Ceramic NF-membrane technology for the cleaning and desalination of oily water

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Purpose

The treatment of “produced water” requires a combination of oil removal and desalination. Ceramic NF-membranes open up new and more efficient recycling processes including partial heat recovery due to their resistance against organics and oil residuals, their desalination behavior as well as their temperature stability. The large water quantity cannot be prepared with the standard NF-membranes economically due to the high membrane costs One important option to reduce the costs is the increase of the membrane surface per element resulting in a reduction of handling.

Methods

Ceramic NF-membranes have been testing at an oil sand field in Canada since 2013 starting with standard 19-channel tubular membranes (0.25 m^2/element). Two scale-up steps have been realized, first one to 163-channel elements (1.25 m^2/element) and a second one to 559-channel elements (4.5 m^2/element). A pilot plant containing 180 163-channel elements and a total membrane area of 234 m^2 was commissioned in October 2016 in Alberta, Canada.

Results

First tests with the standard 19-channel membranes indicated a rejection of alkaline earth metals (Ca, Mg) up to 80 % and of alkaline metals (Na, K) up to 55 %. The permeate was free of organics. Long-term tests over several months confirmed the stability of the membranes. In lab measurements, the 163-channel-NF-membranes showed nearly the same flux and retention behavior compared to 19-channel-NF-membranes. These results were confirmed by the pilot plant as well.

Conclusion

With the scale-up to the 559-channel substrate the membrane fabrication costs have been reduced by appr. 50 %. Final target is a scale-up to 10-20 m^2/element combined with a further cost reduction. Combined with a stable and reproducible

membrane performance this will be the basis for large scale application of ceramic NF-membranes.