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Salt-Free Electrodialysis Metathesis for High Recovery Reverse Osmosis Concentrate Management

Because reverse osmosis is often limited to a recovery of 70-85%, implementing a secondary process like electrodialysis metathesis (EDM) to treat concentrate can increase system recovery. Conventional EDM is an electrically driven membrane process that employs the metathesis exchange to turn salts that are sparingly soluble into salts that are highly soluble. A major challenge of conventional EDM is that it requires the addition of aqueous sodium chloride to serve as the substitution solution. Fujifilm developed an alternative salt-free process that uses a combination of conventional cation and anion exchange membranes and monovalent cation and anion exchange membranes. Salt-free EDM produces one diluate and two highly soluble concentrates (one rich in sodium and sulfate and one rich in chloride and calcium), decreasing the associated risks of calcium sulfate precipitation. This technology requires approximately half of the energy required by conventional EDM because it does not transport additional sodium chloride. A series of lab-scale tests based on modeled RO concentrate were performed to inform the design of a pilot-scale system to treat reverse osmosis concentrate in continuous flow at the Brackish Groundwater National Desalination Research Facility in Alamogordo, NM.