Phase 2 Abstract

A Lithium Ion Selective Membrane Coupled to a Chlor-Alkali Electrolysis Cell to Concentrate Lithium from Salton Sea Brines and Produce LiOH and Other Valuable Chemical Products in One Step

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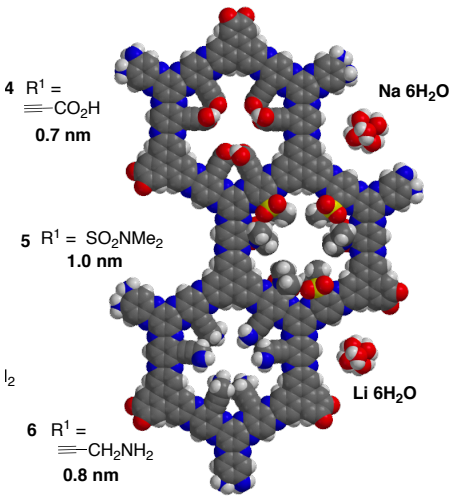
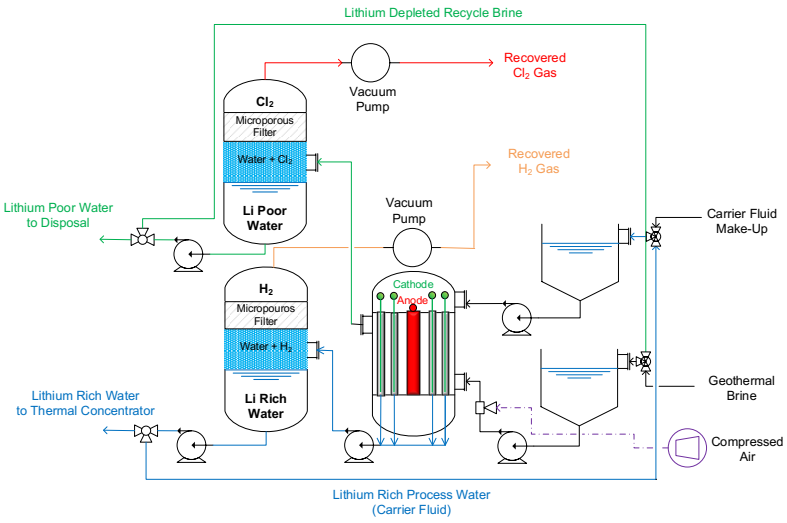
Our proposed innovative process combines the lithium separation process from the geothermal brine with the direct production of lithium hydroxide by using a membrane that is highly selective for lithium in a chlor-alkali electrolysis cell. We will development membranes made of two-dimensional covalent organic frameworks (2D-COFs) that combine high selectivity for the target lithium ion with high flux to reduce processing costs while improving product quality. This selective process addresses issues related to the relatively low lithium concentrations compared to other ions in brines and avoids using electrolysis in a downstream and usually remote process to convert lithium chloride to the hydroxide (LiOH), again reducing a significant economic and time barrier within the geothermal lithium supply chain. Additionally, the economics of the lithium extraction will be improved by the production of both green hydrogen and chlorine gas from sodium hypochlorite or pure oxygen, all of which have value as commodity chemicals.

Phase 2 will concentrate on developing two critical technologies: First the feedback between designing, synthesizing and testing new 2D-COF membrane materials for lithium ion size and charge selectivity over particularly sodium ions since there is a rather small size difference between these two ions. The other feedback will be modelling and then testing our innovative membrane in a novel chlor-alkali electrolysis cell that will be adapted from current industrial electrolyzers to conditions where the current needs to be carried by a minority of cations.





Left: Space filling model of a two-dimensional covalent organic framework (2D-COF) polymer showing different charged group fuctionality in pores for size and charge selective ion sieving. Right: A process flow diagram of a system with a novel membrane configuration for high throughput separation of lithium from brines that also produces green hydrogen and chlorine.