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A Simplified Forward Osmosis Process To Reduce The Volume Of Produced Water From Qatari Gas Fields

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Abstract

One of the key challenges facing the gas industry in Qatar is to reduce produced/process water (PW) volumes injected in disposal wells by a target of 50% to ensure long term reservoir sustainability. This presentation describes a simplified Forward Osmosis (FO) system design that could meet this target. In contrast with conventional FO designs, this design uses readily available seawater or thermal brine as the draw solution and then, instead of recovering water from draw solution, simply discharges the diluted draw solution to the Arabian Gulf. This eliminates entirely the expensive and technically challenging draw solution recovery step. This research addresses the water security grand challenge identified by the Qatar National Research Strategy (QNRS) and helps to foster FO in Qatar. The project is funded by NPRP grant # NPRP 6 - 868 - 1 - 163 from the Qatar National Research Fund (a member of Qatar Foundation).

Commercial flat sheet FO membranes (HTI, USA) and newly developed hollow fiber FO membranes (by Nanyang Technological University in Singapore) have been tested in various bench-scale experiments. The results show that FO can successfully treat the produced/process water from Qatari gas field to achieve the target volume reduction. The average flux, with pretreated feed, was 17 L/m2-h using a draw solution of 1M NaCl and no significant fouling was observed during the 5 hours experiment. Organics passage from the feed to the draw solution was below detection limit, which eliminate the potential concern of organics leaching into the draw solution.

Appropriate pretreatment of the produced/processed water is beneficial to minimize membrane fouling. Results showed a flux decline of approximately 10% over 5 hours when the PW was processed without pretreatment. The fouling has been attributed to the organics present in the PW. Different pretreatment options were evaluated to reduce membrane fouling including: i) ceramic membrane filtration; ii) Powdered Activated Carbon (PAC); and iii) Osorb, (organically-modified silica, capable of absorbing oil and other contaminants from water). This presentation will provide highlights of the results-to-date and discuss the technical feasibility of this FO design. Results look promising and indicate that FO could be a potentially good technology to reduce produced/process water injected in gas fields.