Supporting Information

Text SI-1 Biofouling growth in the small external crossflow plate MBR.

A small custom built polycarbonate cross-flow filtration unit equipped with a modified plate PVDF membrane (normalized pore size, 0.02 μm; effective membrane area, 32 cm^2) was applied to measure the biofouling growth by filtrating activated sludge mixture that was pumped from the MBR tank introduced in the main text. The plate membranes were purchased from Xiamen Kymem Technology Co., Ltd. The membrane flux was 16 L/(m^2 h). During operation, the pressurized feed stream was passed over the membrane. This feed stream was separated into a permeate and a retentate stream. The former was collected to measure flux and rejection, while the latter was recycled to the MBR tank. After 7 days operation, the fouled membrane was taken out for the CLSM analysis.

Text SI-2 Modified heat extraction of biofilm EPS.

The biofilm EPS on the membrane surface was extracted according to the modified heat extraction method (Pellicer-Nacher et al., 2013). The membrane sample with biofouling was gently rinsed with 0.05% NaCl and placed in a tube containing 50 mL 0.05% NaCl. After centrifugation at 4000 g for 5 minutes, the supernatant was excluded to remove the adsorbed soluble microbial metabolites. The mixture in the tube was then diluted to its original volume of 50 mL with 0.05% NaCl and heated to 60℃ in a water bath for 30 minutes and then centrifuged at 4000 g for 20 minutes. The detached EPS was in the supernatant. Then filtrate the supernatant by a 0.22 μm membrane filter, the permeate was the EPS solution.

Table SI-1 Characteristics of the simulated sewage.

Parameters	Concentrations (mg/L)	Components
COD	600	CH_3COONa
TN	60	$(NH_4)_2SO_4$
TP	6	KH_2PO_4

Table SI-2 Hydrolysis rate constants of tested DBPs.

DBPs	pH	T (°C)	Hydrolysis rate constants (h^{-1})	Reference
TCAA	7.0	20.0	6.84×10^{-6}	(Chen, 2011)
DCAA	7.0	25.0	6.60×10^{-12}	Na
MCAA				(Chen, 2011)
TCM	7.0	25.0	2.32×10^{-8}	(Chen, 2011)
BDCM	7.0	25.0	4.26×10^{-7}	(Chen, 2011)
DBCM	7.0	25.0	1.13×10^{-7}	(Chen, 2011)
TBM	7.0	25.0	1.31×10^{-8}	(Chen, 2011)
TCAN	7.2	20.0	6.26×10^{-2}	(Chen, 2011)
DCAN	7.0	20.0	1.68×10^{-4}	(Yu and Reckhow, 2015)
BCAN	7.0	20.0	1.36×10^{-4}	(Yu and Reckhow, 2015)
DBAN	7.0	20.0	1.38×10^{-4}	(Yu and Reckhow, 2015)

1,1-DCP	7.0	21.0	2.20×10^{-2}	(Chen, 2011)
1,1,1-TCP	7.0	21.0	1.82×10^{-1}	(Chen, 2011)
TCNM				Na

Na: not available.

Table SI-3 Combined toxicity values of DBPs.

DBPs	**Combined toxicity values (M^{-1})**	**References**
TCM	101.47	
BDCM	93.37	
DBCM	131.22	
TBM	144.06	
TCAN	1709.40	
DCAN	712.43	(Plewa and Wagner, 2015; Chu
BCAN	6015.76	et al., 2016; Zhu et al., 2019)
DBAN	40040.04	
TCNM	3177.85	
TCAA	233.00	
DCAA	168.00	
MCAA	1310.00	

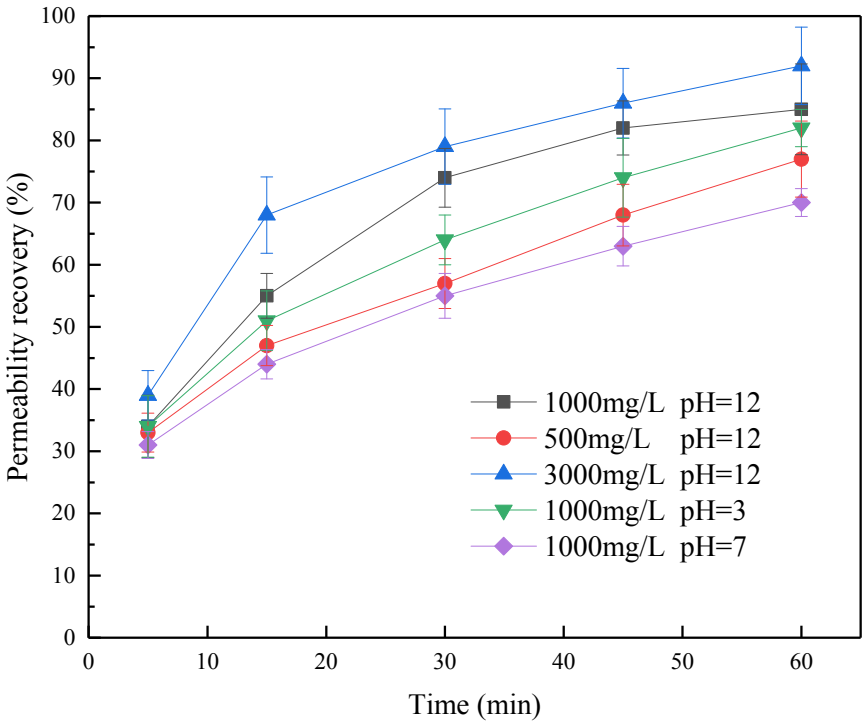

Fig. SI-1 Recovery of membrane permeability with the cleaning process proceeding. The fouled membranes were obtained from the small cross-flow plate membrane bioreactor, and the tests of membrane permeability recovery were also conducted in this small cross-flow plate membrane bioreactor.

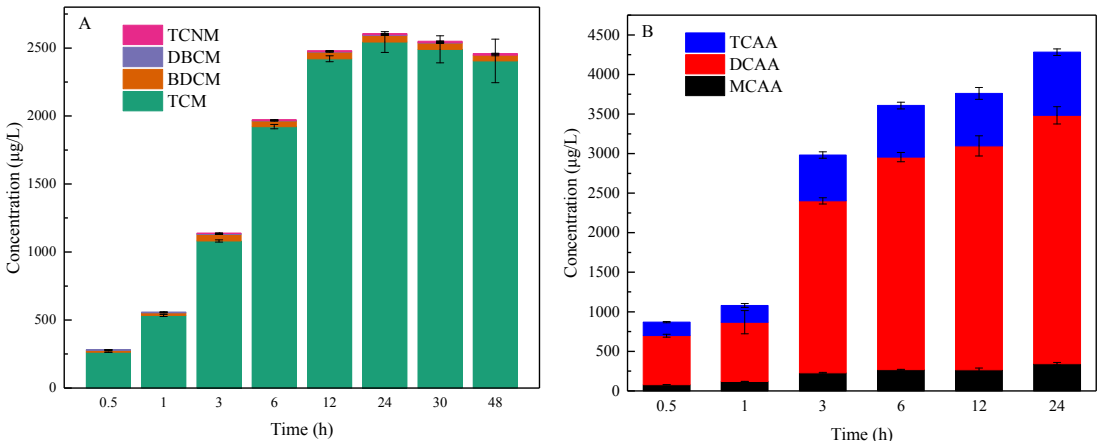

Fig.SI-2 Effects of reaction time on the formation of THMs and TCNM (A), and HAAs (B) during NaClO cleaning of fouled membranes from MBRs. Reaction conditions: Chlorine dosage was 1000 mg/L; Temperature was 25±0.1 ℃; Initial pH was about 12.0.

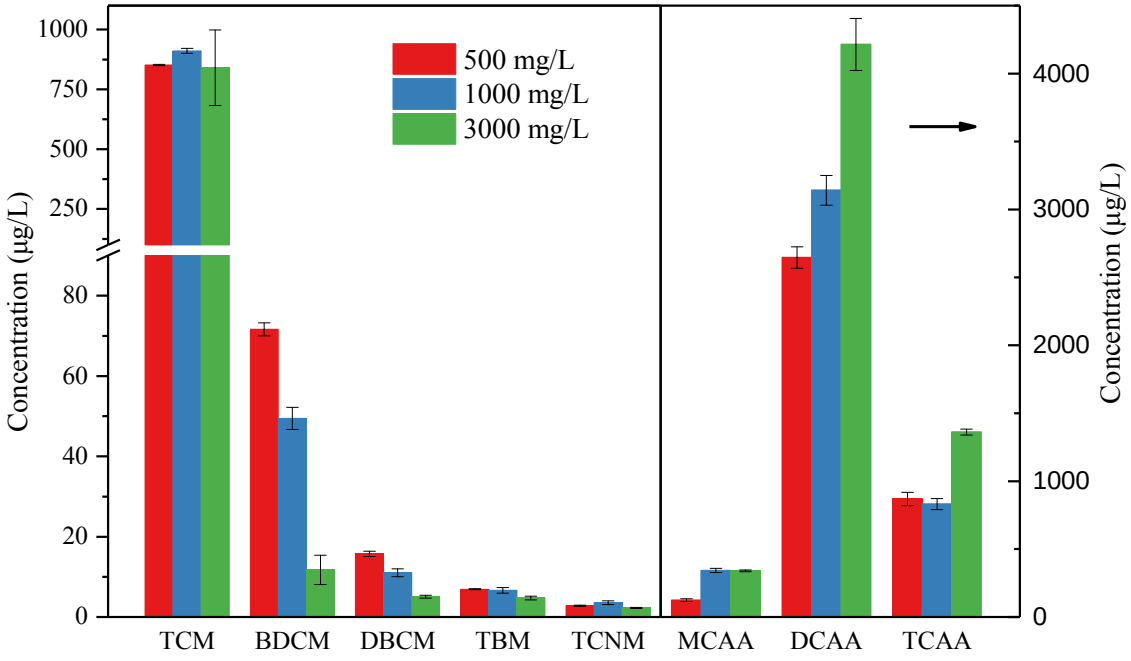

Fig. SI-3 Effects of chlorine dosage on the formation of DBPs during NaClO cleaning of fouled membranes from MBRs. The data were obtained after 24 hours of cleaning. The temperature was 25±0.1 ℃ and the initial pH was about 12.0.

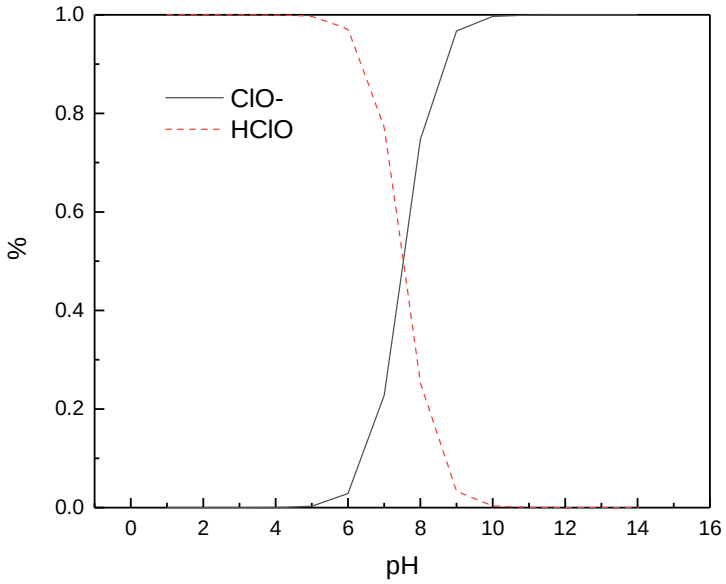

Fig. SI-4 Theoretically relative distribution of main aqueous chlorine species as a function of pH at 25 ℃.

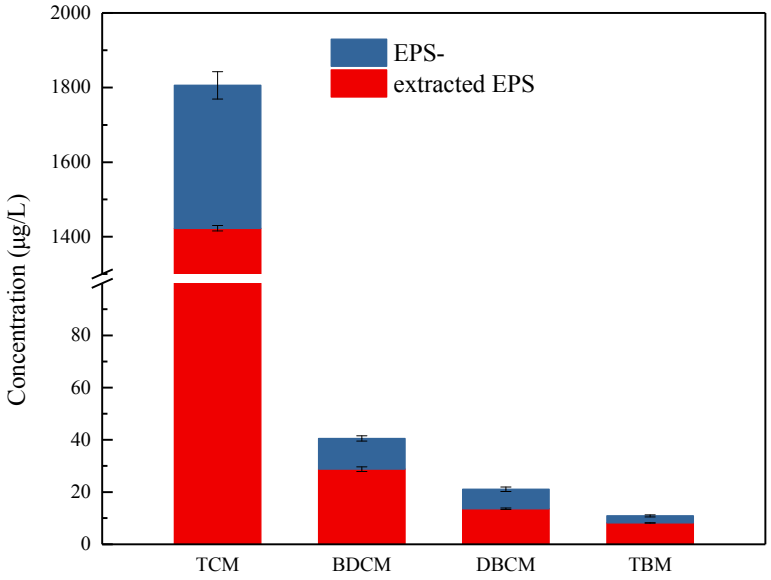

Fig. SI-5 Formation of THMs during chlorination of EPS- module and extracted EPS. Reaction conditions: Chlorine dosage was 1000 mg/L; Initial pH was about 12.0; Reaction temperature was 25±0.1 ℃. EPS- represents the total cells without EPS. The concentrations of the polysaccharides and proteins in the extracted EPS were 71 mg/L and 18.5 mg/L, respectively.

References

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