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PROCESS MODELLING AND LIFE CYCLE ASSESSMENT: CONVENTIONAL AND NOVEL PRCESSING OF SPODUMENE

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ABSTRACT

Lithium is considered a critical metal to enable the transition from a fossil fuelled to an electric economy. It is estimated that lithium demand can grow up to 500% by 2050 compared to 2018 production. However, the cost of production will remain important, and it is critical that the increased production required for moving to an electric economy is not offset by an increase in adverse environmental impacts during raw material extraction.

In this study, process modelling is combined with prospective LCA modelling, enabling earlier and much better-informed decisions about economic and environmental sustainability. The production of lithium carbonate from spodumene is considered. The conventional route is thermal decrepitation, sulphuric acid bake, water leach, purification, and recovery of lithium. The novel approach is thermal decrepitation, pressure leaching with CO_2, precipitation and purification of lithium carbonate.

To ensure holistic decision-making it is important that costs, revenue, carbon footprint, water scarcity footprint and other environmental impact categories are all considered throughout the iterative design phase. Process modelling can be used to evaluate the technical and economic feasibility of a project design, whilst life cycle assessment (LCA) can be used to quantify environmental impacts of a production route or processing technology. LCA is a methodology to quantify environmental impacts associated with all stages of a product, process, or activity. An integrated approach is presented that enables the early consideration of economic and environmental factors when evaluating alternative technologies.

Keywords: Lithium, CO_2, water, environment, LCA, economics