**New eco-efficient process to produce high-purity lithium hydroxide**

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Lithium is a light alkali metal that is essential to produce lithium batteries and hence a key raw material in the process of the global green energy transition. Sources of lithium include lithium ores in pegmatitic and sedimentary rocks, brines in salt flats, oil or geothermal fields, and even seawater[1]. Although this metal is present in about 60 parts per million (or grams per ton) in the earth's crust and is therefore more abundant than for instance lead, boron or tin[2], there are not too many lithium deposits worldwide with sufficiently high concentrations and quantities that allow a profitable exploitation.

At present, the extraction of lithium from salt brines is the most competitive practice in the market, due to its relatively low investment and operating costs. Most of the important lithium deposits in salt flats worldwide are found in brines in the region known as the "lithium triangle", located in the territories of Argentina (salt flats of the Jujuy and Salta puna, and northern Catamarca), Bolivia (Uyuni and Coipasa salt flats) and Chile (Atacama and Maricunga salt flats)[3]. In South Amercia, Peru also has significant reserves, present for example in the brines of the Bayovar and Sechura depressions in the Piura region[4] or in the Falchani deposit of the Macusani project in the Puno region[5].

Salar de Uyuni in Bolivia; Foto from Lucca Galuccia

The growing demand for newer cathode technologies requires high-purity lithium hydroxide with low residual concentrations of ions such as sodium, calcium, magnesium or chloride. However, lithium from brines usually is obtained in the form of chloride, carbonate or sulfate, and there is demand for cost-effective and environmentally sound technologies for the production of battery grade lithium hydroxide.

At present there are few processes for the conversion of lithium salts into lithium hydroxide with the required quality, applying methods such as interionic exchange, selective extractions or electrolytic or electrodialytic procedures[6-11]. Most of these known processes are characterized by low yields or in the case of electrochemical procedures by robustness deficiencies and frequently require harmful reagents and high amounts of water and energy. Particularly the high freshwater consumption required for mining activities is causing socio-environmental conflicts due to its scarcity in the desert areas of the salt flats[12)].

In response to these shortcomings and problems, K-UTEC Salt Technologies has developed an innovative process to produce lithium hydroxide in a quality suitable for battery production, avoiding the use of environmentally harmful chemicals and minimizing the use of freshwater[13)]. Particularly the water efficiency and robustness of the technology is considered an important advance compared to other lithium hydroxide production processes currently applied.

*Pilot Plant of K-UTEC Salt Technologies in Sondershausen*

The new process consists of subjecting the pre-concentrated lithium solution to a sophisticated process using evaporation and cooling operations to eliminate most of the impurities present in order to crystallize high-purity lithium chloride. This product then is converted into lithium hydroxide using an innovative proprietary electrodialysis process. The process yield reaches almost 100% and commercially valuable by-products such as magnesium salts are also retained for commercialization. With 40% lower investment costs, a 30% reduction in operating costs and the commercialization of by-products, the technology is highly competitive and environmentally friendly[13)]. K-UTEC Salt Technologies has already optimized the process in its in-house pilot plant and process robustness has been proven during a six-month test run.

The importance of this innovation received official recognition through the silver medal for outstanding innovations in the chemical and polymer category in the framework of the IQ Innovation Award Central Germany 2020 (IQ Innovationspreis Mitteldeutschland 2020)[14)], which confirms the importance and imminent practical application in the current context of global lithium production in the framework of the forthcoming global energy transition.

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