Selective Electrochemical Capture and Release of Lithium from Seawater

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CONTACT

Donna M. Cyr
cyr@tia.ucsb.edu
tel: .

INVENTORS

- Heinrich, Shannon
- Menard, Gabriel
- Sepunaru, Lior
- Wang, Zongheng

OTHER INFORMATION

KEYWORDS

Lithium, Li-ion, Batteries, Li-ion batteries, Li, Li extraction, Li capture, Energy, Energy storage, Lithium capture, Lithium extraction, Seawater

CATEGORIZED AS

- **Energy**
  - Storage/Battery

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BACKGROUND

Lithium (Li) is a valuable element that is experiencing skyrocketing demand due to the growth of Li-ion batteries for energy storage applications. Current Li extraction relies on the lime-soda solar evaporation technique from Li-rich brines. However, this process is very slow, requiring 1-2 years, and current techniques are not expected to keep up with projected market demands. Seawater, which contains vast quantities of dissolved Li+, represents an underutilized source. It is estimated that seawater contains about 10,000 more dissolved Li than all terrestrial and freshwater reserves. While many sorbent-based membrane technologies are being explored for the selective capture of Li+ from seawater or from salty brine well waters, these methods typically rely on further treatment of the membranes with strong acids to remove the extracted Li+. There is a need for techniques that extract Li+ from seawater without requiring expensive membranes or acidic workups and that do not have the related environmental impacts.

DESCRIPTION

Researchers at the University of California, Santa Barbara have formulated a novel electrochemical process for extracting Li+ from seawater. This new method utilizes redox-switchable lithium-selective macrocyclic donors (i.e. carboranes or Cb) to selectively capture and release Li+ from seawater under flow conditions. This technique anchors chelating Cb compounds directly to electrode surfaces, enabling lithium capture from seawater flowing across the electrode. The Li+ is subsequently released from the electrode via application of a low electric current to generate a concentrated Li+ solution. This technique offers cost savings by avoiding membranes and acidic treatments and minimizes environmental impacts by eliminating reagent waste, providing an innovative solution for the growing lithium demand.

Additional information: https://chemistry-europe.onlinelibrary.wiley.com/doi/full/10.1002/chem.202502902

ADVANTAGES

- Efficient lithium capture from seawater requiring only a small electric current
- Avoids costly membranes and acid-based workups
- Minimizes chemical waste and environmental footprint

APPLICATIONS

- Lithium capture and extraction for battery manufacturing and energy storage markets
- Sustainable resource development

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20250277321	09/04/2025	2022-982

University of California, Santa Barbara
Office of Technology & Industry Alliances
342 Lagoon Road, ,Santa Barbara,CA 93106-2055 |

https://www.tia.ucsb.edu
Tel: 805-893-2073 | Fax: 805.893.5236 | padilla@tia.ucsb.edu