Clarkson University
Department of Chemical and Biomolecular Engineering
SEMINAR (Graduate Student Presentation)

"Electro-driven lithium extraction from geothermal brines using a lithium-selective membrane"

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With rapidly increasing deployment of lithium-ion batteries for portable electronic devices, grid-scale energy storage, and electric vehicles, worldwide lithium demand is anticipated to rise from 559 thousand metric tons of lithium carbonate equivalent (LCE) in 2022 to approximately 2114 thousand metric tons LCE by 2030. In addition to conventional lithium sources found in lithium-rich salar brines and lithium-mineral ores, geothermal brines are a largely untapped source of lithium that can offer a solution to meet the growing demand. Several mature technologies are available, such as adsorption, ion-exchange, and solvent extraction, but membrane-based electrochemical approaches are a promising alternative to directly extract lithium from aqueous sources owing to its low chemical consumption, modularity, and continuous operation.

My research focuses on developing a lithium-selective membrane to directly extract lithium from geothermal brines in an electro-driven membrane process. Preliminary results using ceramic membranes have shown promising selectivity toward lithium, along with critical shortcomings to address including durability and selectivity degradation. These efforts will be leveraged to guide the future research direction of developing new membranes embedded or coated with lithium-selective materials. Lithium manganese oxide (LMO), which has been extensively studied as adsorbents and electrode materials due to its high selectivity, will be studied as a model lithium-selective material. The successful introduction of LMO to the membrane will allow for the continuous extraction of lithium at a high selectivity relative to major brine constituents.

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CAMP 175

Sheraz Bashir is a Ph.D. student working with Dr. Taeyoung Kim at Clarkson University. His research is focused on resource recovery from unconventional water sources by electrochemical separations. Prior to joining Clarkson University, he earned a BS degree in chemical engineering from the University of Punjab (Pakistan) and a MS degree in chemical engineering from King Fahd University of Petroleum and Minerals (Saudi Arabia).