# Recovery of Li from the batteries via enhanced chemical transformations using waste carbon and water leaching

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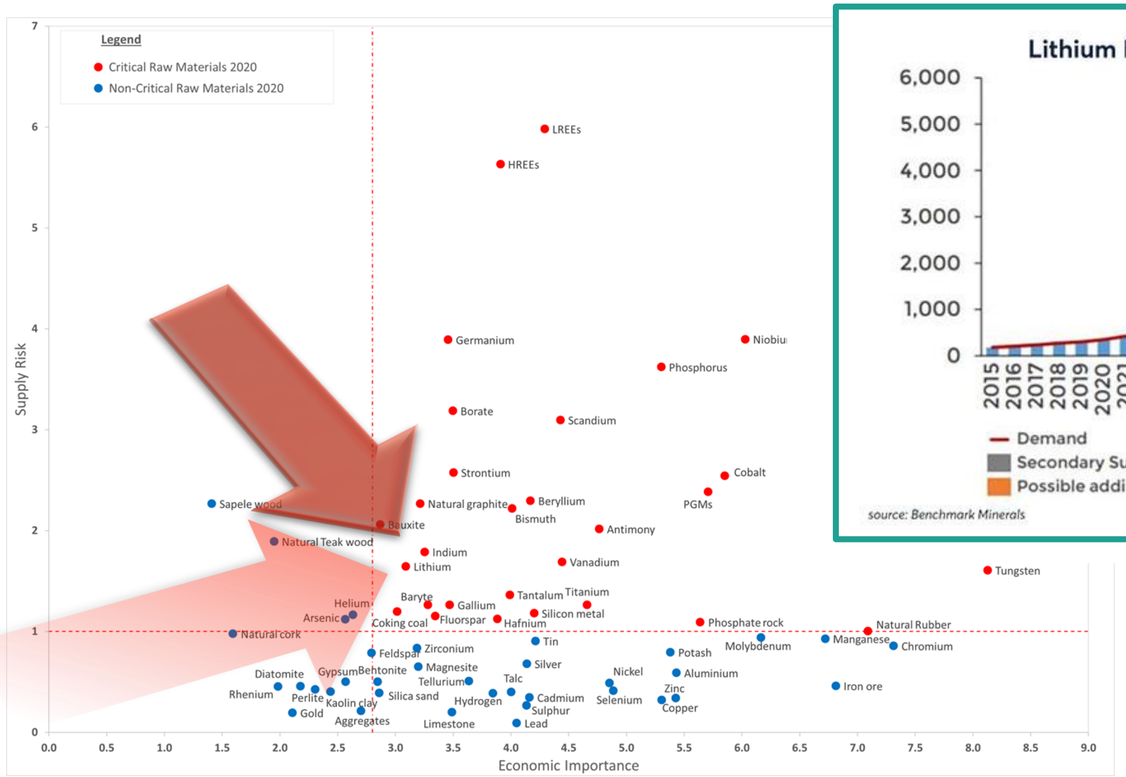
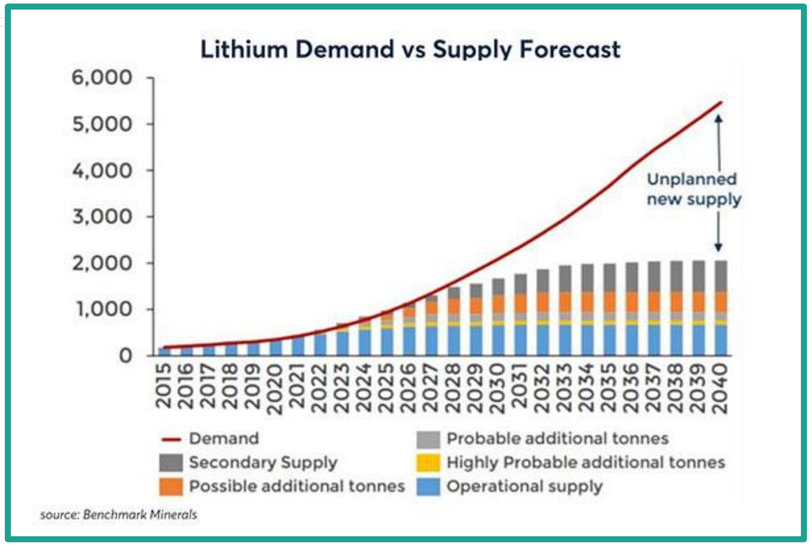
**Project duration**
2021-06-01 – 2021-11-30

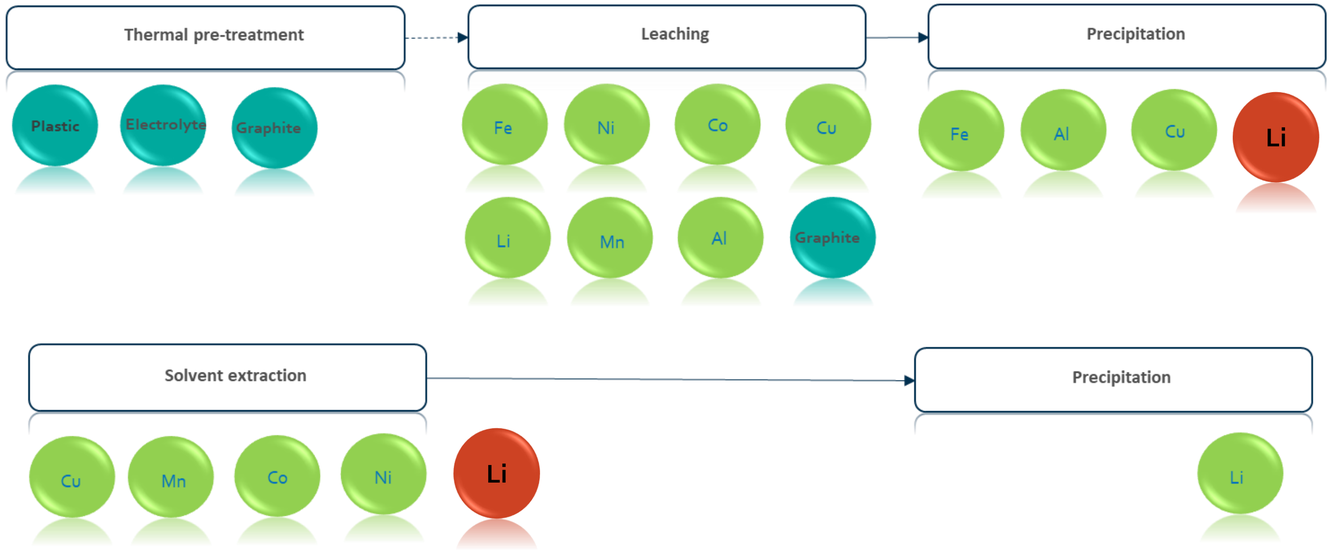
SWEDISH MINING INNOVATION

Med stöd från
VINNOVA Sveriges innovationsmyndighet
Energimyndigheten
FORMAS
Strategiska innovations-program

# Purpose of the project

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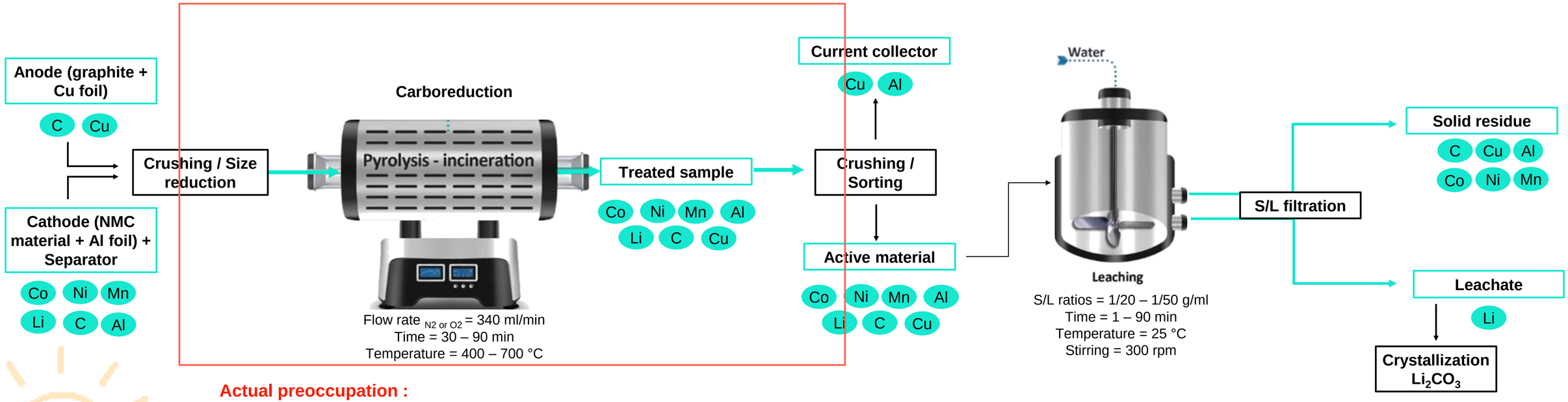
# Goals of the project

→ Improving the lithium recovery rate to 95% using an early-stage water leaching after a reducing thermal treatment and producing $Li_2CO_3$ reusable to produce batteries with a purity of 99.95%




**Actual preoccupation :**

- **Maximize the lithium transformation from its salts and oxides present in the LiBs to lithium carbonate**
- **Minimize waste generation via utilization carbon recovered from the batteries – lower production of solid residues**



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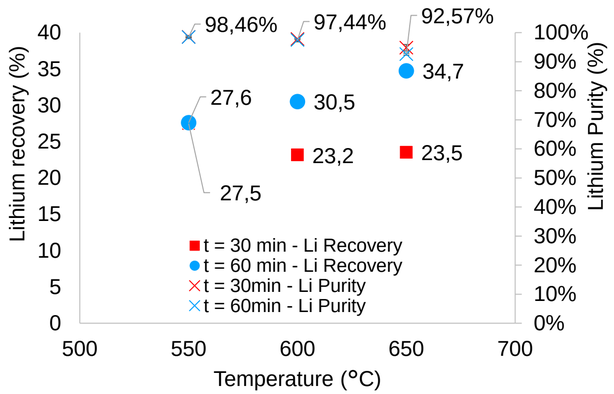
# Results so far

## ① Identification of the optimal carbon source during the thermal treatment

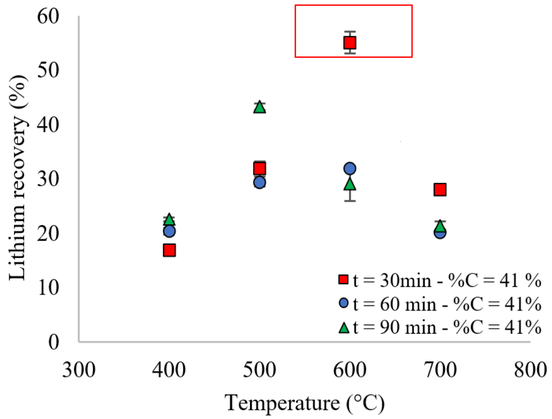
Pyrolysis - Anode and cathode crushed without the separator %C = 21%

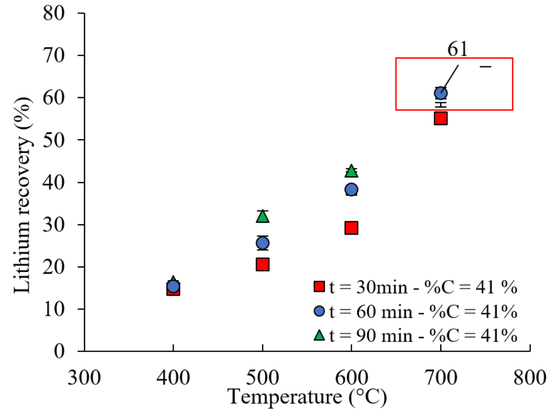



Limitation of the lithium recovery **at 30%** when the initial material is Cathode + Anode only in the case of pyrolysis and incineration

**→ Processing active material + current collector and separator ( %C $_{optimal}$ = 41 %) to optimize the reduction**

## ② Investigation of the optimal thermal treatment parameter for the lithium transformation




**Incineration**

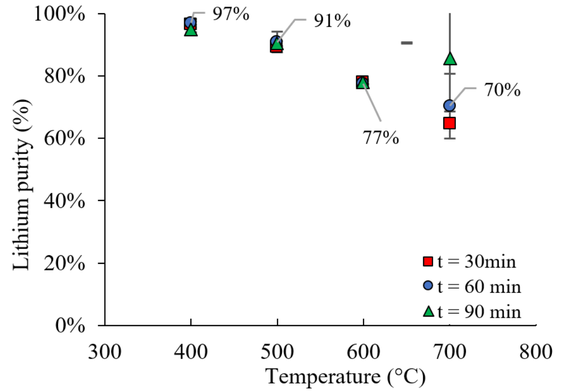
Limitation factor → the flow rate of O2

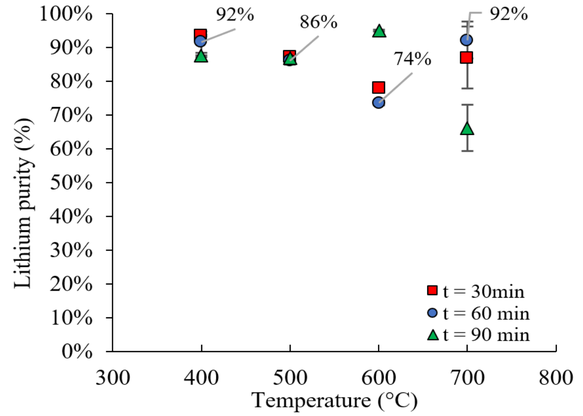
**Pyrolysis**

Limitation factor → too low temperature

## ③ Selectivity of the leaching

**Co-extraction of Aluminum but the other metals remain in the residue**



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# Upcoming activities and next step

**Optimize the thermal pre-treatment to achieve maximal Li transformation**

Define the optimal ratio between $C/O_2$

**Purify lithium carbonate product by aluminium removal**

Use of selective molecules for solvent extraction process.

**Identify anionic impurities in the product**

F, Cl – can affect the usability of the product in the battery production.

**In the process of writing the manuscript – submitted November/December**





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