



Electrodialysis Cells with Reduced Operating Voltage for Seawater Desalination

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WARF: P180373US01

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The Wisconsin Alumni Research Foundation is seeking commercial partners interested in a new type of electrodialysis cell where the oxidation and reduction of the same electron mediator are used as the anode and cathode reactions, which significantly lowers the operating voltage as compared to traditional electrodialysis cells.

Overview

Seawater desalination is a promising solution for the global water crisis. However, the current methods of distillation and reverse osmosis are expensive and energy-intensive.

Electrodialysis is an alternative method that removes salt ions, rather than water, from saline water. Electrodialysis could produce more fresh water with less energy than reverse osmosis, but it has a drawback: it needs a high voltage to drive the electrode reactions. To make electrodialysis more suitable for seawater desalination, new electrode materials and reactions are required.

The Invention

UW-Madison researchers have produced a novel type of electrodialysis cell that uses the same redox mediator for both the anode and cathode reactions, reducing the thermodynamically required voltage to operate the electrodialysis cell to 0 V. The system includes an additional electrodialysis cell to perform salination in tandem with desalination to reverse any composition change in the catholyte and anolyte that may occur. The system may also include a regenerative solar cell, which enables deionization and ion-accumulation with no external energy input while generating electrical energy.

Applications

- Seawater desalination
- Sustainable potable water generation
- Water purification
- Wastewater treatment

Key Benefits

- Can significantly lower the operating voltage of electrodialysis
- Enables electrodialysis methods for seawater desalination
- May provide solar energy generation and desalination in a single device
- Desalination generates electrical energy, in contrast to current desalination technologies that consume electricity.

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For More Information About the Inventors

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Related Technologies

- [See P170083US01 for a rechargeable desalination battery.](#)

Publications

- [Nam D.-H. & Choi K.-S. 2018. Electrochemical Desalination Using Bi/BiOCl Electrodialysis Cells. ACS Sustainable Chem. Eng., 6, 11, 15455–15462. <https://doi.org/10.1021/acssuschemeng.8b03906>](#)
- [Nam D.-H., Lumley M. & Choi K.-S. 2021. Electrochemical Redox Cells Capable of Desalination and Energy Storage: Addressing Challenges of the Water–Energy Nexus. ACS Energy Lett., 6, 3, 1034–1044. <https://doi.org/10.1021/acsenerylett.0c02399>](#)

Tech Fields

- [Clean Technology : Solar, wind & water technologies](#)

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854

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