

# Mechanochemical Activation and Acid Leaching of Lithium from Spodumene

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## ABSTRACT

Spodumene is becoming a significant resource in production of lithium (Li) salt, with demand mainly driven by battery market. In the conventional process of Li extraction from spodumene ( $\text{LiAlSi}_2\text{O}_6$ ), the mineral concentrate is subjected to calcination at 1000-1100 °C followed by sulphation baking at 250 °C, after which Li is extracted by water leaching. Moreover, significant amount of concentrated sulfuric acid is utilized on roasting, with the excess acid neutralized after with an alkaline medium. Thus, conventional processing of Li from spodumene is not only energy intensive but chemically demanding as well.

Mechano-activation is a technique which relies on the use of mechanical energy to effect surface and structural changes in minerals, and results to a metastable state. In this study, alpha spodumene is subjected to mechano-activation followed by citric acid leaching. Statistical screening design was used to determine milling conditions in a planetary mill that could render amorphousness of spodumene mineral structure. Results showed that spodumene exhibited amorphous signatures at high milling rate of 600 rpm, at 100 % solids, higher ball ratio of 50:1 g/g and longer milling time of 15 min. The data also showed that particle size after grinding could not be a direct indicator of amorphousness.

Results of organic acid leaching experiments of mechano-activated spodumene samples showed that leaching kinetics is relatively slow and marked with low recoveries. However, sulphuric acid leaching of mechano-activated sample showed a higher Li recovery and indicated improvements in Li extraction. These findings are described and discussed in this paper.