Review

Recent Advances in Lithium Extraction †

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Abstract: The increasing global demand for lithium, driven by its critical role in battery technology and nuclear applications, necessitates efficient and sustainable extraction methods. Lithium, primarily sourced from brine pools, igneous rocks, and low-grade ores, is extracted through various techniques including ion exchange, precipitation, electrolysis, and adsorption. This paper reviews the current state of lithium extraction, focusing on the diverse methodologies employed to meet the burgeoning demand. Extraction methods exploit solubilities of salts in brine water, employing techniques like liquid-liquid extraction. Despite effectiveness, challenges arise from the similar characteristics of lithium and other constituents. Adsorption methods utilize lithium-selective adsorbents, requiring stability and adaptability under varying conditions. Membrane processes, such as electrodialysis and nanofiltration, offer potential for energy-efficient, continuous lithium recovery. Electrochemical processes facilitate lithium intercalation and deintercalation, emphasizing the need for electrode optimization. The review further delves into emerging technologies like electrosorption and ionic pumps, highlighting their roles in lithium recovery. Challenges such as temperature dependency, impurity influence, and initial concentration are discussed, underscoring their impact on lithium recovery efficiency. Finally, the paper identifies research gaps and future directions, emphasizing the need for cost-effective, high-performance electrode materials and systems. It concludes that enhancing lithium recovery and separation techniques, particularly in electrochemical Li-extraction, is crucial for sustainable lithium production in response to global demand.

Keywords: lithium; extraction; leaching; adsorption; reaction-coupled separation technology

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