

# Synergistic Hydrometallurgical Treatment for Pyrolysed and Flotated Black Mass from the Spent Li-Ions Batteries

## AP 4 : Cleaning of flotation products and development of a recycling concept

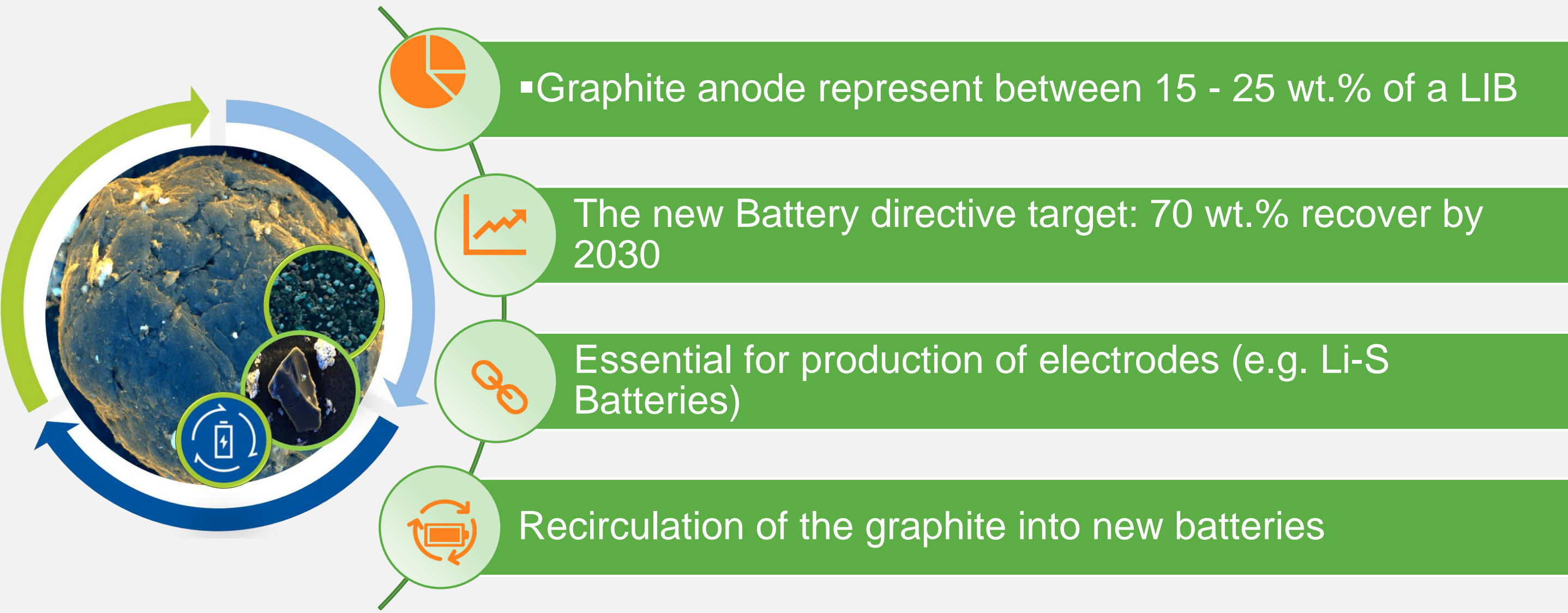
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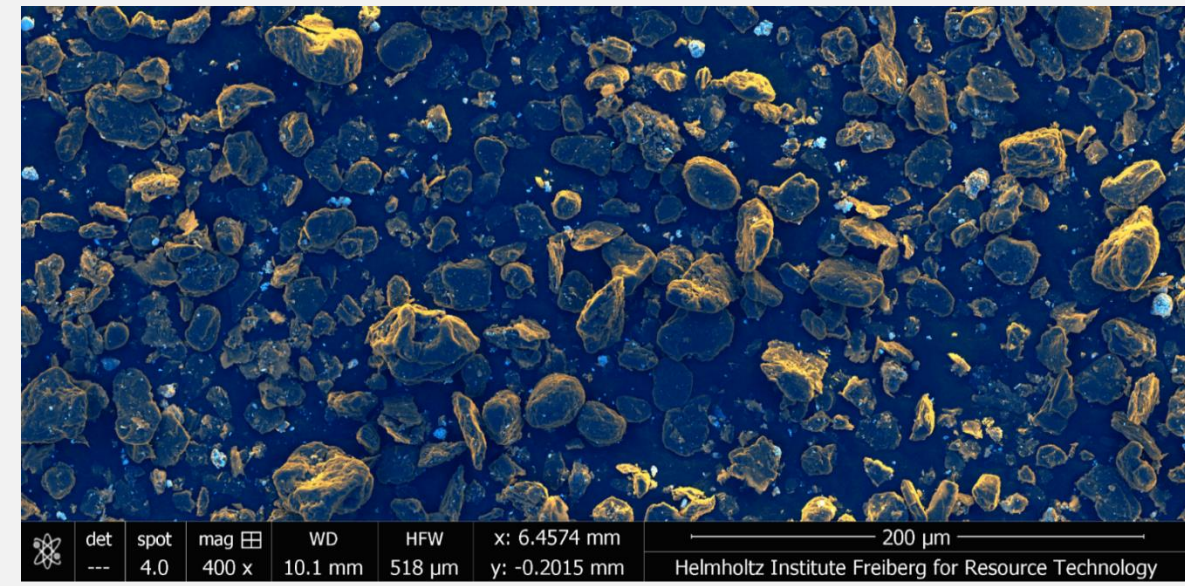
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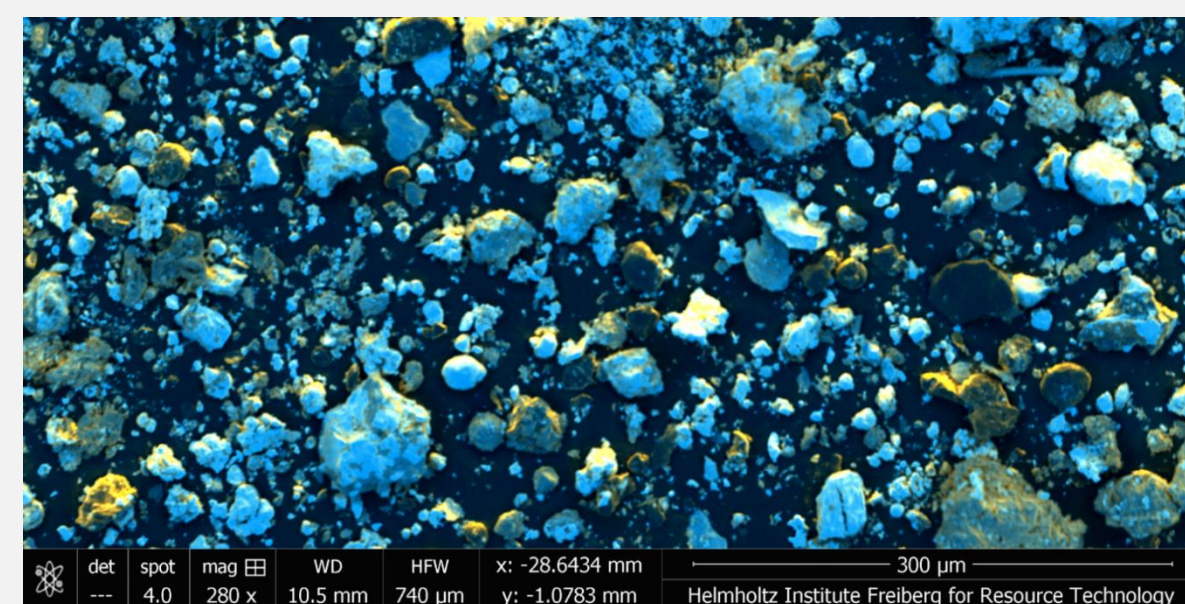
### Recovery of graphite from flotation products



### Initial Situation / State of Research



Concentrate Fraction (~80% C)

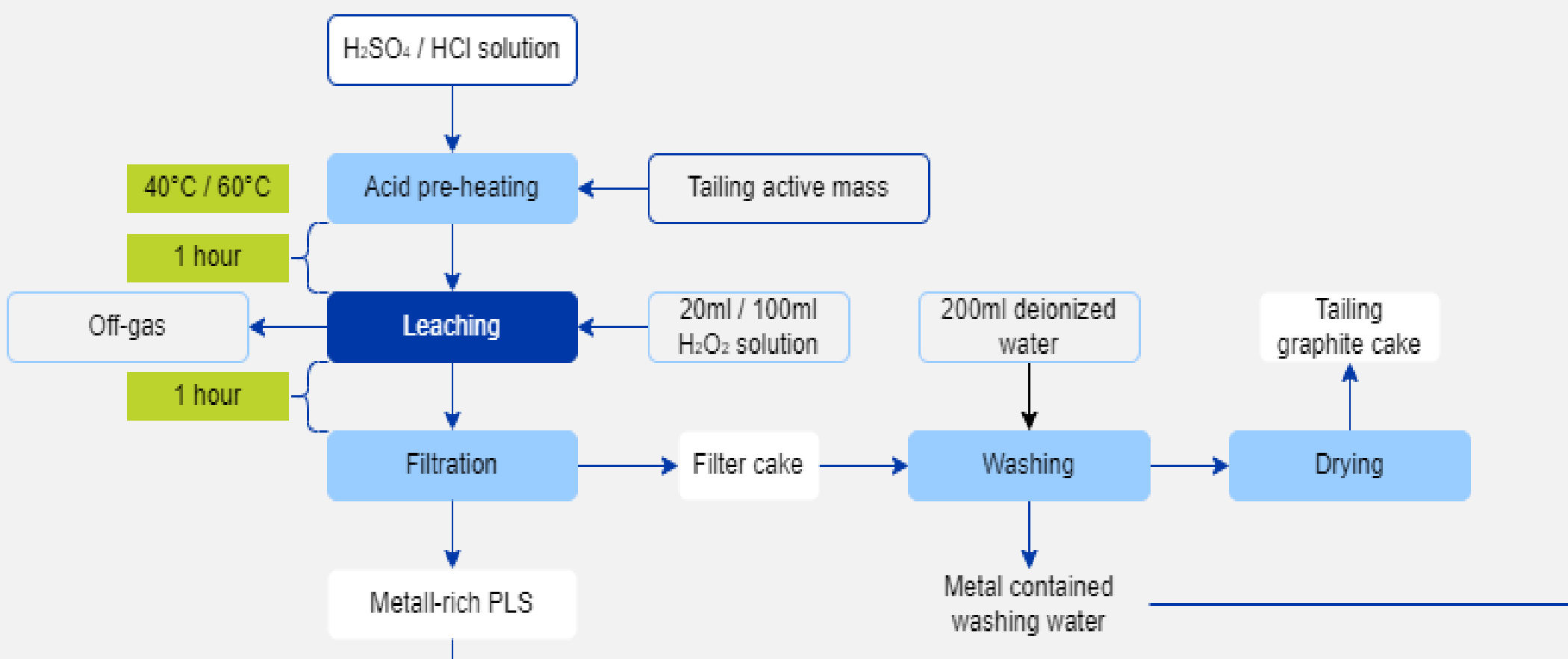


Tailings fraction (<10% C)

- Froth flotation from AP 3 produced overflow and underflow fractions
- Overflow consists mainly of carbon
- Underflow consists mainly of metal oxides
- Floated materials contain large amount of valuables to be extracted → Hydrometallurgy Treatment

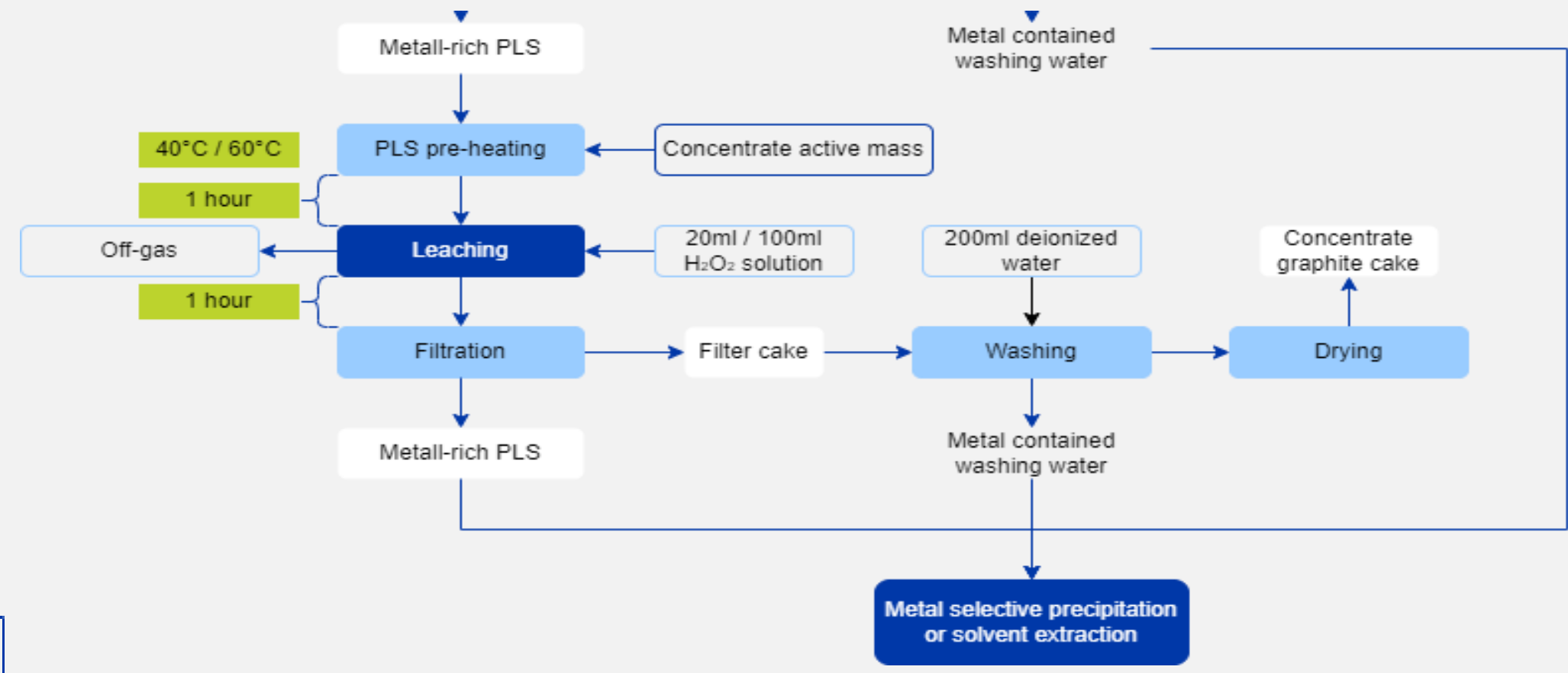
### Methodology

#### Stage 1 leaching with fresh acid solutions



- 2 Types of acids tested : Sulphuric and Hydrochloric
- Input materials : Tailing fraction (<10% C) → tailing graphite cake and metal-rich PLS (pregnant leaching solution)

#### Stage 2 leaching with metal-rich PLS



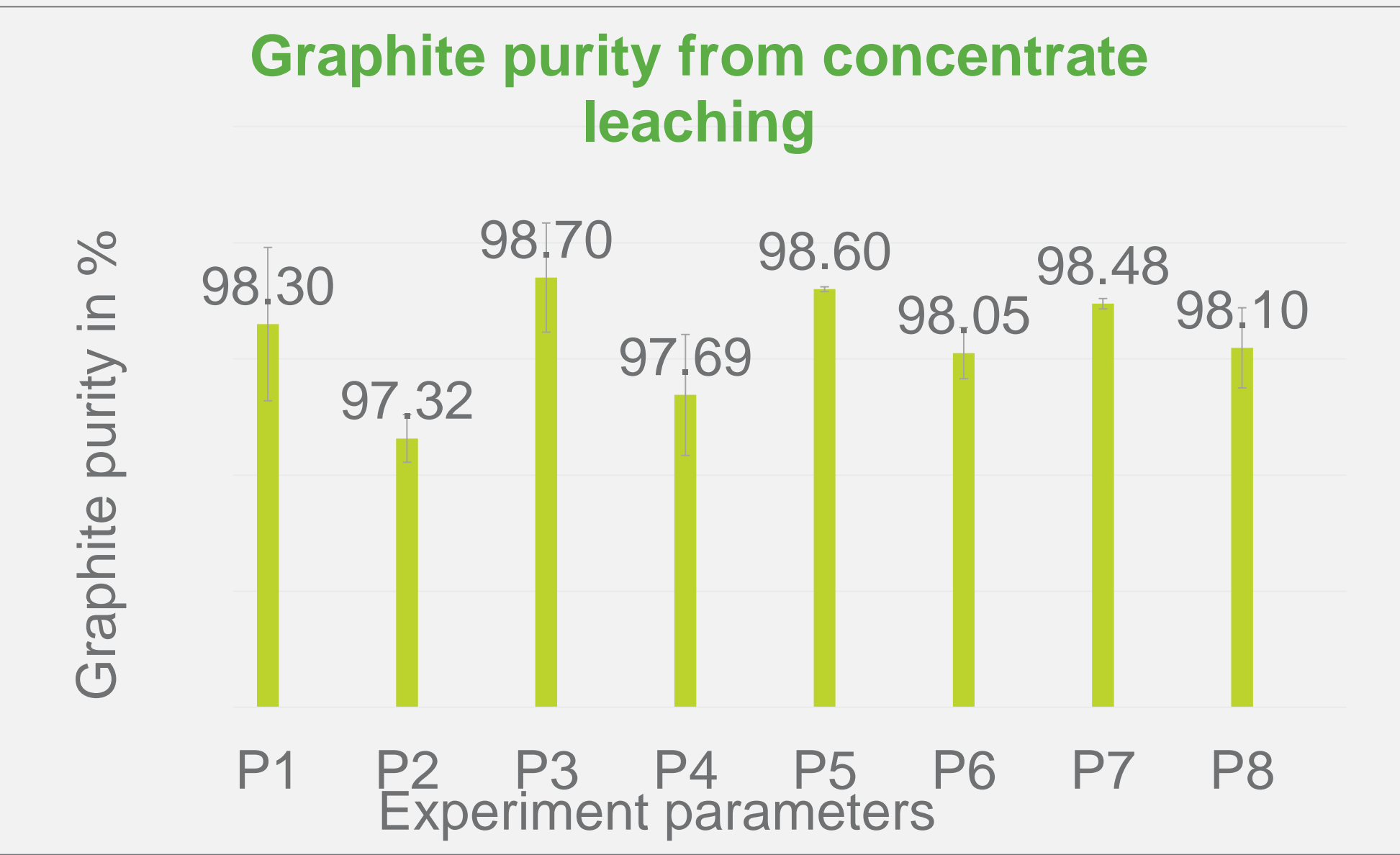
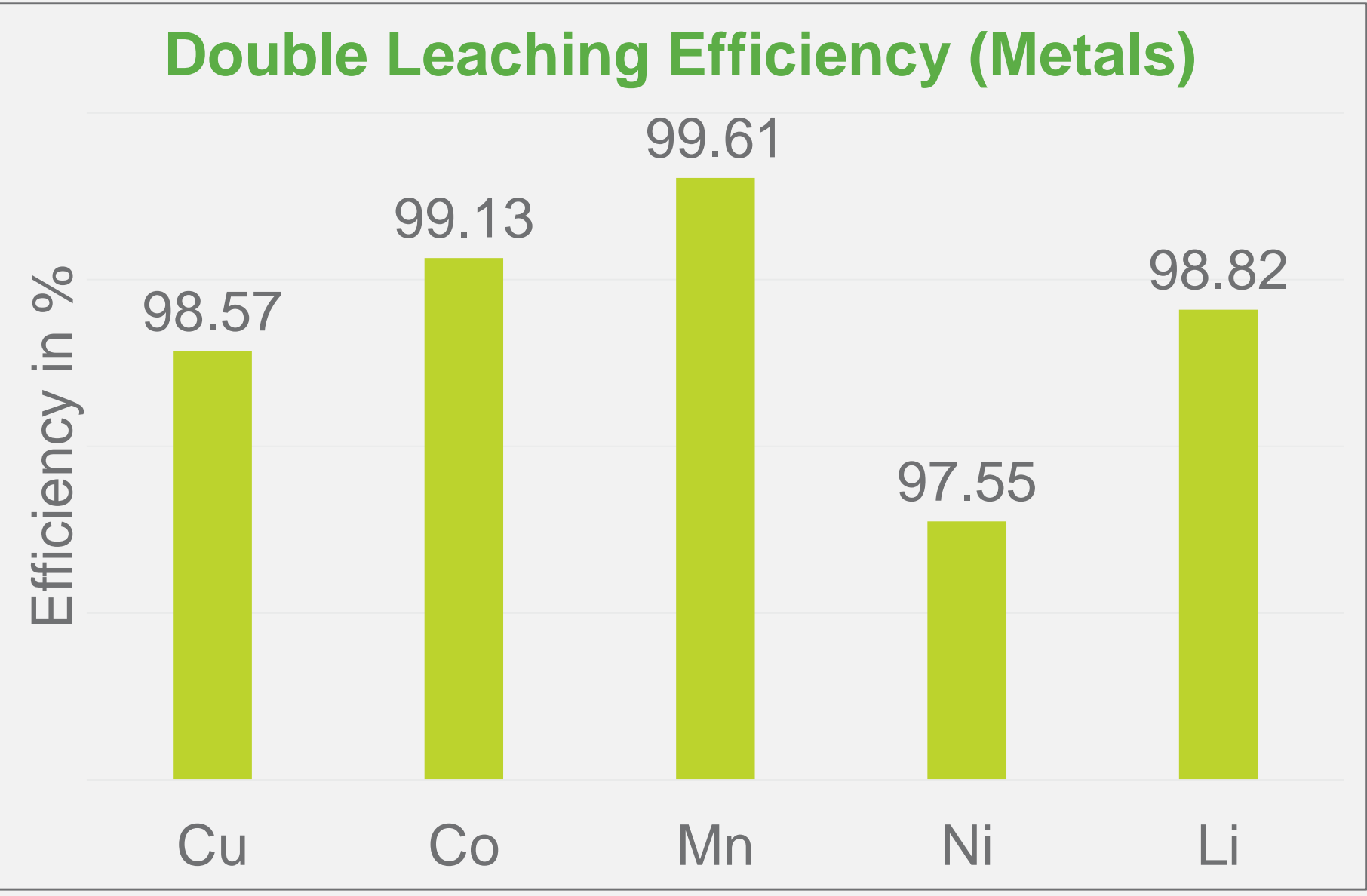
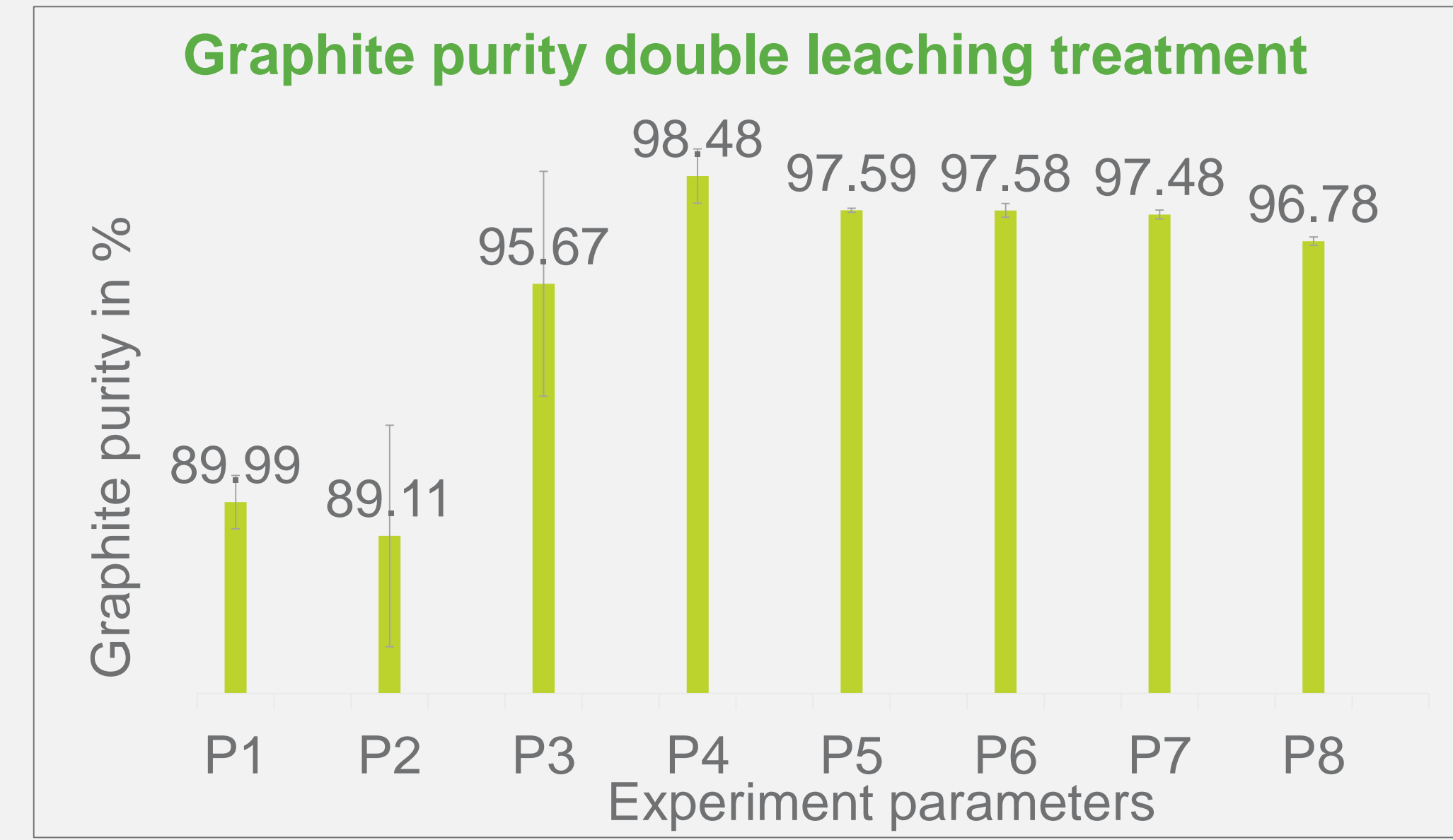
- Stage 2 tested leaching with metal-rich PLS
- Input materials : Concentrate Fraction (~80% C) → Graphite cake with metal rich solution for metal recovery

- Two steps hydrometallurgical treatment developed
- Extractive → Graphite/carbon recovery
- Purification → Metal recovery

### Results

- Best case parameters determined from Experiment P4
- KPI for graphite purity > 98% achieved in P4

- Concentrate leaching on its own show very high graphite purity



	Leaching medium	Acid concentration	Temperature	Hydrogen peroxide	S/L ratio after 2 hours
P4	H <sub>2</sub> SO <sub>4</sub>	3 mol/L	60°C	20 ml	1:10,5

- Experiment parameters vary in terms of acid concentration (2-4 mol/L) and temperature (40°C or 60°C)
- Repeated experiments conducted with 4 mol/L sulphuric acid

### Sources and own publications

1. J.Wijaya, P. Sabarny, B. Friedrich, Synergistic Hydrometallurgical Treatment for Pyrolysed and Flotated Black Mass from the Spent Li-Ions Batteries, Master Thesis, submitted March 2023

### Acknowledgements

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