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The effect of feed water composition in selective removal of ions in electrodialysis process

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Abstract

Electrodialysis Reversal (EDR) is a membrane based separation processes in which cations and anions pass through cation and anion exchange membranes, respectively, under the influence of an electric field. Electrodialysis has been applied in very diverse industrial fields such as brackish and sea water desalination, salt production by concentering sea water or using brine discharged from a reverse osmosis seawater desalination plant, heavy metal recovery from waste water, recovering reverse osmosis concentrate stream, and citric acid separation. EDR process has been utilized for over 50 years for the drinking water production from brackish water sources. Although Electrodialysis Reversal (EDR) technology has been commercially used since the early 1960s, the fundamental understanding of this technology is less developed than that of other technologies such as distillation and reverse osmosis. Selectively removal of some ions of interest compared to other ions which present in water has not been studies in details. Drinking water supplies in the Southwestern region of the United States are highly dependent on groundwater sources. Due to an emerging water crisis, brackish groundwater resources have and continue to be considered as a complementary resource for drinking water supplies. However, depending on the location of the available brackish resource, there are different water chemistries to contend with and concentrate issues to address. Depending on the specific chemistry of the given water resource, an appropriate desalination technology can be utilized including technologies such as reverse osmosis, thermal desalination or electrodialysis. Therefore, understanding of selective removal of ions and implication of this understanding would help to reduce the cost of desalination by reducing the number of moles of ions that is removed to get appropriate product water. The objective of this study is to verify the effect of water composition on the ion selectivity of ion exchange membrane at different operating conditions. Lab-scale selectivity studies were performed using a tiny electrodialyzer. Different composition of saline water was examined in order to determine the effect of feed water composition on electrodialyzer's performance. For this purpose different combination of cation and anion exchange membranes were applied. The primary results show that saline water composition affects selectivity of anions and cations in electrodialysis process which can cause significant increase in the process cost.

Biography

Leila attended Sahand University of Technology and earned a Bachelor of Science Degree in Chemical Engineering. She then started her graduate studies at the same university and same field. Leila graduated as outstanding graduate of Chemical Engineering Department at Sahand University of Technology. Upon earning her Master degree in 2009, she started to teach some undergraduate courses from 2009-2011. Then she decided to pursue the doctoral program at NMSU and excel in water desalination. She chose NMSU due to its international leadership in the field of water treatment and the opportunity to work with distinguished researchers from academia, government and industry. She started her research as a member of the research team in Institute for Energy and The Environment/WERC under the supervision of Professor Abbas Ghassemi since August 2011. Her research focus is on selective removal of ions from brackish ground water in electrodialysis pilot and lab-scale. Leila has done several presentations in different conferences on water desalination using electrodialysis since 2011.