Membrane Capacitive Deionization

Sub-department of Environmental Technology

Sep 2013 - 2017

Researcher	Supervisor	Promotor
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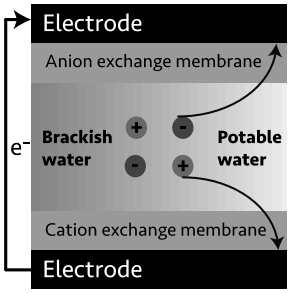
Motivation

One out of seven people does not have access to clean drinking water. Since the world population is still increasing, it is a major challenge to meet the drinking water demand of today and tomorrow.

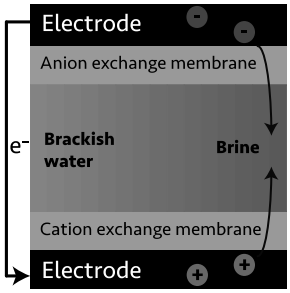
Because there are large resources with brackish water, that is, water with a moderate salt concentration, it is attractive to use these for drinking water production. Therefore, energy efficient and cost effective desalination technologies are of utmost importance.

Membrane Capacitive Deionization is a robust, energy-efficient and cost-effective technology for the desalination of brackish water.

Process



During the adsorption phase, a potential difference is applied over two porous carbon electrodes. The cations move to the negatively polarized electrode, while the anions move to the positively polarized electrode.

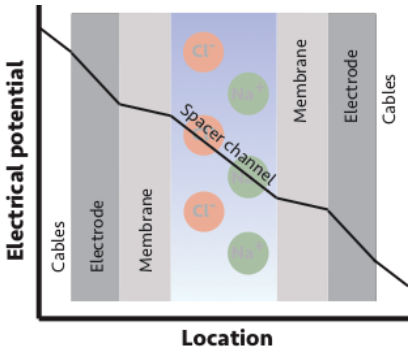


After the electrodes are saturated, the electrodes are regenerated and therefore short-circuited. Consequently, the ions are released to the spacer channel, resulting in a concentrated salt effluent stream (brine).

Technological challenge

Reducing resistances

To make Membrane Capacitive Deionization more cost-effective, it is important to reduce the energy costs. Therefore, we should determine which parts of the cell contribute to the electrical and ionic resistance of the process, so we can improve the cell design to lower the energy losses.

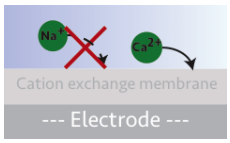


Understanding electrochemical reactions

Adsorption and desorption of ions are not the only processes happening during a desalination cycle. Electrochemical reactions occur as well, resulting in pH fluctuations of the effluent or other undesired effects. Our challenge is to understand these reactions.

Removing specific ions

Another goal is to develop Membrane Capacitive Deionization to specifically adsorb certain ions (e.g. Ca2+) from the water, while keeping other ions (e.g. Na+) in solution.



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