298e Desalination Using a Novel Ammonia-Carbon Dioxide Forward Osmosis Process: Evaluation of Process Performance

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Forward (direct) osmosis (FO) using polymeric membranes may be a viable alternative to reverse osmosis as a lower cost and more environmentally friendly desalination technology. The driving force in the described novel FO process is provided by a draw solution consisting of highly soluble gases — ammonia and carbon dioxide. Using a commercially available FO membrane, experiments conducted in a crossflow, flat-sheet, membrane filtration cell resulted in water fluxes ranging from 1 to 10 □m/s (2 to 21 gfd) for a wide range of draw and feed solution concentrations. It was found, however, that the experimental water fluxes were far lower than those anticipated based on available bulk osmotic pressure difference and water permeability coefficient data. Internal concentration polarization was determined to be the cause of the lower than expected water flux by analysis of the available water flux data and SEM images of the membrane. Draw solution concentration was found to play a key role in this phenomenon. Sodium chloride rejection was determined to be 95-99% for most tests with higher rejections occurring under higher water flux conditions. Desalination of very high sodium chloride feed solutions (simulating 85% recovery of seawater) was also deemed possible, leading to the possibility of brine discharge minimization.