lithum-extraction-refining

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Salgenx

The Emergence of Grid-Scale Saltwater Flow Batteries for Lithium Extraction

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Explore the revolutionary potential of grid-scale saltwater flow batteries in this in-depth article. Discover how this cutting-edge technology, capable of extracting lithium during the charging process, is poised to transform the electric vehicle battery supply chain. Delve into scientific insights, technological advancements, and the sustainable future of lithium production.

PDF Version of the webpage (first pages)

Revolutionizing the EV Battery Landscape: The Emergence of Grid-Scale Saltwater Flow Batteries for Lithium Direct Lithium Extraction (DLE)

Unlocking a Sustainable Future in Lithium Production

In a remarkable leap forward for electric vehicle (EV) technology, a new grid-scale saltwater flow battery system has emerged, promising to revolutionize the EV battery materials supply chain. This innovative system stands out for its ability to extract lithium during its charging process, a breakthrough that could redefine how we approach lithium production for EV batteries.

Understanding the Technology

At the heart of this technology are the methods to extract lithium, including DLE and the process of electrolysis, a method traditionally used for decomposing chemical compounds. In this context, electrolysis facilitates the extraction of lithium from saltwater, a resource that is both abundant and underutilized. DLE can also be used as a simple adsorption process using resins.

The saltwater flow battery from Salgenx uses a electrolysis method, but also employs pumping the saltwater, which can readily be used by the adsorption process.

Methods of Lithium Extraction

The system employs several methods for lithium extraction, adaptable to different brine resources:

1. Adsorption: Utilizing resins like those developed by Dupont, which have been shown effective in adsorbing lithium from brines.

2. Electrolysis of Lithium Chloride: A method which is already used in the battery by NaCl (sodium chloride).

3. Precipitation: A process to extract lithium from effluent, aligning with techniques. Since this is a flow battery, the effluent is readily accessable.

These methods can be deployed according to the source of the lithium in the brine, its concentration, and amount of other contaminants. These factors can readily be determined by sensors which can deploy available techniques prior to battery installation, which allow the user to determine the most cost-effective method of extraction and refining.

Energy Efficiency and Cost-Effectiveness

Energy Savings

The integration of lithium extraction into the charging process of these batteries leads to more than 50 percent energy savings compared to standard lithium extraction methods. This efficiency is particularly noteworthy when paired with renewable energy sources like solar PV systems. When deployed with solar PV, the power can be stored during the day, then used for post-processing (refining) at night with the power already stored, resulting in huge energy savings.

Impact on Lithium Costs

With the raw material cost of lithium dropping significantly (nearly 70 percent as reported by Bloomberg), this technology could further drive down costs, making this one of the most efficient and profitable methods to extract and refine lithium from brine sources. This is especially relevant given the current trends in EV sales and battery output capacity.

Implications for the EV Industry

The deployment of this technology offers a sustainable and economically viable path for the EV industry. It addresses key challenges such as the environmental impact of lithium mining and the growing demand for battery materials.

Conclusion

The grid-scale saltwater flow battery system represents a significant advancement in sustainable lithium production. By harnessing the principles of electrolysis and integrating renewable energy sources, this technology paves the way for a more eco-friendly and cost-effective EV future.

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Lithium Refinement through Water-Based Methods

Lithium production facilities utilize water in their operations, focusing on refining lithium to a high quality while ensuring the water is recyclable. The process typically involves several stages, such as brine concentration, altering the chemical state of lithium, purification, and ultimately crystallizing it.

Salgenx provides a range of solutions tailored to each phase of this process. They offer integrated packages for concentrating, refining, and converting lithium. These solutions are particularly effective in eliminating challenging ions like silica, which enhances the efficiency of membrane systems in recovering lithium.

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Lithium Extraction and Refining is a Water Handling Process

Advanced Water Refining Technology

The Salgenx system applies sophisticated water refining technology which is typically used in lithium processing plants , but as part of the battery charging process. It involves concentrating brine, undergoing chemical conversion steps to alter the lithium form, and then proceeding through washing and final crystallization phases. This process results in high-grade lithium output, with the water being recyclable, thereby enhancing sustainability.

Direct Lithium Extraction (DLE) Capability

The technology is uniquely adaptable to various DLE methods, typically producing a lithium chloride solution of 1,000 to 2,000 mg/L with impurities. Our system adds value by concentrating these lithium chloride solutions and converting them into battery-grade lithium carbonate or lithium hydroxide solids, suitable for use in EV batteries.

Energy and Time Savings

Integrating lithium extraction into the battery's charging process, along with advanced water refining and DLE, results in significant energy and time efficiencies. This integration addresses both the growing demand for efficient energy storage and the need for sustainable lithium production.

Recovering Lithium from Brines by Lee, John M. and Bauman, William C.; US Patent 4,347,327, August 31, 1982

Regeneration of Crystalline Lithium Aluminates by Burba, III, John L.; US Patent 4,472,362, September 18, 1984

Lithium Adsorption Resins

What are adsorbents? Polymeric adsorbent resins are synthetic spherical beads with defined pore structure, polymer chemistry and high surface area used for purification and selective extraction of target molecules in aqueous solutions.

DLE is an alternative using a highly selective absorbent to extract lithium from brine water. The solution removed from the brine water is then polished of impurities to yield high-grade lithium carbonate or lithium hydroxide. Ion exchange ensures that this process rejects critical impurities to deliver a higher quality product.

Lithium, along with other cations, can be removed from water with a strong acid cation exchanger such as AmberSep G26 H Resin. However, since lithium has a very low affinity compared to most other cations, leakage from the resin will occur ahead of the more attracted ionic species in the matrix. Lithium can only be selectively removed as an aluminum complex as described in the provided references.

Inter-China Chemical: Titanium-based ion-exchanger G-100 is an ion sieve made of titanium dioxide based material with stable crystal structure and three-dimensional ion exchange channels.

Other resins are available on the market. A sample of some are listed below.

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