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Motivation

Deionization of water is a widely used process, for instance in the production of drinking water from sea water, or in your washing machine to prevent calcium and magnesium scaling.

A problem with current techniques is that when dealing with a scarce water resource, expensive technologies like ion exchange and electro dialysis have to be used, or in the case of water softening by precipitation, a lot of chemicals.

To overcome these problems, a recently developed technique called Capacitive Deionization (CDI) will be employed.

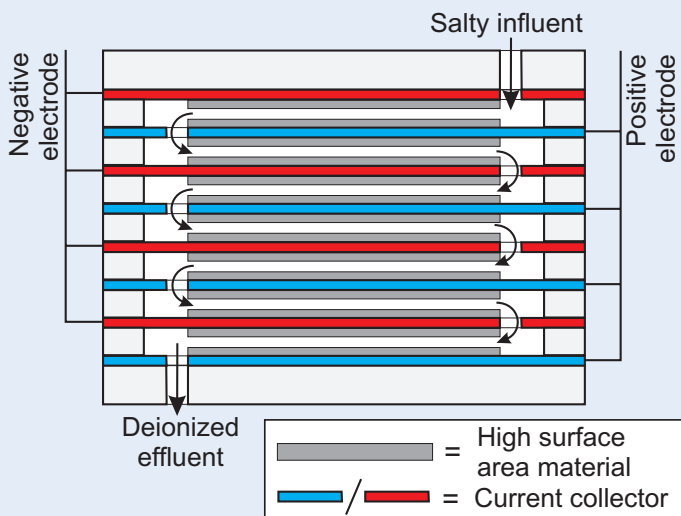


Fig. 2: Example system design

Advantages CDI

- No use of chemicals
- Low energy consumption, energy recovery during discharge
- High removal efficiency
- Simple, cheap and robust design
- Applicable on-line (e.g. washing machine)

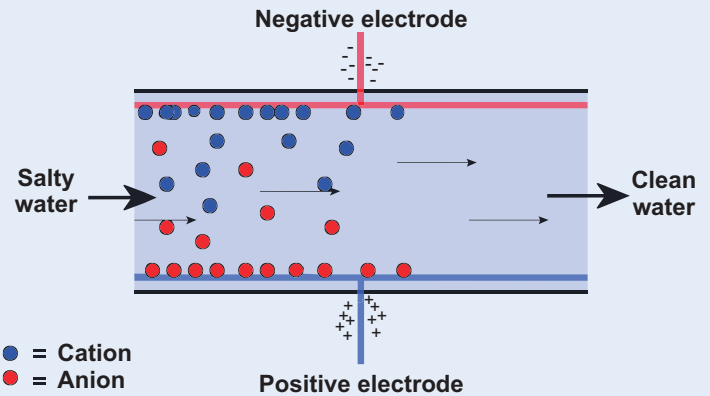


Fig. 1: Principle Capacitive Deionization

Technological Challenge

At the interface between an electrically charged surface and an electrolyte solution there will be a built-up of ions to compensate for the surface charge (fig. 1).

This phenomenon can be exploited by flowing salty water between a positive and a negative electrode, with an external voltage to charge the surface of the electrodes, thereby removing ions from the water (fig. 2).

Once the electrode surfaces are saturated with ions the surface is regenerated by switching off the water flow and the external voltage, and ions will go back into solution, resulting in a concentrated brine.

Research goals

- Identify suitable electrode material
- Improve electrode efficiency and reduce electrochemical reactions
- Prevent scaling, biofouling and precipitation in the system
- System optimization
- Create design criteria for a pilot plant

