Lithium capture in seawater reverse osmosis (SWRO) brine using membrane-based capacitive deionization (MCDI) system

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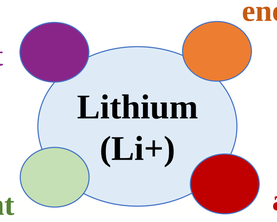
Faculty and Post Docs Energy and Environment

Introduction and motivation

Why we need to focus on capturing lithium (Li+) from Sea water

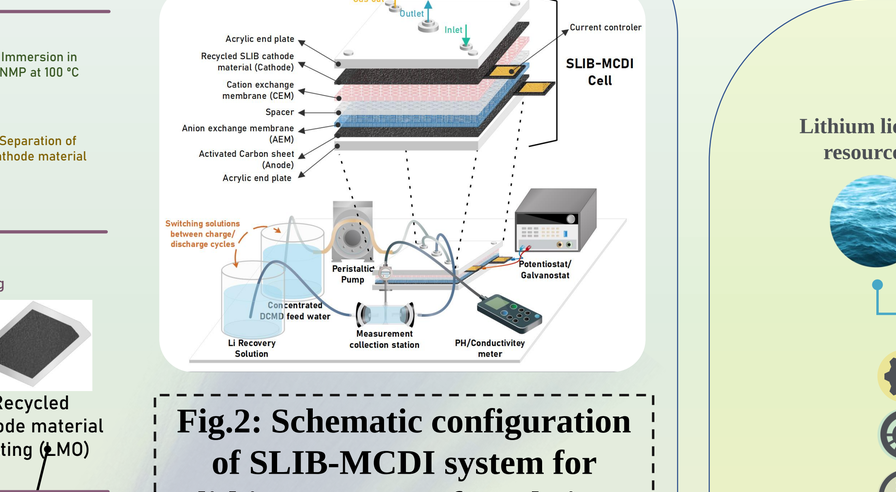
Electrochemically active alkali metal that offers excellent heat and electrical conductivity.

25th most abundant metal on earth

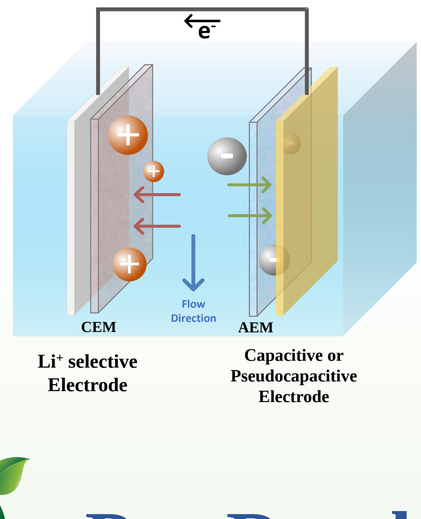


Important element for energy system

High demand associated with the accelerating growth of its consumption



Capturing lithium ion using CDI with SLIB material as cathode electrode (Li+ selective electrode).



CDI is an economical desalination technology, that removes dissolved ions from water by forming an electric double layer (EDL) on the charged electrode when an electric field is applied.

Experimental setup and Methodology

MCDI electrode fabrication

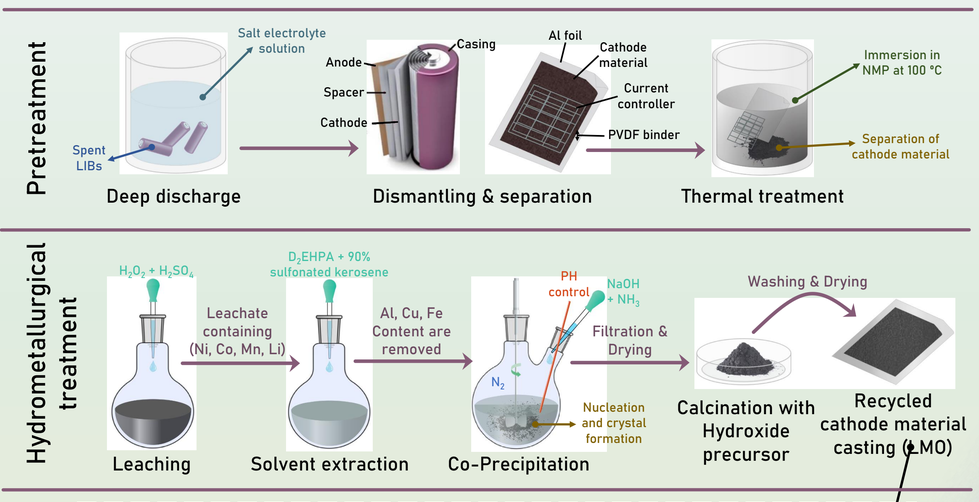
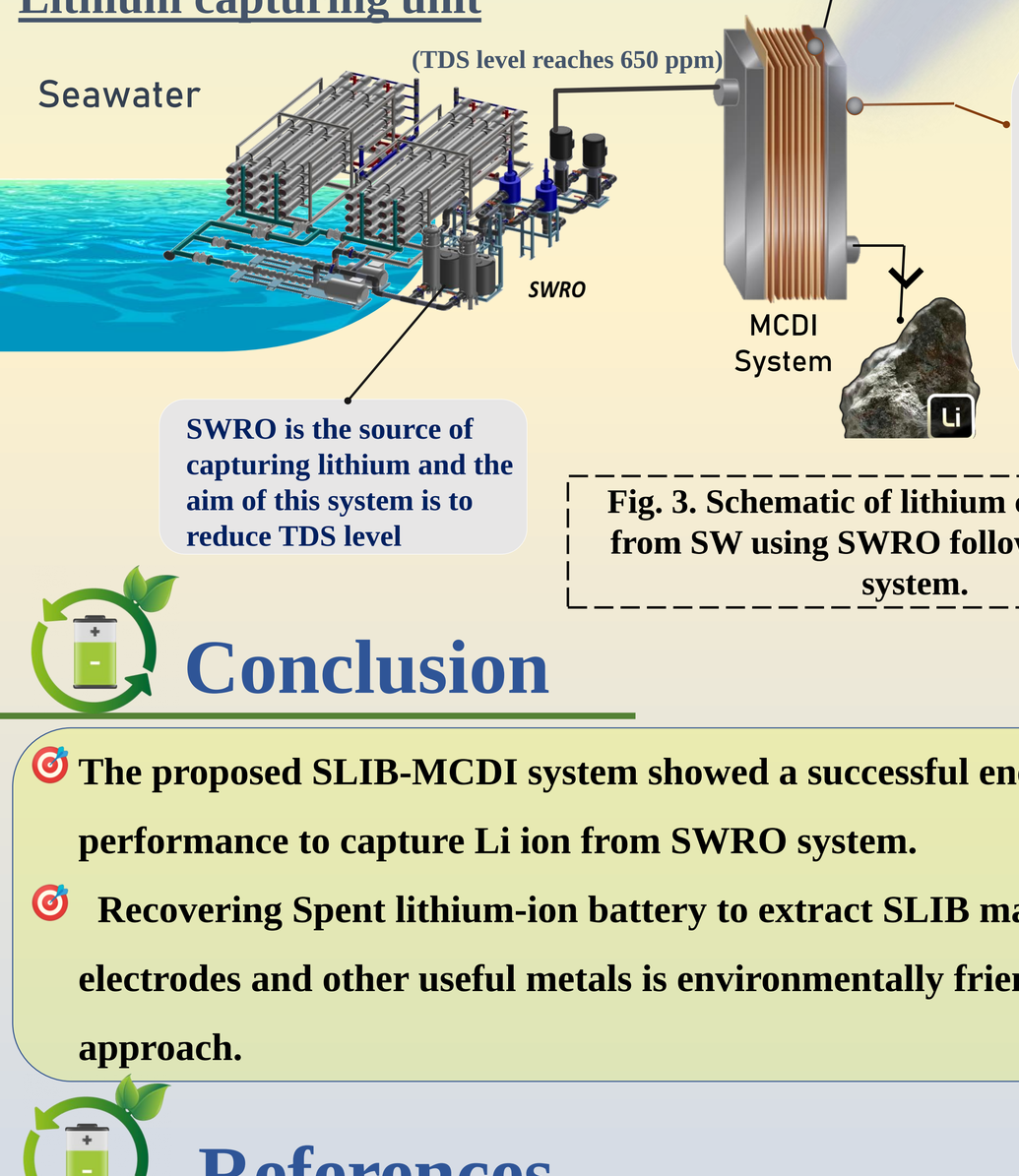


Fig. 1. Schematic procedures of the pretreatment and recycling processes of SLIB materials for fabrication of MCDI cathodes

MCDI system

Fig.2: Schematic configuration of SLIB-MCDI system for lithium recovery from brine solution.

Lithium capturing unit

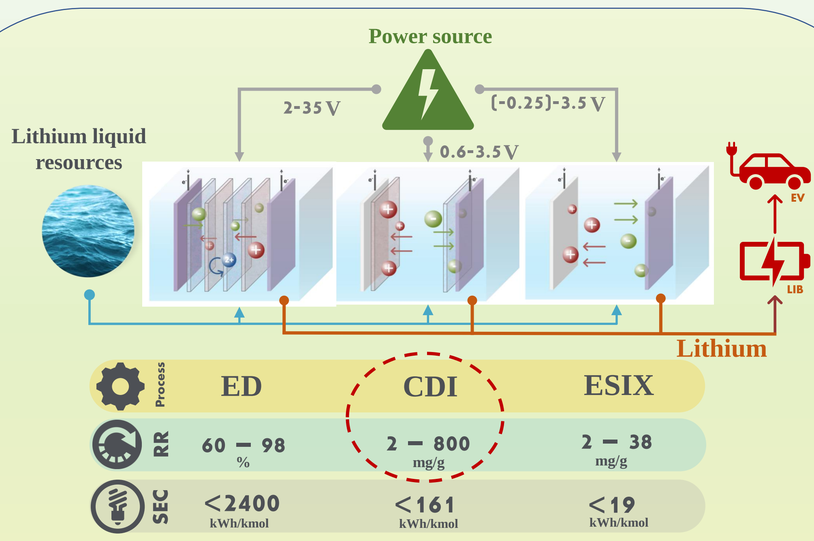


SWRO is the source of capturing lithium and the aim of this system is to reduce TDS level

Using SLIB material (e.g LMO) as cathodic electrode in MCDI system to selectively capture lithium elements as a second pass of SWRO system.

Fig. 3. Schematic of lithium capturing unit from SW using SWRO followed by MCDI system.

Pre-Results



Impact and sustainability (IS) of the system =RR (mg/g) / O&M cost

Fig.4: Comparison of lithium recovery rate and specific energy consumption between various electrochemical capture systems

The key indicator to prove the successful performance of the project is a value of the impact and sustainability (IS) of the SLIB-MCDI system

Significance

Recovering lithium-ion Batteries is an excellent way to get rid of battery wastes as well as fabricate cathode electrode material for MCDI system for lithium capturing

Conclusion

- **The proposed SLIB-MCDI system showed a successful energy performance to capture Li ion from SWRO system.**
- **Recovering Spent lithium-ion battery to extract SLIB material electrodes and other useful metals is environmentally friendly approach.**

References

S. Zavahir, T. Elmakki, M. Gulied, Z. Ahmed, L. Al-Sulaiti, S. Hokyong, C. Yuan, H.Park, B. Bill and D. S. Han,A review on lithium recovery using electrochemical capturing systems, Desalination (2020).

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