Nanofiltration (NF) membrane process with pre-ozonation for brine treatment

Minkyu Park
Chemical and Environmental Engineering
Advisor: Shane A. Snyder

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How do we treat brine?

Surface water

NF/RO membrane

Potable water

Wastewater effluent (Water reuse)

Ocean outfall
Not available in AZ

Evaporation pond
Volume reduction required

Wastewater (Brine)
Objectives

- To investigate the effects of pre-ozonation on fouling reduction in nanofiltration (NF) membrane systems.
- Eventually, to help increase water recovery and reduce brine waste from NF membrane systems.
- To enhance potential for water reuse and brackish water utilization for in-land cities (common scenario in AZ) with more sustainable engineered processes.
Schematic of experimental plan

Brine generation (CAP water)

Ozonation of the brine

Fouling propensity test for ozonated brines
• Ozone reduced the extent of flux decline by lowering fouling potential.

Modified fouling index (MFI): indicator of fouling potential
Fouling propensity test

Cake layer formation

Mass transfer

Size change of NOM would not cause enhanced dispersive transport of NOM away from membrane.

Attractive force

Alteration of functional groups by ozone would reduce aromatic interaction, which is a major fouling mechanism in NF membranes.
Conclusion

• Ozonation significantly reduced fouling potential of brine.

• Little alteration of NOM size was found, thereby mass transfer of NOM was not likely to be enhanced by ozonation.

• The decreased aromaticity indicated that the ozone would help reduce the aromatic interaction between the membrane and NOM, which is a major cause of fouling in NF membranes.

• This study will provide new options in the management of membrane brines in inland areas such as AZ.
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