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Role of membrane fouling substances on the rejection of N-nitrosamines by reverse osmosis

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1 **Role of membrane fouling substances on the rejection of**
2 ***N*-nitrosamines by reverse osmosis**

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17 **SUPPLEMENTARY MATERIAL**

18 _____
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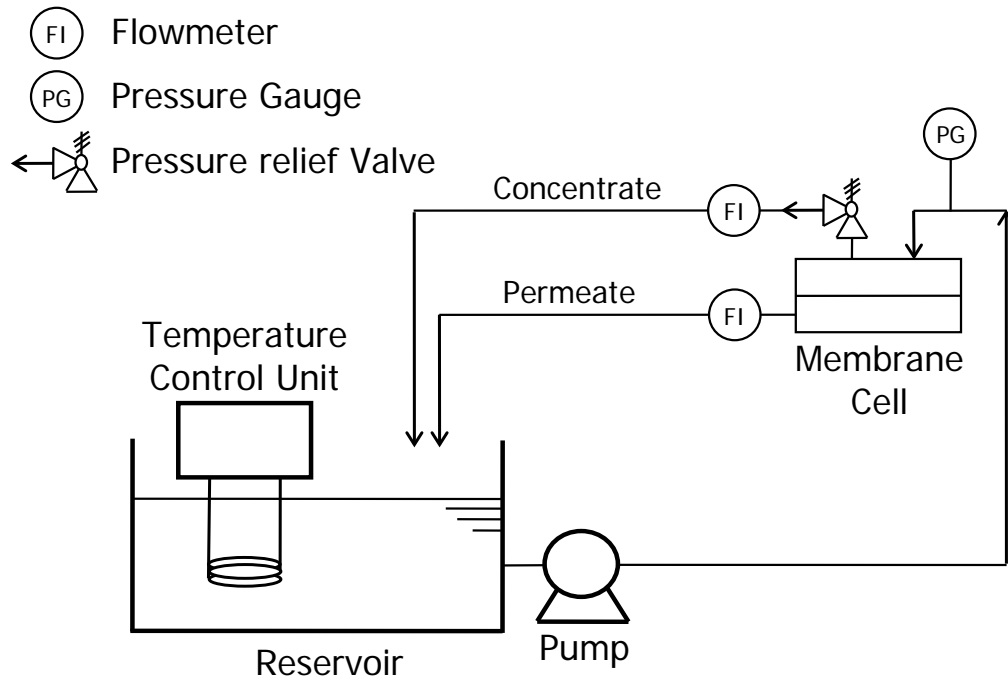


Fig. S1 – Schematic diagram of the cross-flow RO filtration system.

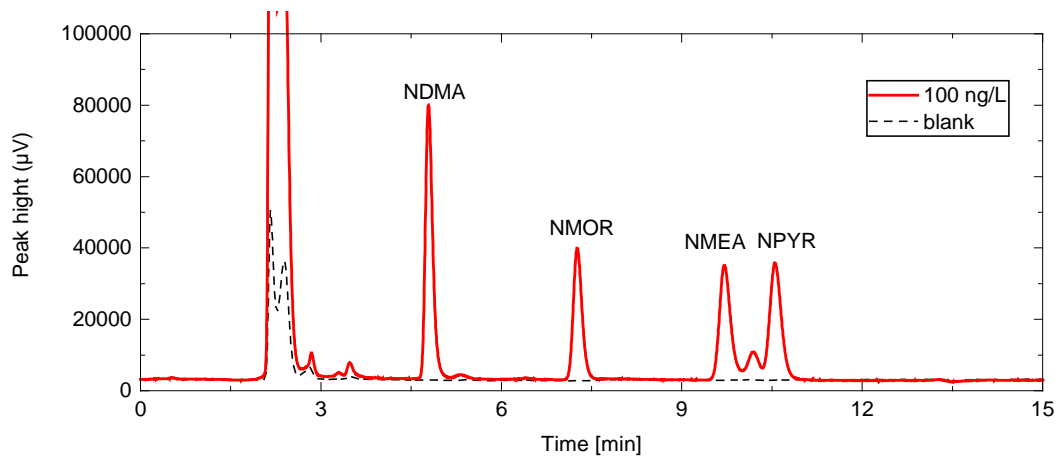


Fig. S2 – HPLC-PR-CL chromatogram of NDMA, NMOR, NMEA and NPYR.

Table S3 – HPLC-PR-CL peak height and recovery for each *N*-nitrosamine. *N*-nitrosamines were not detected in the secondary wastewater effluent sample prior to spiking of NDMA into the wastewater samples.

Chemical	Injection volume [μ L]	Peak height of 50 ng/L dose [μ V]		Recovery [%]
		Secondary wastewater effluent	Clean water matrix	
NDMA	200	25526	38820	66
	20	4352	4537	96
NMEA	200	14545	16709	87
	20	1802	1847	98
NPYR	200	15297	16994	90
	20	1827	1911	96
NMOR	200	16733	19026	88
	20	2163	2049	106

Table S4 – Description of LC-OCD fractions.

Fraction	Molecular weight range	Properties	Description
Biopolymers	> 20,000 Da	Hydrophilic, Not UV-absorbable	Polysaccharides and proteins
Humics	~1,000 Da	Hydrophobic, UV-absorbable	Calibration based on humic acid and fulvic acids of Suwannee River standards from IHSS.
Building blocks	350–500 Da	UV-absorbable	Breakdown products of humics.
Low molecular weight acids	< 350 Da	Negatively charged at neutral pH, Aliphatic	All aliphatic low molecular mass organic acids, Small amount of humics
Low molecular weight neutrals	< 350 Da	Weakly charged, hydrophilic or slightly hydrophobic (i.e. amphiphilic)	Alcohols, aldehydes, ketones, amino acids, biogenic organic matter

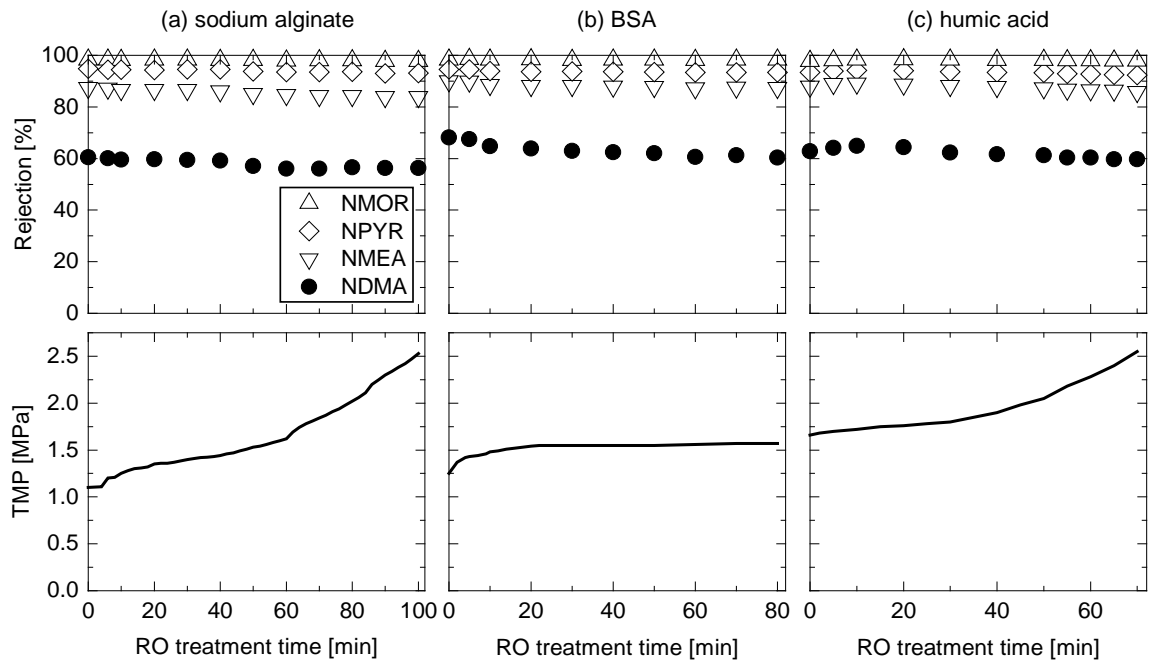


Fig. S5 – Changes in *N*-nitrosamine rejection and TMP during RO treatment of solutions containing (a) 50 mg/L of sodium alginate, (b) 100 mg/L of BSA and (c) 50 mg/L of humic acid with ESPA2 membrane (20 mM NaCl, 1 mM NaHCO₃, 1 mM CaCl₂, feed temperature = 20.0 ± 0.1 °C, permeate flux = (a)–(b) 60 L/m²h and (c) 80 L/m²h).

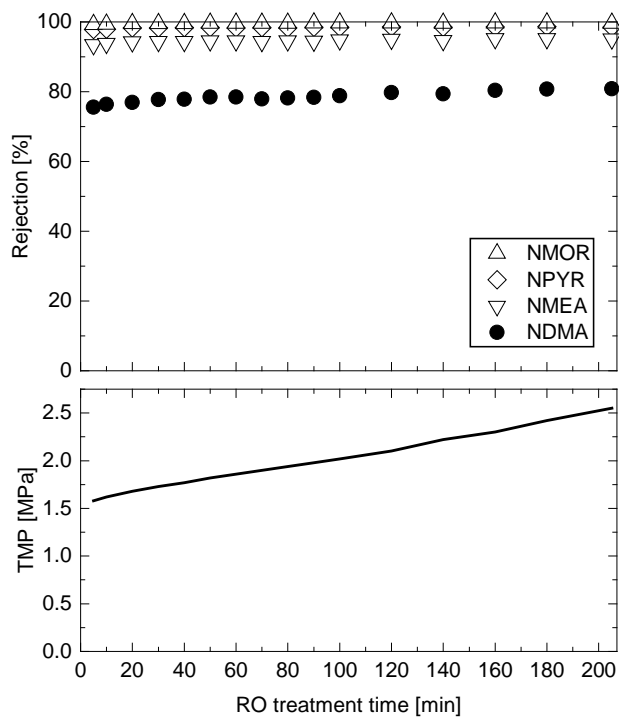


Fig. S6 – Changes in *N*-nitrosamine rejection and TMP during RO treatment of solutions containing 20 mg/L of Pahokee Peat fulvic acid with ESPA2 membrane (20 mM NaCl, 1 mM NaHCO₃, 1 mM CaCl₂, feed temperature = 20.0 ± 0.1 °C, permeate flux = 80 L/m²h).

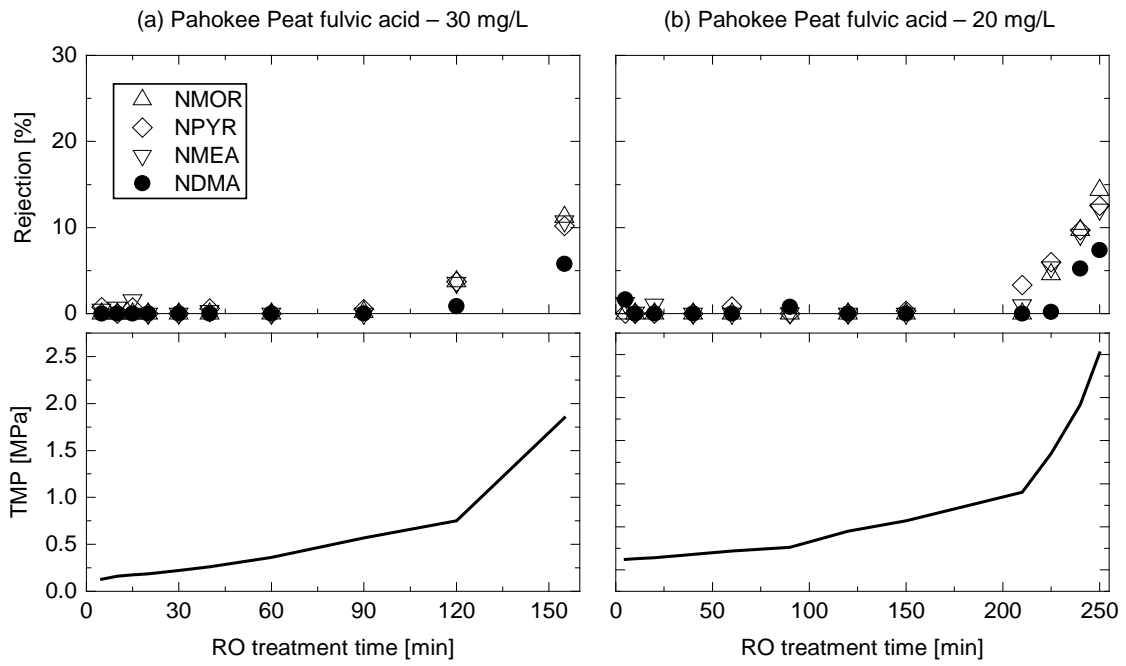


Fig. S7 – Changes in *N*-nitrosamine rejection and TMP during NF treatment of solutions containing (a) 30 mg/L and (b) 20 mg/L of Pahokee Peat fulvic acid with ESPA1-LF membrane (20 mM NaCl, 1 mM NaHCO₃, 1 mM CaCl₂, feed temperature = 20.0 ± 0.1 °C, permeate flux = 120 L/m²h).

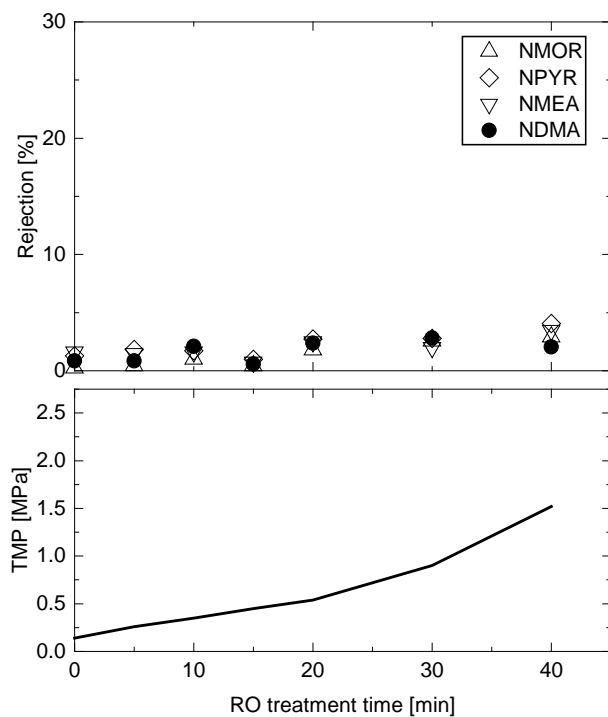


Fig. S8 – Changes in *N*-nitrosamine rejection and TMP during NF treatment of solutions containing 50 mg/L of humic acid with ESPA1-LF membrane (20 mM NaCl, 1 mM NaHCO₃, 1 mM CaCl₂, feed temperature = 20.0 ± 0.1 °C, permeate flux = 120 L/m²h).