Newsletter N° 6 – June 2021
Libat Project, Life 2016

*L*ife *L*iBat *P*roject

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1. Life Cycle Assessment and environmental impacts

Life cycle assessment or LCA is a methodology for assessing environmental impacts associated with all the stages of the life cycle of a commercial product, process, or service.

It is composed by the following phases:

<u>The goal</u>: motivation and context of the study;

<u>Inventory analysis</u>: collection and acquisition of data and the consequent modeling of the system

<u>Impact assessment</u>: obtain the information resulting from the inventory analysis constitutes the starting point for the assessment phase.

<u>Interpretation</u>: a valid correlation is achieved between the results of the inventory analysis and the impact assessment in order to propose useful recommendations and identify which are the critical issues.

LCA carried out were focused to characterize the environmental advantages derived by recovering materials with the LiBaT process in place of implementing a pyrometallurgical process.

The innovative treatment, which assessment produced a whole negative value.
Confirms the environmental benefit of the process, thanks to the recovered fractions.

By comparing the impact category relating to climate change, by using the libat process a significant reduction in the environmental impact in terms of kg of carbon dioxide equivalent is obtained. The greatest environmental load in this process derives from the use of leaching reagents while in the case of the pyrometallurgical process the main contribution is associated with the energy consumption.

The LiBaT process allows a reduction in terms of kg CO_2 equivalent equal to 91%.

By analyzing all the impact categories of the LiBat process, it was found that, despite representing a significant progress if compared to more traditional processes, it is possible to make it even less impactful on the environment by optimizing the use of reagents and replacing them when possible, with more environmentally friendly chemicals.

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2. Process simulation and economic feasibility analysis

In a process simulation, the **data coming from the laboratory and the date coming from prototype demonstration campaign** were used both for the characterizations of the batteries and for the chemical operations involved. Fixed costs, reagent costs, labor costs, waste disposal costs and finally those linked to the sale of products have been entered to make an economic feasibility analysis.

Simulation 1: LiBat full process at various scale

Economically not feasible for:

12,6 t/y (prototype scale)

300 t/y (actual collection amount in EU)

Current amount of Li(0) batteries on the market do not allow process profitability

Simulation 2: LiBat mechanical and lithium recovery sections

A further simulation was performed to verify the costs of the treatment associated with only the mechanical treatment including the precipitation of lithium, which is a critical raw material.

SEVal currently pays other plants to treat these batteries, with also relevant costs for logistics.

If SEVal with the LIFE LIBAT prototype treats the batteries (using only a part of prototype, excluding the Mn recovery) and recovers lithium, should only send the electrode powder to other plant treatment with a minor cost associated.

Economically feasible already at prototype scale!

SEVal now continues to operate LiBat plant to treat Li(0) batteries

Simulation 3: LiBat implementation with Li-Ion batteries

Finally, a process simulation was performed by implementing the treatment of lithium ion batteries in the LIFE LIBAT process.

The mechanical section of the LIFE LIBAT process can be used in this combined process, but dedicated campaigns must be carried out to treat lithium ion and lithium (0) separately, on the mechanical side.

Once the electrode powder mix has been obtained, it is treated to leach and recover (after impurity precipitation) a mixture of hydroxides (with high added value) precursors for the formation of NMC to be used as a constituent of new batteries.

Including the treatment of lithium-ion batteries, the process becomes economically feasible starting from 110 t batteries processing per year.