Supplementary information for

The impact of monochloramines and dichloramines on reverse osmosis membranes in wastewater potable reuse process trains: A pilot-scale study

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Table S1. Tap water analysis

Parameters	Tap water	Parameters	Tap water
Conductivity (μS/cm)	413	pH	6.0
Na^+ (mg/L)	40.0	HCO_3^- (mg/L)	106.4
Mg^{2+} (mg/L)	10.0	Cl^- (mg/L)	10.4
Ca^{2+} (mg/L)	1.9	SO_4^{2-} (mg/L)	29.6

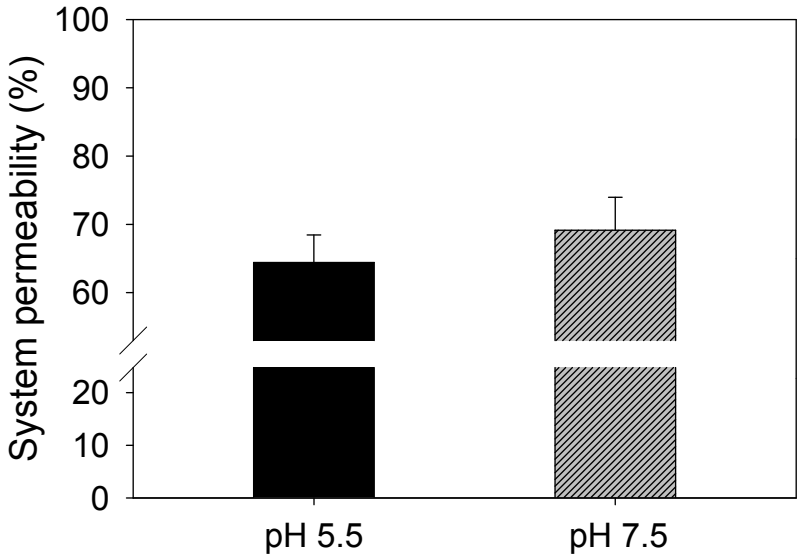

Fig. S1. Permeability of monochloramine using lab-scale RO system as a function of pH (Applied pressure = 220±10 psi; monochloramine = 3 ppm as Cl_2; feed pH = 6.0; permeate flux = 43.46 L/m^2/h).

Table S2. One-Way ANOVA for Fig. 3a – Excel Output

SUMMARY

Groups (Monochloramine)	Count	Sum	Average	Variance
pH 5.5	8	707.59	88.45	19.38
pH 6.5	8	730.53	91.32	5.44
pH 7.5	8	733.61	91.70	4.42

ANOVA

Source of Variation	SS	df	MS	F	P-value	F cirt
Between Groups	50.55	2	25.27	2.59	0.098	2.57
Within Groups	204.70	21	9.75			

Total	255.25	23

Table S3. One-Way ANOVA for Fig. 4a – Excel Output

SUMMARY

Groups (Low concentration of NH_4^+)	Count	Sum	Average	Variance
Feed	2	20.21	10.10	0.37
Overall permeate	2	24.62	12.31	0.54

ANOVA

Source of Variation	SS	df	MS	F	P-value	F cirt
Between Groups	4.85	1	4.86	10.78	0.08	8.53
Within Groups	0.90	2	0.45			
Total	5.76	3				

Table S4. One-Way ANOVA for Fig. 4c – Excel Output

SUMMARY

Groups (Low concentration of NH_4^+)	Count	Sum	Average	Variance
Feed	2	23.17	11.59	0.083
Overall permeate	2	35.50	17.75	0.0039

ANOVA

Source of Variation	SS	df	MS	F	P-value	F cirt
Between Groups	38.03	1	38.03	879.18	0.0011	18.51
Within Groups	0.087	2	0.043			
Total	38.12	3				

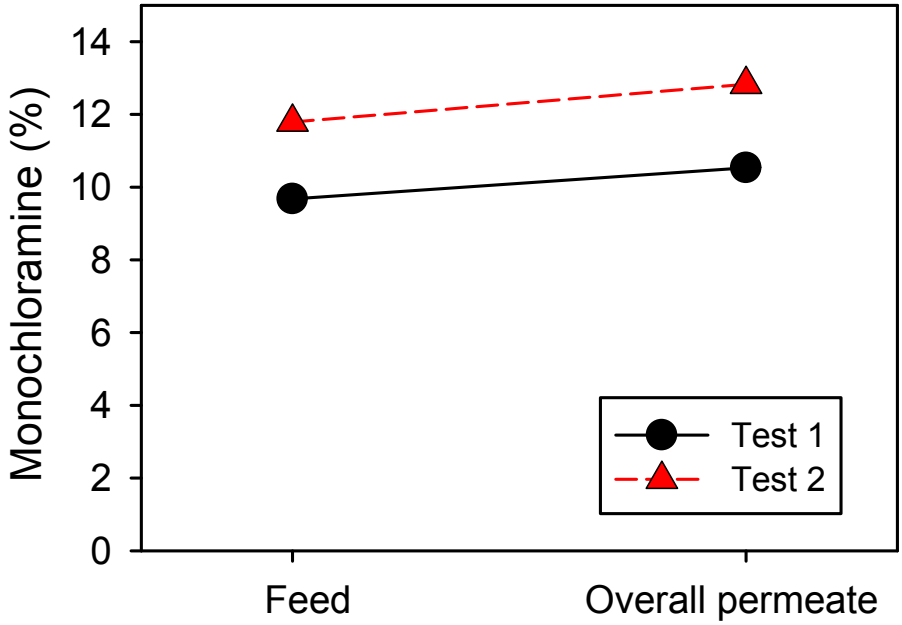

Fig. S2. The proportion of monochloramine in the feed and overall permeate under the low (0.5 mg/L) concentration of ammonium ion in feed water using the pilot-scale RO system (Tested membrane = BW30; temperature = 22±2°C; $[\text{Total chlorine}]_0$ = 3 mg/L as Cl_2 (= 42 μM); feed pH = 6.0; applied pressure = 150±10 psi; permeate flux = 27.46 L/m^2/h; error bars were donated from at least two experimental results).

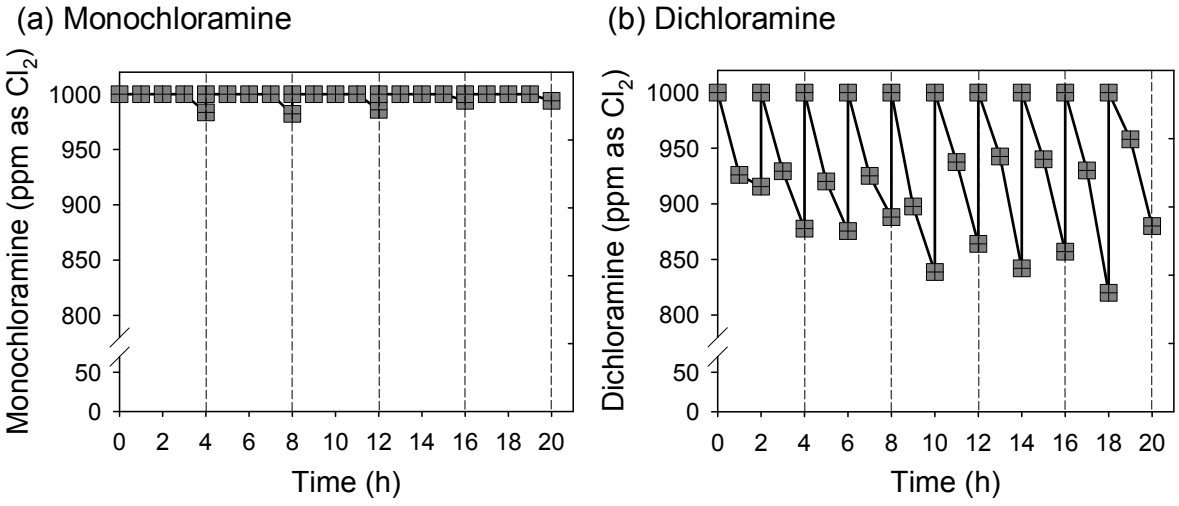

Fig. S3. Concentration change of monochloramine and dichloramine during the membrane

exposure.

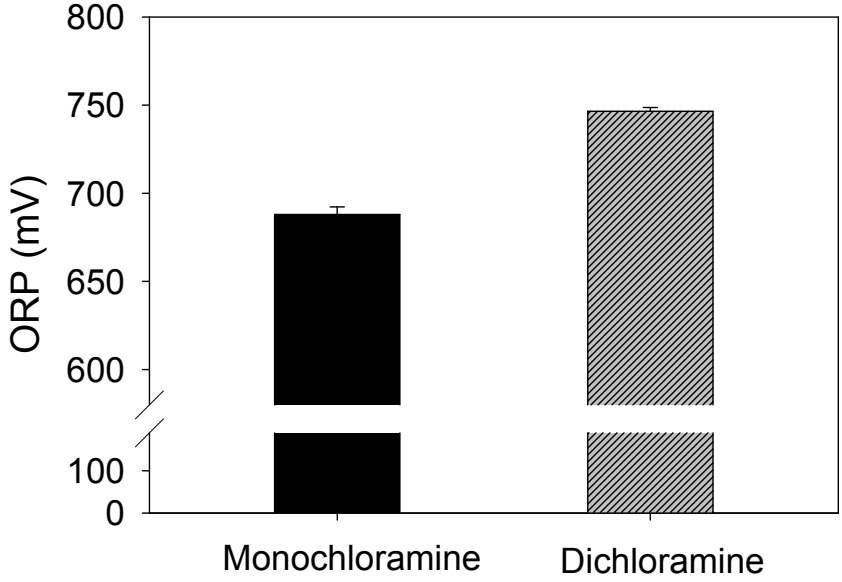

Fig. S4. Measured oxidation-reduction potential of monochloramine and dichloramine ([Monochloramine] = [Dichloramine] = 3 ppm as Cl_2; pH = 6.0).

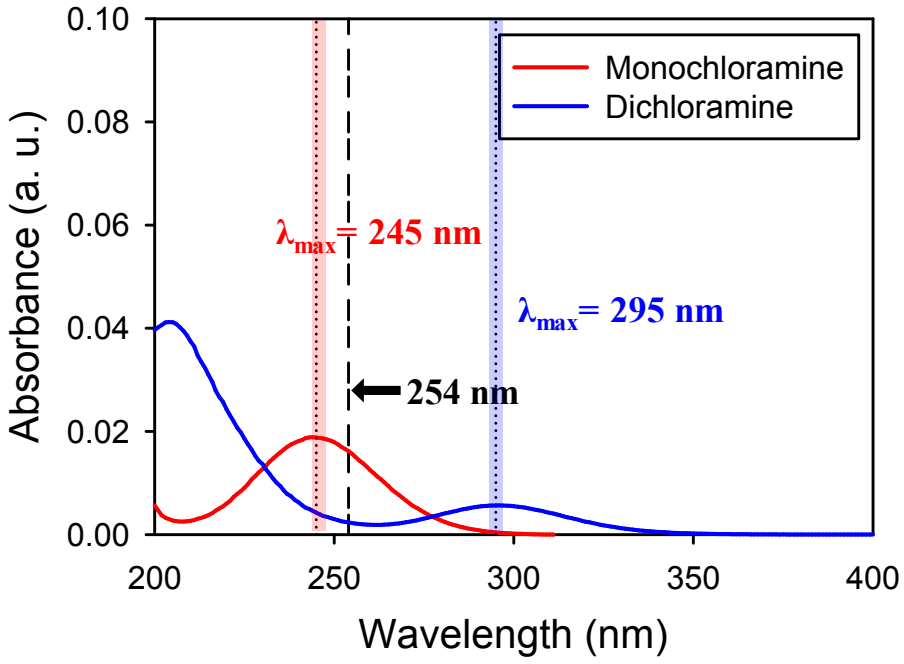

Fig. S5. UV/Vis absorption spectra of monochloramine and dichloramine ([Monochloramine]

= [Dichloramine] = 3 ppm as Cl_2).

Table S5. Quality parameters of microfiltered secondary effluent wastewater samples.

pH	7.8
Conductivity (mS/cm)	1.738
Alkalinity (mg/L as $CaCO_3$)	194.5
Turbidity (NTU)	0.98
DOC (mg/L)	5
SDI	2.39

* The concentrations of dissolved organic carbon (DOC) were analyzed using a TOC analyzer (Shimadzu Co., Japan). The conductivity was determined using a conductivity meter (Thermo Scientific, USA).