

# URBAN SOLUTIONS AND SUSTAINABILITY R&D CONGRESS 2023

BUILDING SUSTAINABLE, RESILIENT, AND LIVEABLE CITIES OF TOMORROW

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# INSPIRATIONS FROM SEAWATER LITHIUM EXTRACTION RESEARCH

**Dr Lan Yihong**

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Suntar International Group



# Inspirations from Seawater Lithium Extraction Research

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# Research Background and Project Introduction



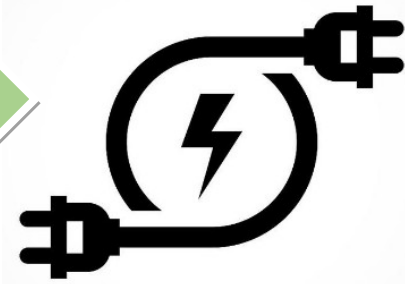
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## Renewable energy

- Solar energy
- Ocean energy
- Biomass energy
- Wind energy
- Nuclear energy

Conversion

## Electric energy



Storage

## Energy storage devices

- **Lithium batteries**
- Lead batteries
- Flow cells
- Supercapacitors

## Issues

- Mechanical strength of glass-type membrane?
- Cost of glass-type LLTO membrane ?
- Energy consumption of 5-step enrichment?

## Solution

Higher mechanical strength and lower cost: Glass membrane → **Ceramic membrane**  
 Lower energy consumption: 5-step enrichment → **1-step enrichment**

## Objective

CWR-2101-0032 is awarded to study advanced LLTO/ceramic membranes for high-performance and low-cost Li mining from seawater.

## Lithium Sources

- Lithium minerals
- Brines
- **Seawater**

Extraction and preparation

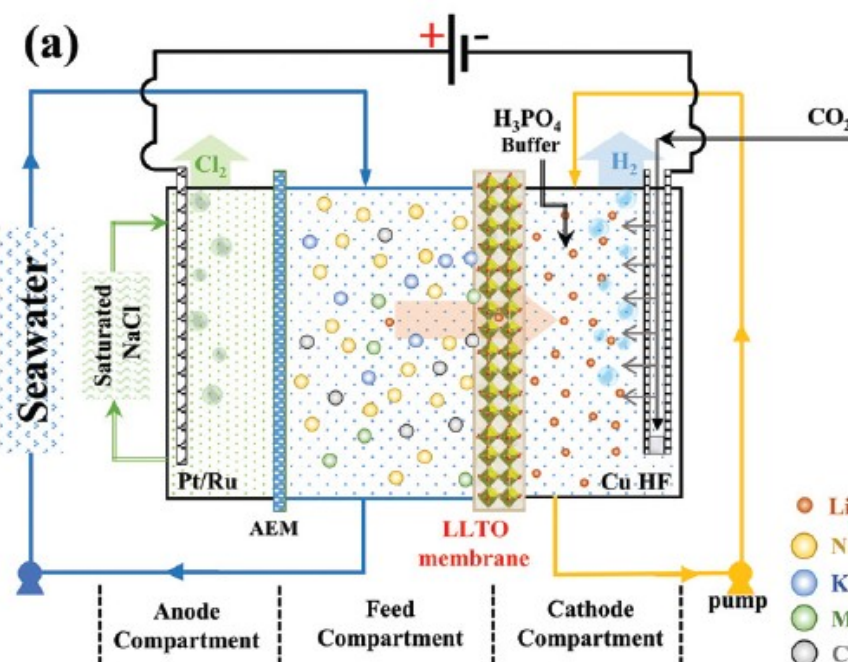
## Lithium batteries



Assembly and application

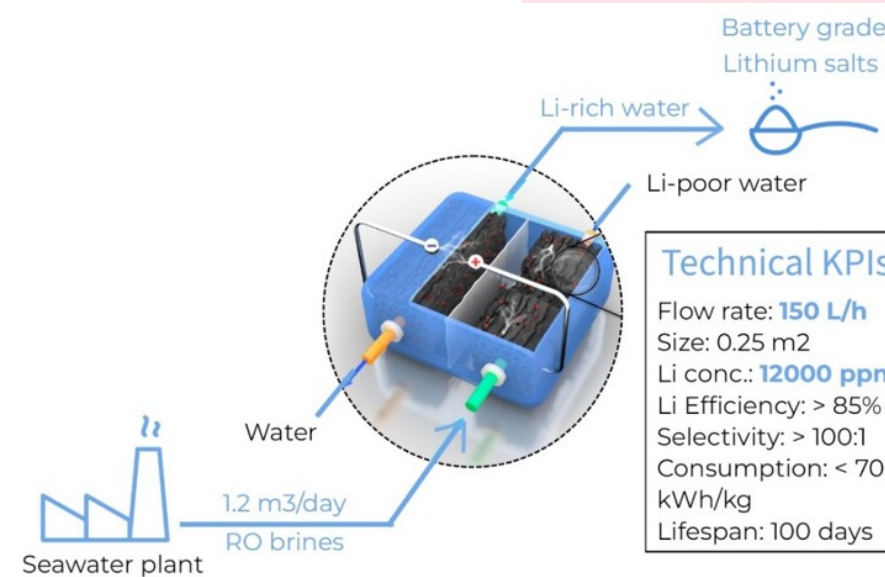
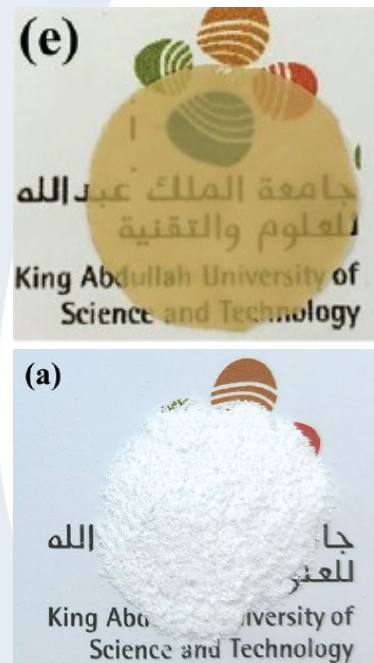


The total lithium reserves in seawater are about 23 B tons.



Glass-type Li-selective  $\text{Li}_{0.33}\text{La}_{0.57}\text{TiO}_3$  (LLTO) is used to enrich Li in seawater by electrolysis.

After 5-step enrichment, Li concentration increases 43000 times, and the purity of the product,  $\text{Li}_3\text{PO}_4$ , attains 99.94%.



## Progress

Li concentration increases to 32 ppm, Na, K, Ca, and Mg concentrations decrease.

In the process of extracting Li from seawater, seawater desalination is achieved at the same time!





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# Comprehensive Seawater Utilization

Techno-economic

Li concentration  
Li concentration

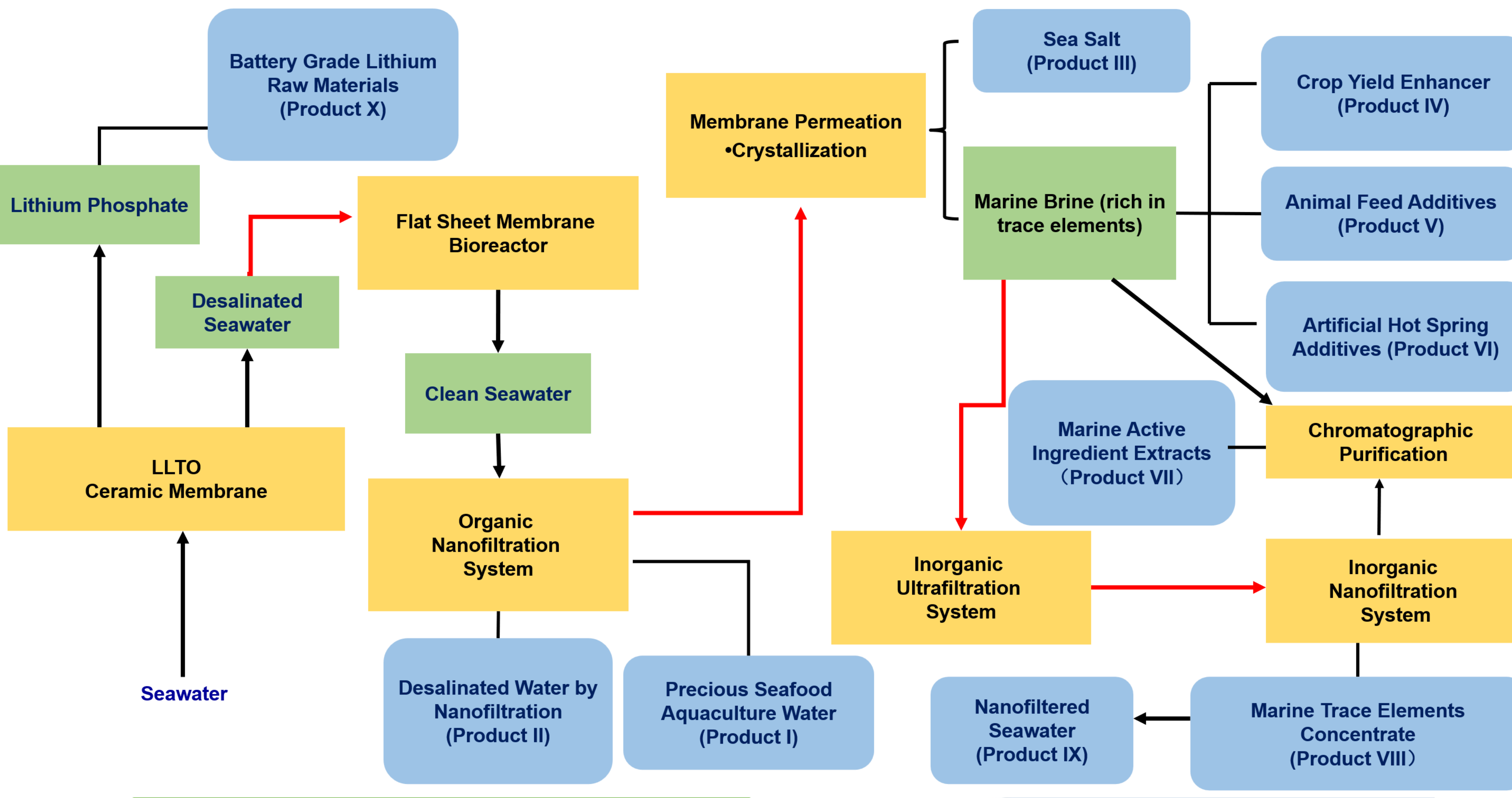
How to improve  
Seawater lithium

Feasibility

How to make

Drinking water  
applications.

The role  
mineral  
elements in  
human body



Unlock the potential of the oceans as a renewable water source for human needs.

**Seawater Desalination**

**Comprehensive Seawater Utilization**

Maximize the economic value of desalination extracting minerals like lithium and potassium from brine byproduct, which would also mitigate the ecological impact brine discharge on the ocean.

**Complementary Integration and Support**

Offer solutions that combine policy and technology to promote sustainable marine development and facilitate marine ecological restoration.

**Sustainable Ocean Governance**

**Blue Economy Advancement**

Drive the transformation and enhancement of the marine industry, fostering economic growth in harmony with nature.