

Project Number

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Dewatering Reverse Osmosis Concentrate from Water Reuse Applications Using Direct Osmosis

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Objectives:

As a proof of concept, this study focuses on exploring innovative draw solutions, commercially available FO membranes, and the feasibility of applying FO to dewater RO concentrate.

Summary of Findings:

- The FO process is shown to be economically feasible for RO concentrate minimization.
- Dendrimers are a promising osmotic media as these macromolecules provide high osmotic pressure.
- Ultrafiltration (UF) has the potential to reconcentrate the dendrimer along with its surface ions, as preliminary UF experiments achieved 87.3% rejection of the surface sodium ions.
- Bench-scale experiments have shown that the RO concentrate was further concentrated in FO using salt (NaCl) as the draw solution.
- Magnetic nanoparticles were evaluated in this study as a candidate draw solution. However, the magnetic fluid could not provide the high osmotic driving force for dewatering RO concentrate.
- Albumin—a protein that has a special role in regulating the osmotic pressure balance within blood vessels—was also not able to provide the high osmotic pressure required for dewatering RO concentrate.

Recommendations

- Investigation of custom-designed dendrimers allowing for effective reconcentration
- Investigation of custom-designed magnetic particles for high osmotic potential
- Optimization of the FO process at bench-scale prior to pilot testing
- Demonstrate the application of using FO to dewater RO concentrate at pilot-scale