Federal Ministry of Education and Research

CO_2WIN Use Carbon Sustainably

CO_2-LiPriSek – Carbonation of lithium-containing primary and secondary raw materials using CO_2

CO_2 as a sustainable source of carbon - Pathways to industrial application (CO_2-WIN)

The "CO_2-LiPriSek" project aims to develop and evaluate a universal, economical process for the extraction of marketable lithium from lithium-containing ores and industrial waste. By means of direct carbonation, different raw materials, like lithium-containing ores or battery residues, will be converted into lithium carbonate of battery-grade quality. The project is funded as part of the funding measure "CO_2 as a sustainable source of carbon – Pathways to industrial utilization (CO_2-WIN)". The measure supports projects that utilize carbon dioxide as a sustainable carbon source for the German economy.

More domestic raw materials and recycling

An essential cornerstone of the German Climate Protection Programme 2030 is the expansion of electric mobility. This is associated with a growing demand for lithium batteries, which corresponds to an ever increasing lithium requirement. More than half of the workable lithium deposits are located in the salt lakes of South America. Europe has only four per cent of the world's lithium reserves. With respect to the rising demand for lithium and the uneven distribution of lithium deposits, domestic deposits, as well as recycling of lithium-containing battery residues, are increasingly coming into focus. Therefore, the aim is to convert the lithium (Li) contained in the lithium-containing raw materials into marketable lithium carbonate (Li_2CO_3) by direct carbonation of the lithium-containing raw materials using CO_2.

Lithium deposits from domestic deposits.

Complete recycling of raw materials

The novelty of the process presented here is to consider CO_2 as a raw material. As a result of the carbonation of Li-containing raw materials, the Li portion is converted into Li_2CO_3. Thus, a marketable product is generated and at the same time, climate-damaging CO_2 is bound. The aim is to develop a process that is as simple and flexible as possible with a variability in input materials. The strategy of producing CO_2-free building materials from the silicate residues is pioneering, which guarantees the complete recycling of the raw materials. To achieve the goals, the educts are first thermally treated at high temperature with subsequent carbonation. This approach is exemplary for an economically viable zero-waste process with an almost climate-neutral carbon footprint. The process concept involves converting the Li fraction into soluble $LiHCO_3$, followed by concentrating by electrodialysis and purifying, for instance by ion exchange. The separation is finally carried out by precipitation and subsequent filtration of the resulting Li_2CO_3.

Based on a complete optimization and upscaling, an economic evaluation of the process is performed. Due to the expected composition of the resulting silicate residues, they represent a promising binder for the production of so-called geopolymers. The aim is to develop a basic mixture that guarantees a product quality in accordance with the required specifications despite varying residue compositions. The produced building materials are interesting because of their uncomplicated recyclability and will be investigated for their application potential as building materials above and below ground. Finally, an assessment of the CO_2 emission savings potential in comparison with classic cements will be carried out.

A strong team from business and science

The "CO_2-LiPriSek" project addresses a broad raw material base and leads to a significant and sustainable

reduction of CO_2 emissions. For this purpose, a collaboration between the Institute of Chemical Technology of the TU Bergakademie Freiberg and the company Dorfner ANZAPLAN GmbH was established. The academic partner deals with raw material conditioning, carbonation, and the development of building materials. The project is accompanied by an analytical characterization of all process streams.

The task of ANZAPLAN is the extraction of the desired product Li_2Co_3, as well as the economic and ecological evaluation of the process. In this way, a process is developed that enables the production of marketable Li_2Co_3 in battery grade quality from primary and secondary raw materials containing Li. As the process allows the use of different starting materials, the potential for worldwide marketing of the technology is created. The project results have a knock-on effect in raw material extraction and recycling, and also in the building materials sector, creating a cross-sectoral value chain.

"CO_2-LiPriSek" promotes electric mobility.

Funding initiative
CO_2 as a sustainable source of carbon –
Pathways to industrial utilization (CO_2-WIN)

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CO_2-LiPriSek – Carbonation of lithium-containing primary and secondary raw materials using CO_2

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