Recovery of lithium from mineral resources: state-of-the-art and perspectives

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Abstract

Lithium (Li)-bearing minerals, owing to the wider distribution and more rapid pathway to market than brines, have attracted much attention in recent years, with a number of new industrial projects launched and various novel methods proposed.

Currently, most of the Li obtained from minerals come from spodumene concentrate processed by a sulphuric acid (H_2SO_4) method, while many advances have been actively reported to overcome the drawbacks behind the current method. On the other hand, the low-grade Li minerals, such as lepidolite and zinnwaldite, have been actively investigated aiming to develop an industrially viable process, which is particularly important for the countries that heavily relay on the import of spodumene concentrate. For example, fluorine-based process, including direct and indirect use of hydrofluoric acid (HF), has been actively reported in recent three years which shows effectiveness to treat various Li-bearing silicate minerals. However, many outstanding issues, such as safety risks, equipment design and waste management, still need to be solved.

This study provides a start-of-the-art review and perspectives on Li recovery from mineral resources. In the study, the worldwide Li mineral resources, Western Australia in particular, are firstly summarised to contextualise the field and serve as point of reference. Then, various methods are classified, summarised and discussed with different minerals (spodumene, lepidolite, zinnwaldite, *etc.*). In addition to Li extraction, the downstream purification and recovery of Li and other metals are also included that helps to form an integrated recovery process. Finally, some perspectives and outlook are given based on the current status of the area.

It is expected that, as a review specializing in mineral resources of Li, this study can provide insights for the development of the area.

Keywords: Lithium extraction; Mineral resources; Spodumene; Lepidolite; Review.