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Utilizing membrane technologies in advancing the recycling of spent lithium-ion batteries using green electrochemical method – A review
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Abstract
The demand for lithium (Li) resources is soaring due to the widespread production (or consumption) of electronic products such as mobile and electronic devices, (or laptops, tablets, and home-appliances goods in accommodating current global lifestyle). The other lithium-ion batteries (LiBs) applications include electric vehicles, solar panels, wind turbines, and electric toys. The increasing demand for Li, while driving the economic progress of the industry, is putting a strain on the resource reserves. Therefore, the production industry is promptly searching for an efficient spent LiBs recycling process to counterbalance the highly sought-after element. Current Li recycling systems, in which extraction and recovery are typically accomplished by hydrometallurgical processes, have a significant impact on the environment, are energy-intensive, and necessitate vast operational capacities. Recently, electrochemical methods are seen as sustainable and green approaches to Li production. The use of membrane materials for Li recovery together with electrochemical processes provides a means to reduce energy consumption and scale up the spent LiBs recycling. In this overview, Li recovery technologies through pyrometallurgy, hydrometallurgy and green electrochemical extraction are explored along with their benefits and drawbacks. Recent advances in membrane materials selection that lead to significant improvement in Li production are also discussed.

Author Keywords
Electrochemical Method; Interpenetrating Network Polymer; Lithium Green Recycling; Membrane Technology; Solid Polymer Electrolytes; Spent Lithium-Ion Batteries

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