

Lithium Extraction from Hydraulic Fracturing Flowback

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Lithium has become a high demand resource in recent years due to the increase in production of lithium ion batteries. Currently, most lithium is mined in South America through the solar evaporation of Li-bearing salars; however, a large lithium resource exists in subsurface brine deposits throughout the world, including much of Alberta, Canada. During the hydraulic fracturing process, this brine mixes with injected hydraulic fracturing fluid and is brought to the surface as a waste byproduct of natural gas and oil production. The relatively low lithium concentrations in these fluids cannot be extracted using the solar precipitation method used in South America, and therefore a selective adsorption method is a more suitable option for lithium recovery from this potential resource. This study utilizes protonated spinel manganese oxide as an ion sieve to selectively extract lithium from the flowback water, in order to produce a high purity product of concentrated lithium ions in acid. This presentation outlines the process of optimizing experimental sorption and desorption conditions for benchtop scale lithium recovery with the goal of designing a process which could be scaled up to be economic as a resource recovery system at the commercial scale. The previously unexplored challenge of this sorbent's recyclability when using field collected versus laboratory synthesized flowback fluids will be discussed in depth along with the effect which the organic hydraulic fracturing compounds have on sorbent performance and structure. A complete characterization of the spinel manganese oxide sorbent's oxidation state, crystal structure and reactive surface area, among other properties, throughout its sorption and desorption cycles will be presented in order to probe structural changes in the sorbent at the atomic scale during the ion exchange process.

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