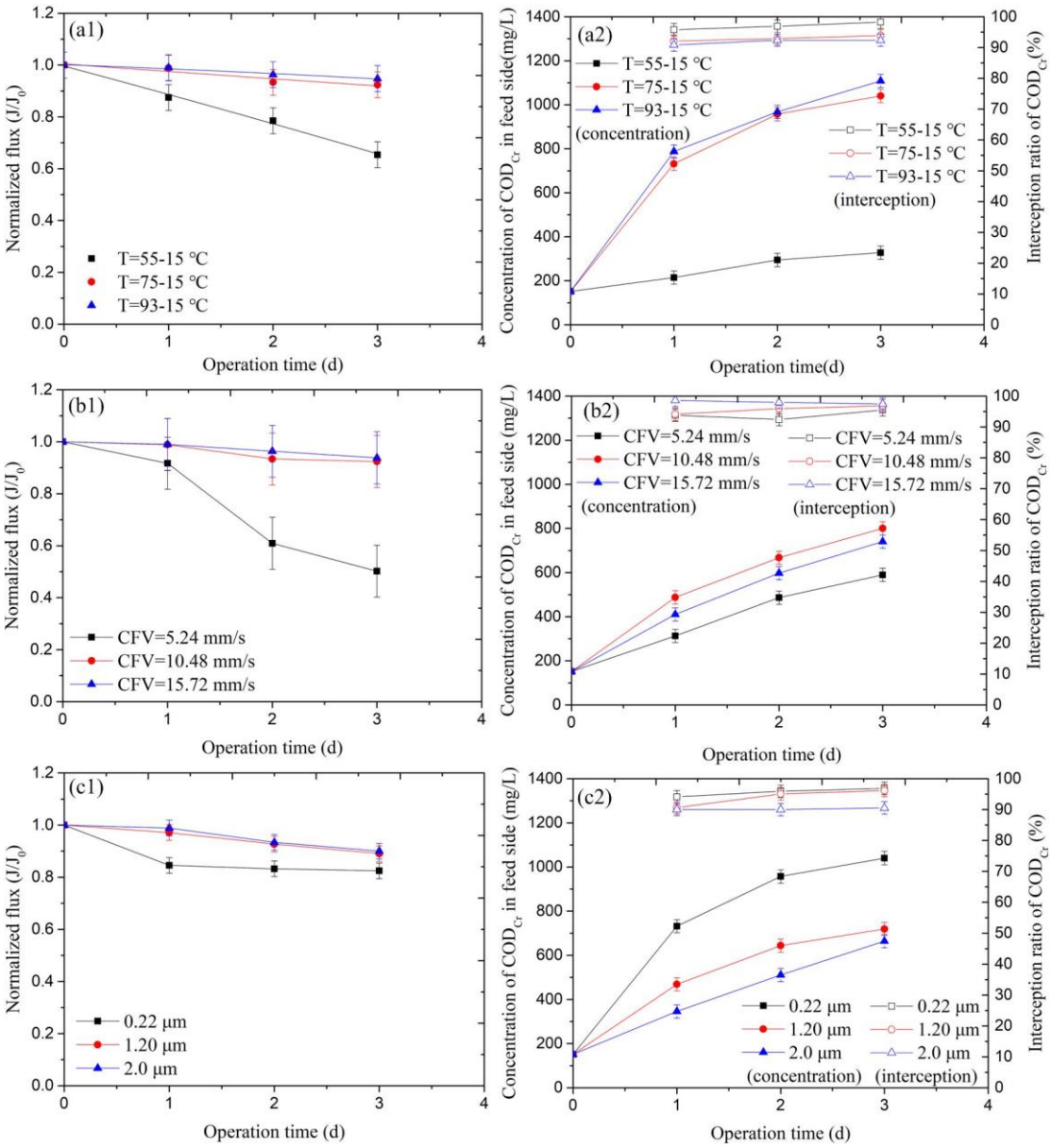

Figure S2. The effect of operating conditions on the permeate flux and the interception of COD_{Cr} (a) effect of feed temperature; (b) effect of cross flow velocity; (c) effect of membrane pore size.

In our previous study, the effects of DCMD operating conditions on the treatment efficiency for AnMBR effluent were detailedly investigated, and the main results are presented in Fig.S2. Three main operating conditions, including temperature difference,

cross-flow velocity and membrane pore size, were considered in that study. The temperature of permeate side was maintained at 15 ^{o}C, and that of feed side was set at 55, 75 and 93 ^{o}C, respectively. Additionally, the cross-flow velocity was set at 5.24, 10.48 and 15.72 mm·s^{-1} by changing the rotate speeds of peristaltic pumps, respectively. Furthermore, three different membrane pore sizes were studied, that were 0.22, 1.20 and 2.00 μm, respectively. As shown in Fig.S2, it can be observed that higher temperature difference and cross-flow velocity, as well as lower membrane pore size would be help to maintain the flux at a relatively higher level for a period of time. Temperature difference of 75/15 ^{o}C, cross-flow velocity with 10.48 mm·s^{-1} and membrane pore size with 0.22 μm was seemed to be a better choice for a longer term of membrane distillation.

Figure S3

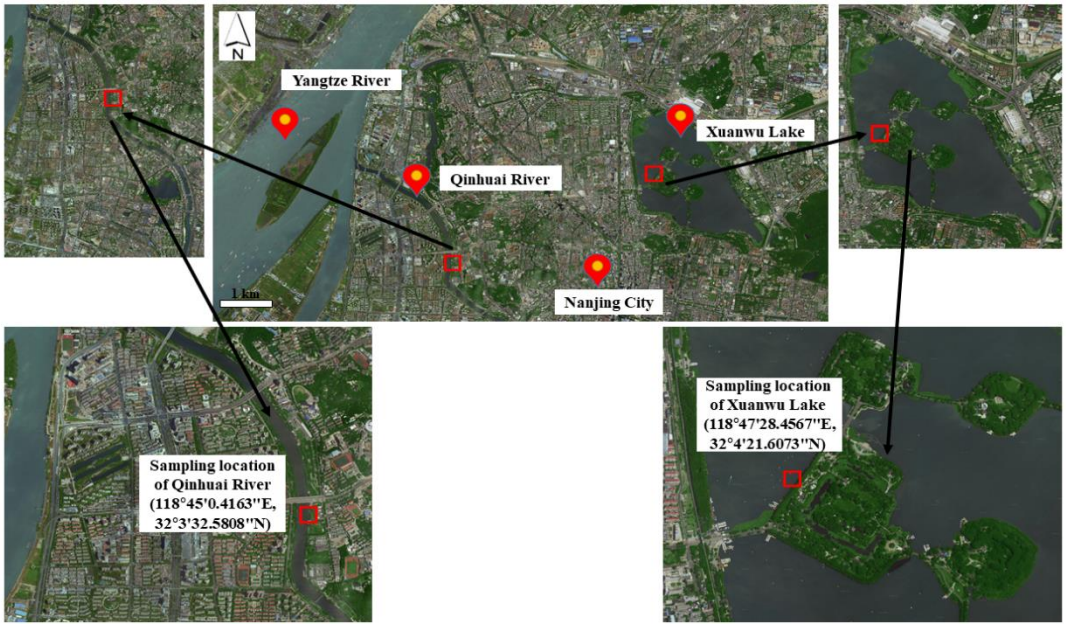

Figure S3. Location of feed water sample collection for MD operation. Qinhuai River, 118°45'0.4163" E, 32°3'32.5808" N; Xuanwu Lake, 118°47'28.4567" E, 32°4'21.6073" N.

Figure S4

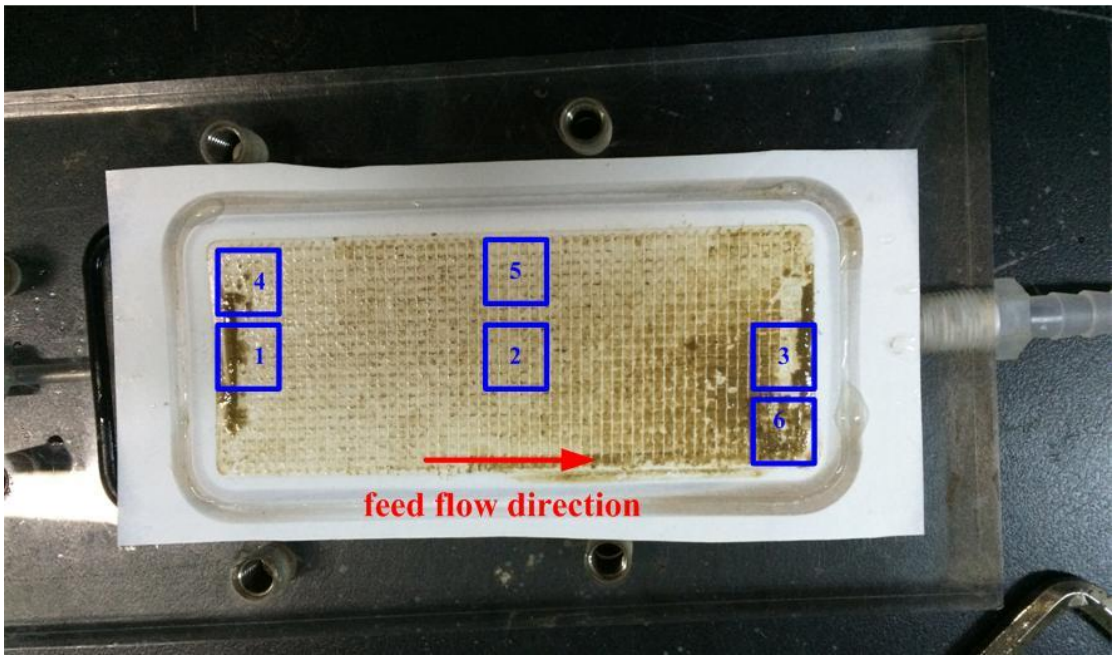

Figure S4. Sampling sites of membrane depositions for 3D-EEM analysis.

To avoid the error causing by the different sampling areas on the membrane, six pieces of fouled membrane disk (area of around 1.0 cm^2 for each disk) were cut from different areas of fouled membrane basing on the flow regime characteristics near the membrane surface.

Additionally, the EEM spectra could be divided into six regions: (I) tyrosine region with Ex/Em=200 – 250/280 – 330 nm, (II) tyrosine-like protein region with Ex/Em=250 – 450/280 – 330 nm, (III) tryptophan region with Ex/Em=200 – 250/330 – 400 nm, (IV) tryptophan-like protein region with Ex/Em=250 – 450/330 – 400 nm, (V) fulvic acid-like region with Ex/Em=200 – 250/400 – 560 nm, and (VI) humic acid-like region with Ex/Em=250 – 450/400 – 560 nm.

Figure S5

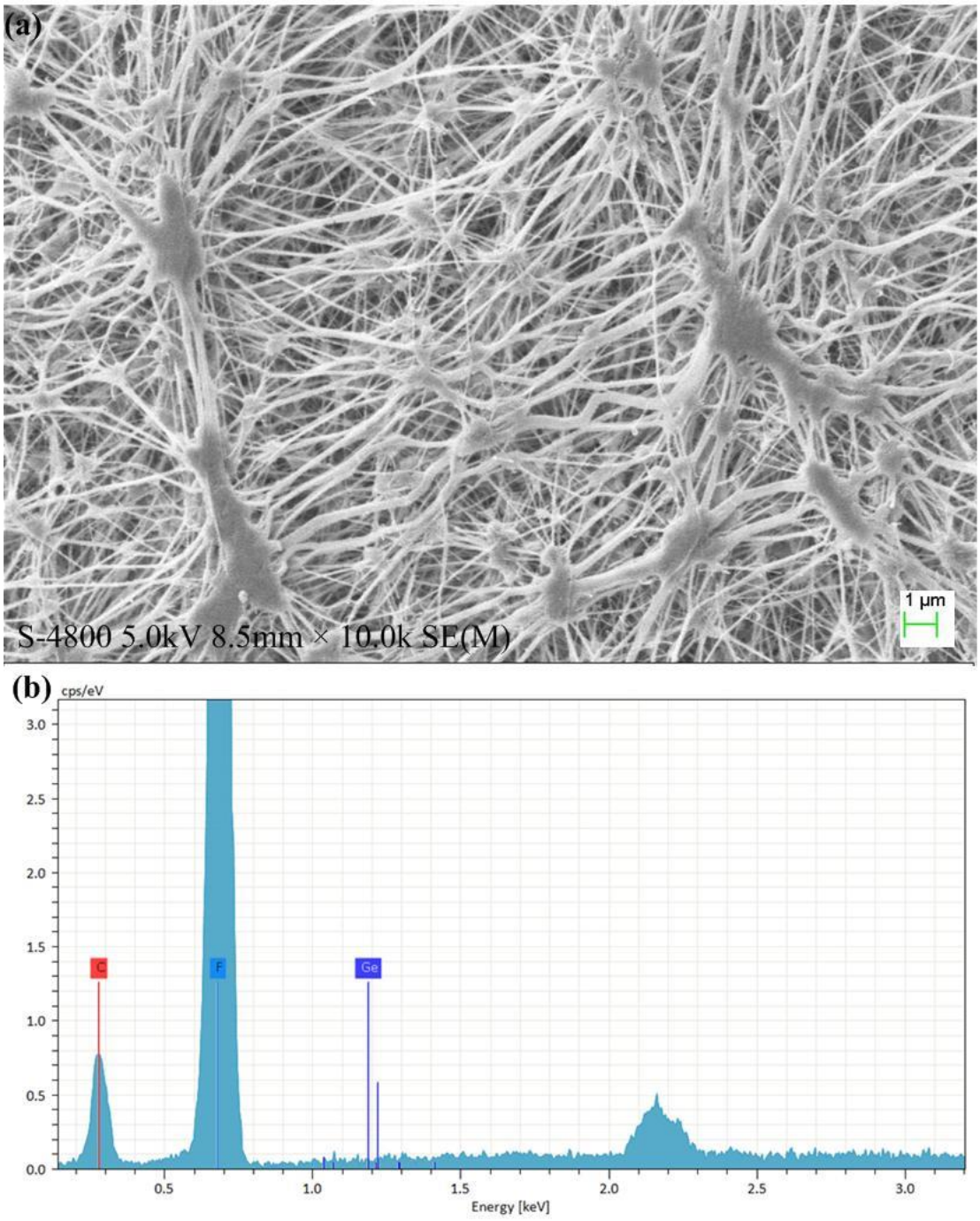

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Figure S6

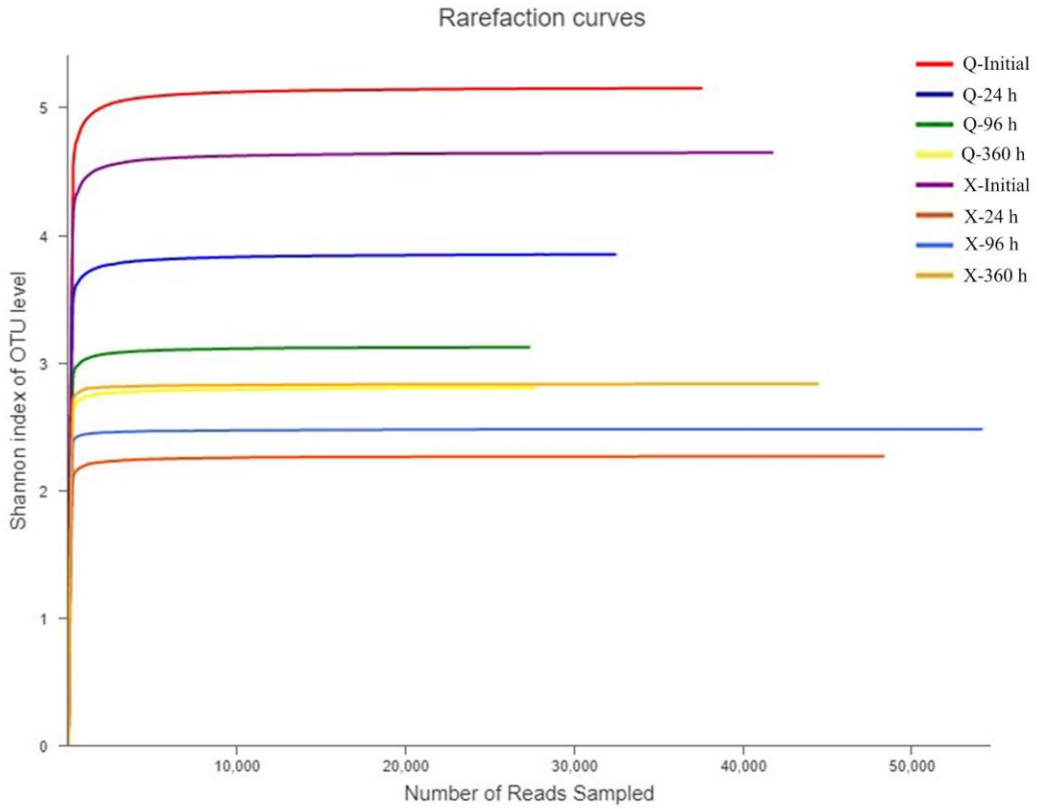

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Figure S7

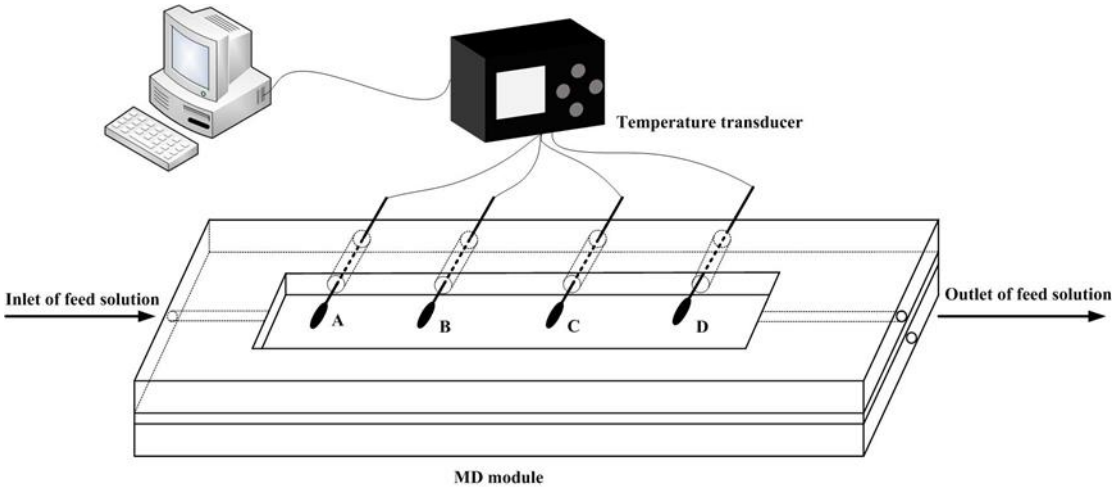

Figure S7. Experimental setup for the temperature measurement of membrane surface during the membrane distillation operation process.

With an aim to investigate the difference of temperature between feed solution and membrane surface, the temperatures of feed solution and membrane surface were both measured in this study. Four temperature transducers (A, B, C and D) were applied into the feed side of MD module to research the average temperature of membrane surface ($(T_A+T_B+T_C+T_D)/4$). The online detected temperature data (T_A, T_B, T_C and T_D) for different locations on the membrane surface were logged into a computer.

Considering the feed temperature of 60 ^oC, the average temperature of membrane surface was approximately 50.3 ^oC. Basing on the measured temperature data, it can be concluded that the temperature of membrane surface was relatively lower than that of feed solution, thus the survived bacteria in feed solution were more tended to colonize onto the membrane with an aim to escape from thermal circumstance of feed solution.

Table S1 Detail characteristics of the DCMD membrane.

Membrane type	Pore size (μm)	Porosity (%)	Thick (μm)	Effective area (cm^2)	Pure water permeability (60/10 ^oC) ($L\cdot(m^2\cdot h)^{-1}$)
PTFE	0.22	75.0-80.0	190	50.0	9.67