Extraction of lithium from *β*-spodumene using potassium chloride and hydroxide

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# **ABSTRACT**

The extraction of lithium from spodumene requires decrepitation of *α*-spodumene at 1100 °C, acid bake of *β*-spodumene at 250 °C, and several refining steps that make the process equally energy, feedstock, and by-product intensive. The refining of spodumene with sulfuric acid forms sodium sulfate (Na2SO4) as a low-value by-product, and it also generates substantial volumes of hydrogen aluminosilicate (HAlSi2O6) that necessitate disposal. New technologies need to retrieve lithium from spodumene with less energy and chemical consumption. From this standpoint, we investigated two processes to extract lithium from *β*-spodumene at moderate and alkaline conditions using potassium chloride with and without potassium hydroxide. We observed low lithium recovery from leaching *β*-spodumene with KCl at circumneutral pH and 200 °C, with XRD spectra indicating recrystallisation of *β*-spodumene into leucite which progresses at slow rates. This is because the ionic radius of K+ is 2.6 times larger than that of Li+, preventing the reaction to advance via the anticipated ion-exchange mechanism to produce K-keatite (K-aluminosilicate). However, as expected, leucite forms more rapidly when *β*-spodumene is leached with KCl and KOH at pH ∼ 13. We conclude that the alkaline leach condition with KOH enhances the recrystallisation process of *β*-spodumene into leucite, but the process temperature needs to be raised to about 250 °C to increase the rate of lithium extraction.

Keywords: *β*-spodumene; potassium; leach.