PRODUCTION OF LITHIUM CARBONATE FROM GEOTHERMAL BRINE BY SELECTIVE EXTRACTION OF LITHIUM USING A NOVEL ION SIEVE METHOD

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INTRODUCTION

- Today, there is an increasing demand for energy storage systems in the form of a battery for electronic devices and electric vehicles (EVs) that are made up of lithium
- The common practice of extracting lithium is not environmentally friendly. These technologies require a significant amount of water, energy, land, and time for extraction
- Adsorptive extraction is the next-generation method for the extraction of lithium from geothermal brine. Moreover, doped adsorbents have little exposure to research but they show high selectivity to lithium.

Objective:

- The idea is to provide a novel approach to extract lithium from a geothermal brine with minimal water loss which will be an alternative to the solar evaporation/ concentration process which is very slow (takes 24 months) and water intensive
- We will use $H_4Mn_{4.9}Al_{0.1}O_{12}$ compound for the adsorption of lithium from the brine and ultimately produce lithium carbonate that will be used to produce a Li-ion battery.

Challenges:

- Determine the optimal condition to produce $H_4Mn_{4.9}Al_{0.1}O_{12}$ to attain higher adsorption and low manganese dissociation
- Optimization of production conditions for the cyclic usability of the same adsorption material.

SOLUTION

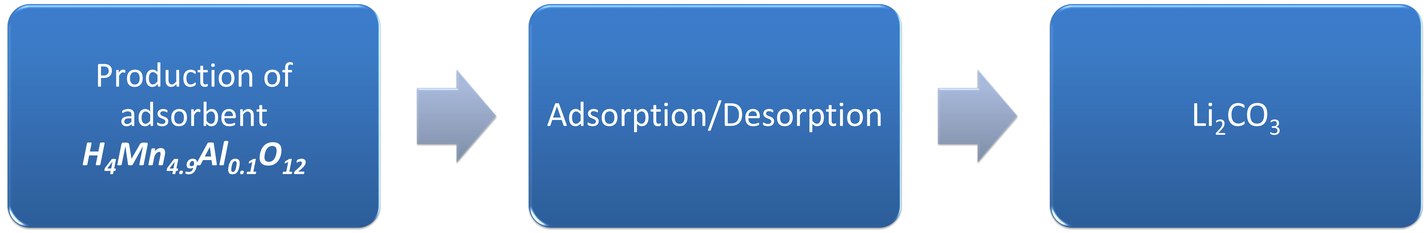
- Variation in temperature in the muffle furnace will be carried out to the mixture of $LiOH.H_2O$, MnO_2 and $AlCl_3$, molten LiCl and KCl
- $H_4Mn_{4.9}Al_{0.1}O_{12}$ will be tested against different concentration of HCl

RESEARCH PLAN

Goal 1. Synthesize and characterize $Li_4Mn_{4.9}Al_{0.1}O_{12}$ ion sieve
Goal 2. Conversion of $Li_4Mn_{4.9}Al_{0.1}O_{12}$ to $H_4Mn_{4.9}Al_{0.1}O_{12}$ which is the adsorbent material for the lithium extraction and conduct adsorption-desorption process.
Goal 3. Purify the salt precipitates to get Li_2CO_3.

METHOD

- In the first stage, $Li_4Mn_{4.9}Al_{0.1}O_{12}$ will be synthesized
- In the second stage, $Li_4Mn_{4.9}Al_{0.1}O_{12}$ will be converted to $H_4Mn_{4.9}Al_{0.1}O_{12}$ (adsorbent material) by passing HCl
- Design a simple bench-scale batch system to carry out the cyclic adsorption and desorption process that can be upgraded to a fixed bed flow configuration
- Lithium chloride after cyclic adsorption and desorption will be purified by removing unwanted metals to produce Li_2CO_3.
- Different analytical instruments like ICP-OES, SEM, TEM, and FTIR will be used to analyze and characterize the adsorbent before and after the adsorption process.
- Based on the success of the bench-scale experiments, and the design of a fixed bed flow process for the adsorption will be done



Process Flow Diagram

Results

- The ultimate expected outcome of the project will be to synthesize the $H_4Mn_{4.9}Al_{0.1}O_{12}$ compound and use it for the adsorption-desorption process to extract lithium from geothermal brine and produce lithium carbonate out of it.

REFERENCES

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