LITHIUM EXTRACTION FROM NATURAL BRINES THROUGH MEMBRANE ELECTROLYSIS WITH LIMITED WASTE GENERATION

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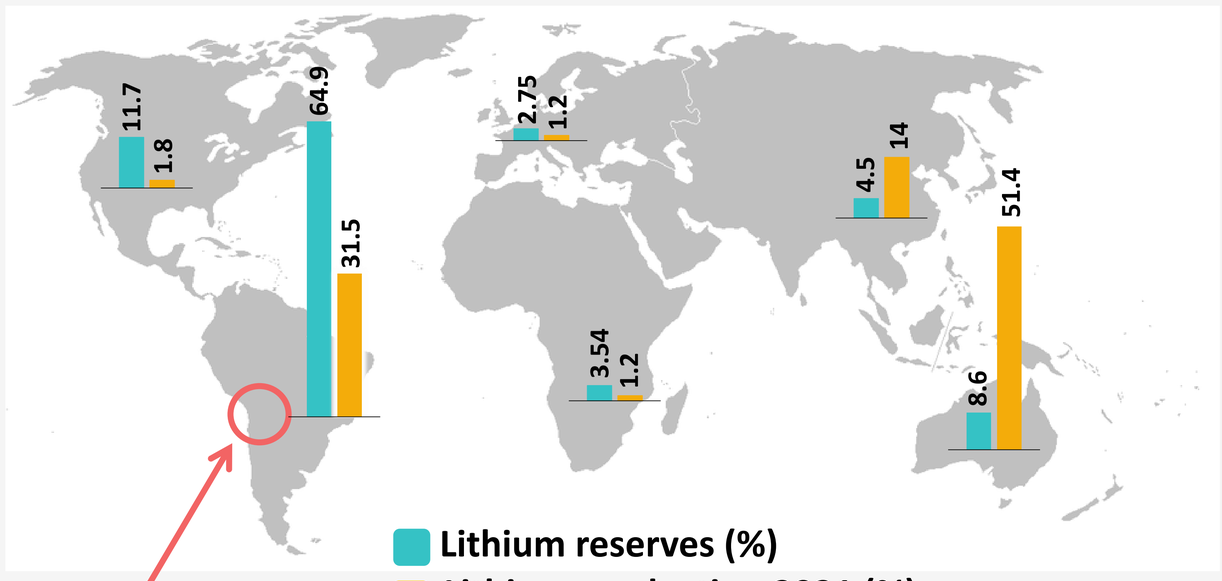
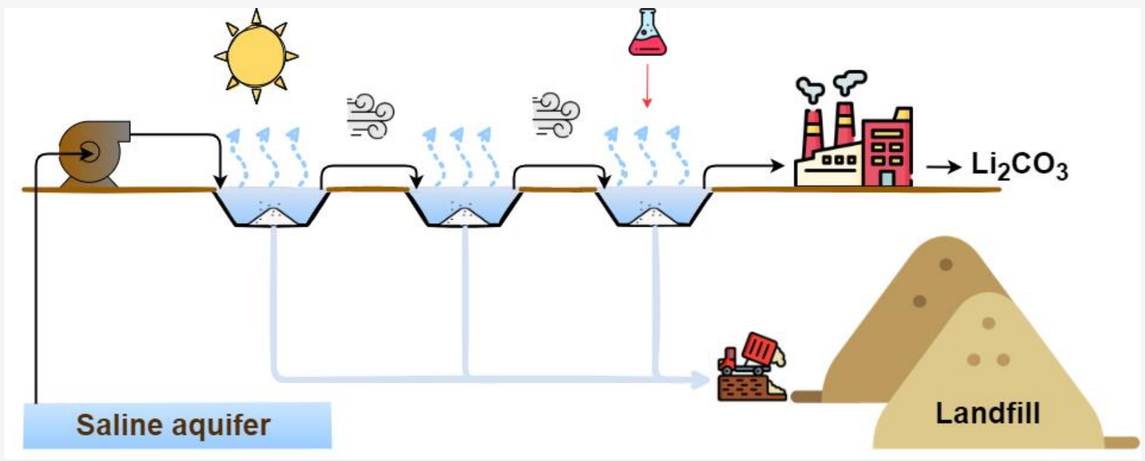
Background: Lithium distribution



Lithium triangle : 65% of the global lithium reserves are located in salt lakes with a concentration 10x higher than the sea [1].

State-of-the-art mining process

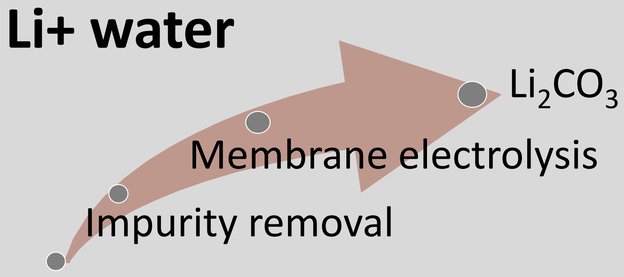


Waste landfilling
Lithium loss (30-50%)
Slow process (1.5-2 yr/cycle)
Weather dependent

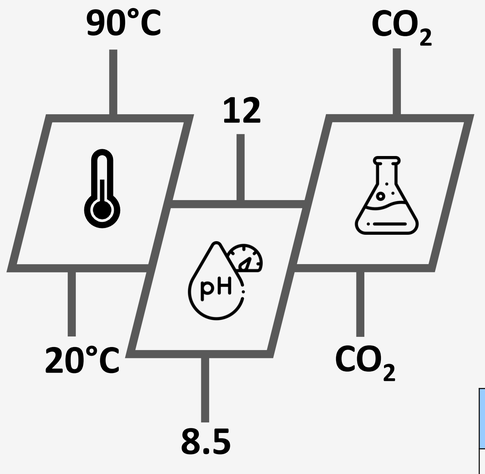
Low cost

Per ton Li_2CO_3 [2,3]			
CO_2	Water	Chemicals	Waste
3200 kg	320 m^3	3 ton	76 ton

Li+ water



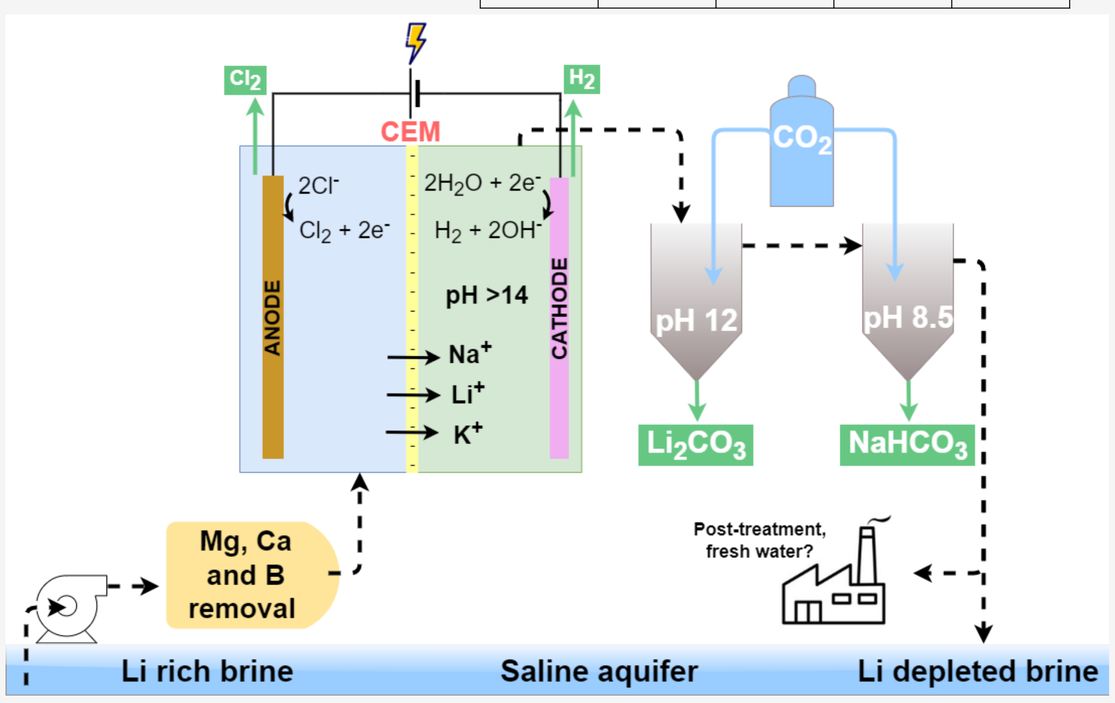
Membrane electrolysis [4]



$\Rightarrow$ Li_2CO_3

$\Rightarrow$ $NaHCO_3$

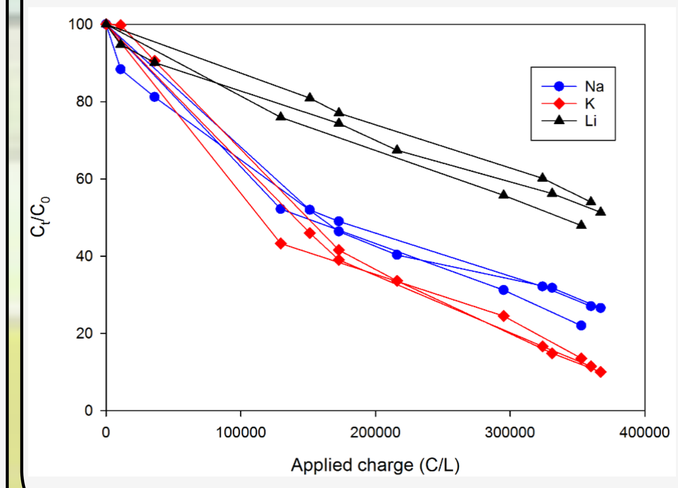
Na^+	Li^+	K^+	Cl^-	SO_4^{2-}
103.3	1.3	14.2	182.9	11.1



Results

*Cost includes only the electricity cost of the electrolyser

Current density (A/m^2)	Li extracted (%)	Na extracted (%)	E_{cons} (kWh/kg Li_2CO_3)	*Cost (€/kg Li_2CO_3)	Purity Li_2CO_3 (%)
100	73.9	28.5	79.62	3.58	98.5
250	69.7	22.5	86.12	3.87	98.3



Ion migration over membrane international (CEM): The ion migration speed is $K^+ > Na^+ > Li^+$, and is caused by the increasing hydration shell and dehydration energy from K^+ to Li^+. All ions must be migrated to the catholyte to limit Li^+ loss, but increase electricity costs drastically.

Ongoing works

Decrease of energy consumption of electrochemical cell

Reduction of CO_2 footprint, e.g. production of LiOH

References

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