

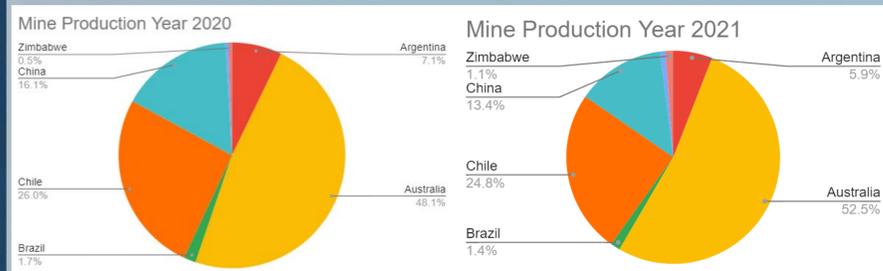
The Lithium Supply Chain: Is There Enough Lithium Globally?

By Jacob Lang

Penn State University College of Earth and Mineral Sciences

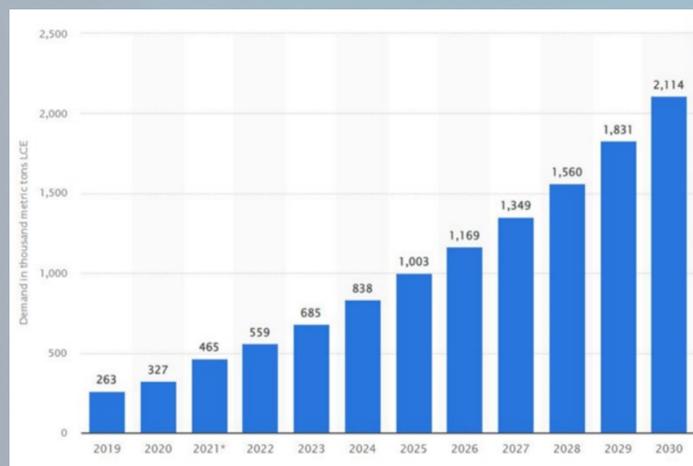
Introduction

Governments, such as the Biden Administration, Norway, China, and The European Union have taken interest in increasing and hitting a **100% zero emissions production target** for vehicles. **Lithium is the key element for Lithium-ion batteries** and in the year 2021 there was a production of **100,000 tons of lithium**. This led to the question of is there enough lithium to guarantee this target of phasing out petroleum and diesel models in the automotive industry? An analysis of a sample size of large lithium companies claiming to be able to fuel this shift could show whether the lithium industry can sustain this goal.



Objective

- Find Out Where Most of the Lithium Supply is Coming From
- Find How Much Lithium Companies Can Produce
- Find Out How Much Lithium Is Needed to Produce Batteries, Cars, etc.
- Find What the Demand is for Lithium Around the World
- **Figure out- Is there enough to achieve the goals of policymakers?**



Research Experience

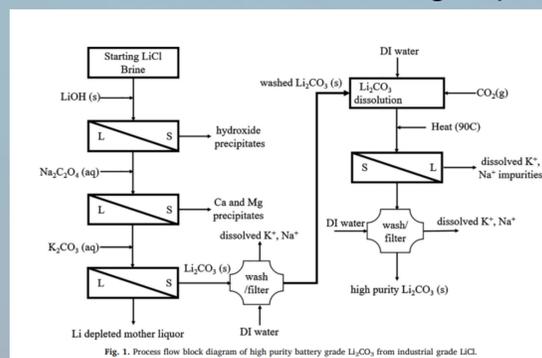
- Every Week I would get an assignment from my mentors.
- Ex: Find out how much lithium goes into a lithium-ion battery
- I would send a memo involving my research each week. We would then take that information and place it into a final report where I would have my mentors and I would discuss what more background the report needed on.
- Used Excel to create graphics and data sets.
- Learned a lot about what goes into a research project. Including format, citation, editing procedure, discussions, reaching out to various students, faculty, and companies

Company Name	Headquarter Location	Lithium Product Capacity Expected	Mining Technique
Jiangxi Ganfeng Lithium Co	China	600,000 tons	Spodumene, Clay, Brine
Albemarle Company	North Carolina, US	200,000 tons	Hard Rock, Brine
Sociedad Quimica y Minera de Chile (SQM)	Chile	108,400 tons	Brine
Pilbara Minerals	Australia	180,000 tons	Spodumene, Hard Rock
Livent	Argentina	16,000 tons	Brine
Allkem Limited	Australia	96,534 tons	Brine, Hard Rock
Lithium Americas	Canada	60,000 tons	Brine, Spodumene
Bacanora Lithium	United Kingdom	35,000 tons	N/A
Piedmont Lithium Inc	New York, US	272,000 tons	Spodumene
Core Lithium Ltd	Australia	173,000 tons	Hard Rock?
Savannah Resources	Portugal	175,000 tons	Hard Rock
Mineral Resources Limited	Australia	1,106,000 tons	Hard Rock
Total	Various	1,281,000 tons	Various



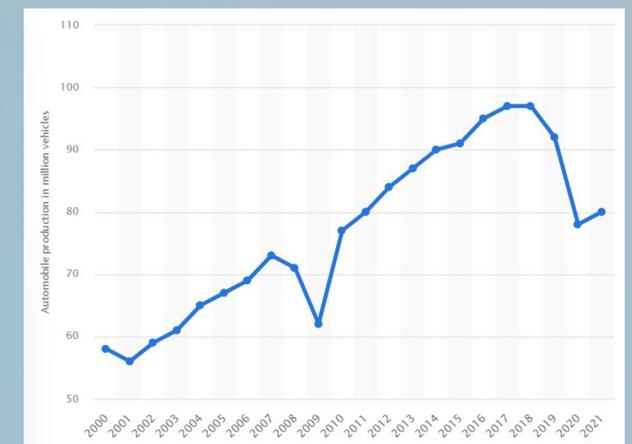
Challenges and Obstacles

- Understanding the different processes and the amount of lithium produced by each process. Each company has its own process.
- Not all lithium goes into ion-batteries. Lithium is also used in electronics, and even the medical field
- Finding "exact" numbers is very difficult. (Population Growth, Sample Size)
- Time Management- Research is very time management heavy.
- Language and cultural barrier- due to researching companies globally.



Where the Research is Heading

- We have found that one figure has each car needing 0.008 tons (8 kilograms) of lithium go into a lithium-ion battery.
- In the year 2020, the United States produced approximately 8.8 thousand cars while globally approximately 78 million cars were produced. In the year 2021 80 million cars were produced globally. The current number we have is it would take approximately 624,000 tons (566 million kilograms) of lithium to produce enough electric cars globally to match cars in 2020. In 2021, it would take 640,000 tons (580 million kilograms) for global production.
- The lithium companies I analyzed together claim they can produce 1,281,000 tons of lithium by the year 2026. Next I will be breaking down what companies are producing in the present versus the future to get a better idea of the current amount of global lithium.



References

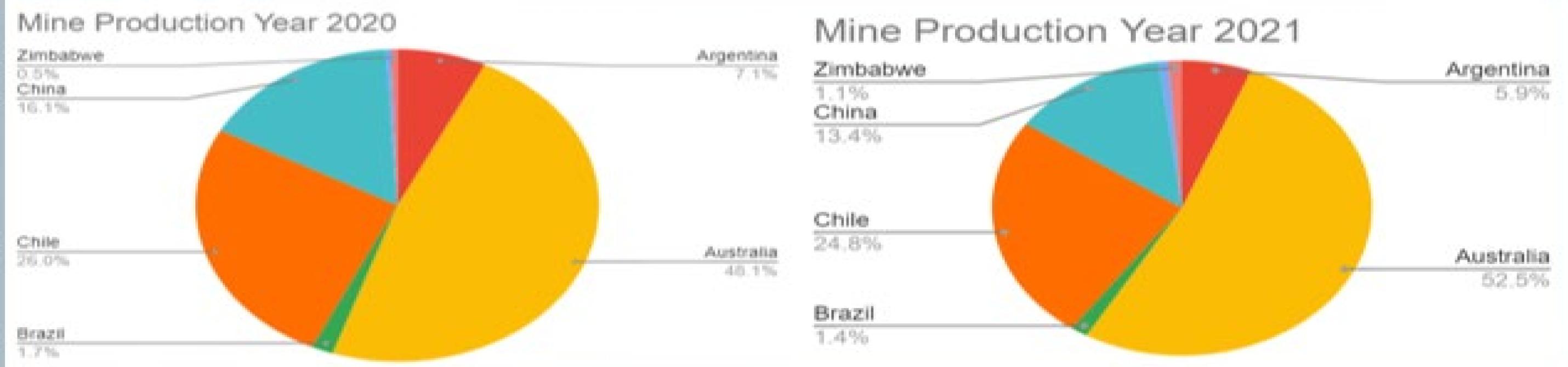
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- Placek, Martin. "Car Production: Number of Cars Produced Worldwide 2018." *Statista*, Statista, 13 Apr. 2022, <https://www.statista.com/statistics/262747/worldwide-automobile-production-since-2000/>.

Acknowledgements

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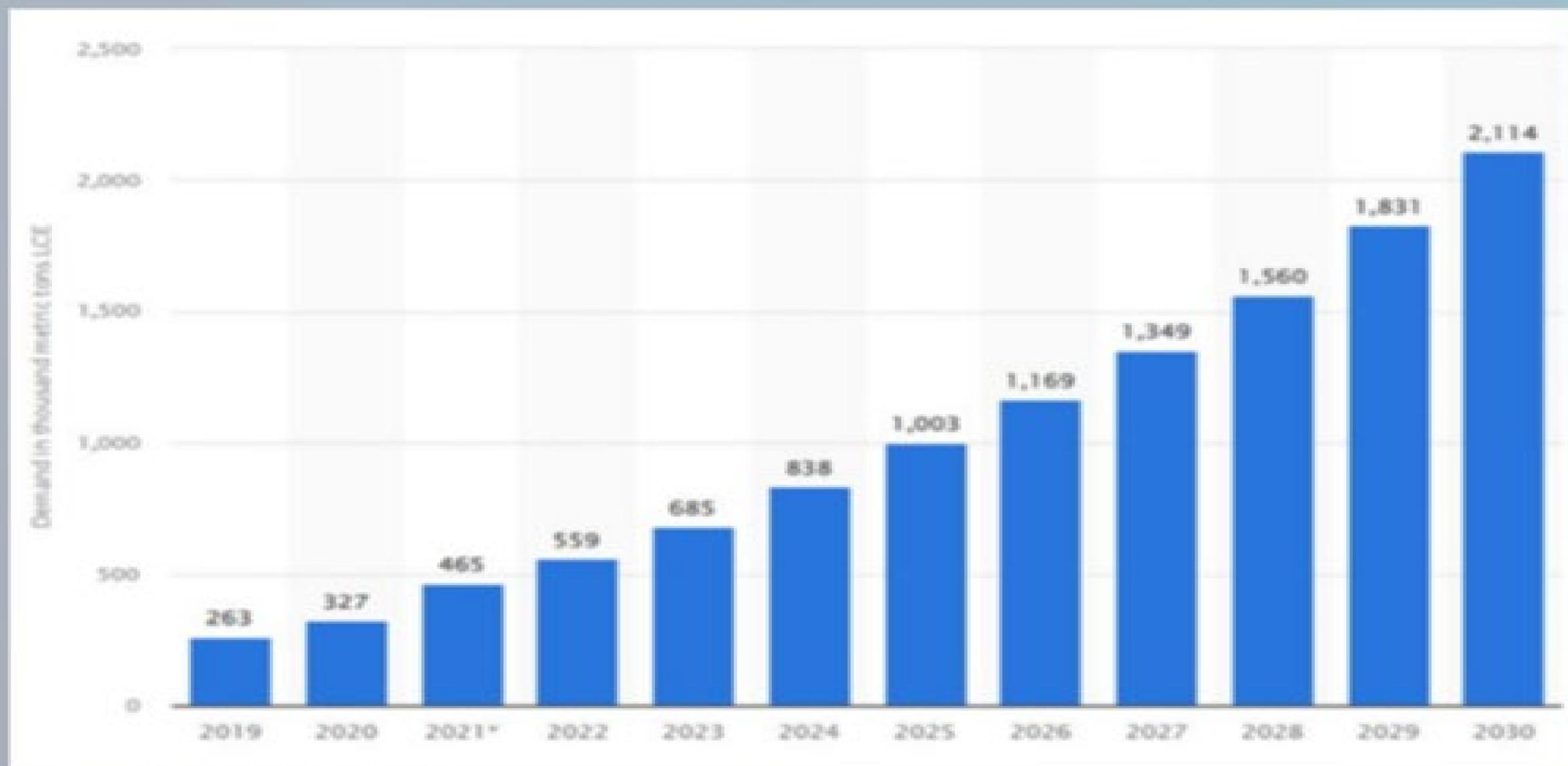
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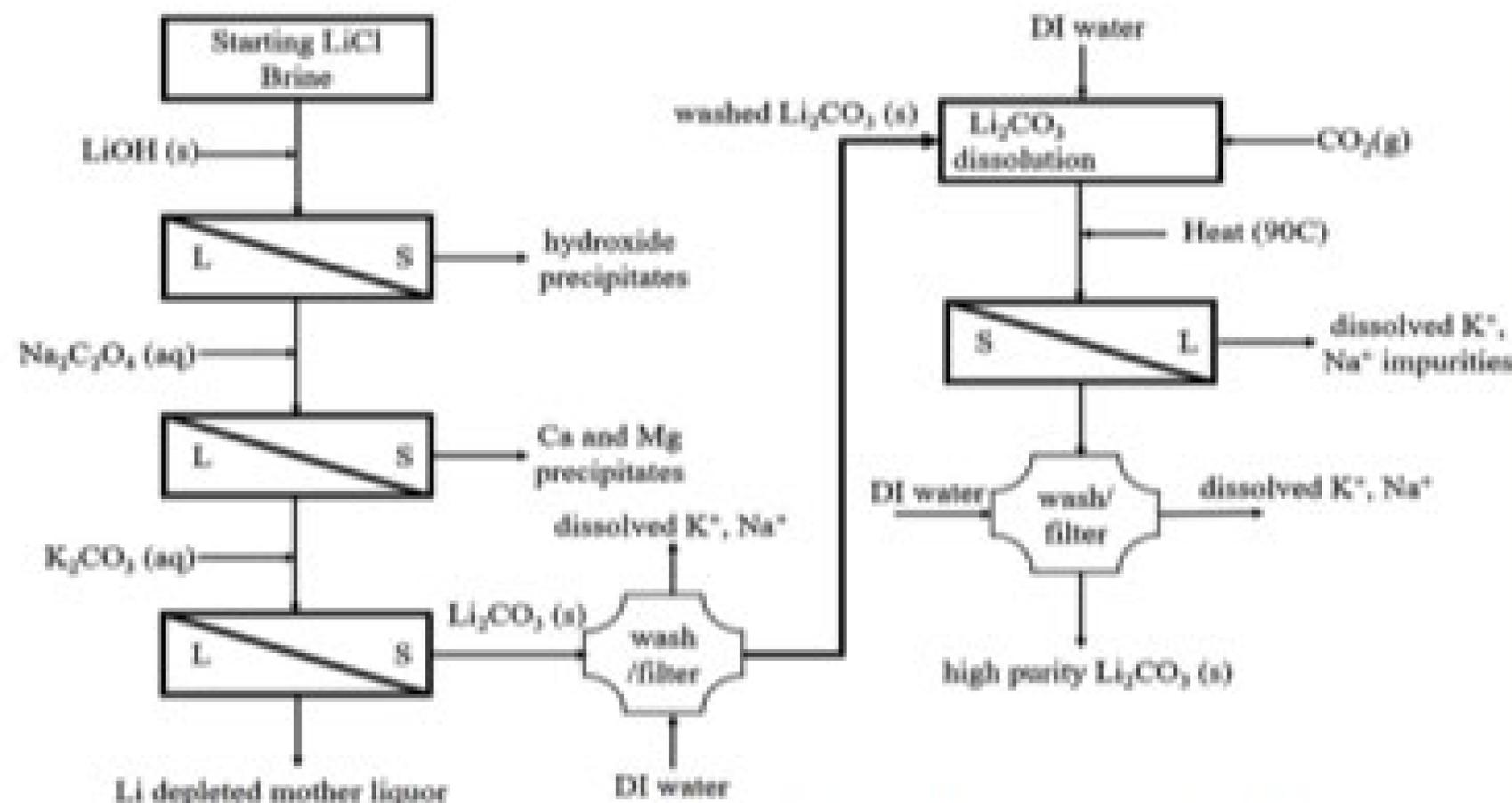


Fig. 1. Process flow block diagram of high purity battery grade Li_2CO_3 from industrial grade LiCl .

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