

Extraction of lithium from Pegmatite mine tailings via microwave-assisted leaching and chemical precipitation

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Abstract (1500 characters/ 25 lines)

Lithium-bearing minerals such as lepidolite and zinnwaldite are the major sources of lithium production worldwide. However, current industrial extraction methods, such as acid roasting, alkaline treatment, and carbonate roasting, are energy-intensive and have a huge environmental impact.

Herein, we propose an alternative low temperature and highly efficient process to extract lithium (Li) from the mines of *Pegmatitica*, Portugal. Firstly, the mine tailing samples containing zinnwaldite and lepidolite phases were treated with HCl under microwave heating. The influence of various parameters such as temperature, solid-to-liquid ratio, and particle size on lithium leaching was studied systematically. Under optimal conditions, more than 95% of lithium was leached into the solution. Microwave leaching with HCl offers the advantage of exceptional selectivity against silicate impurities and obviates fluorine emissions. Furthermore, the extraction kinetics was rapid, with nearly complete extraction within one hour. Compared to direct leaching, microwave-assisted leaching has 70% low acid consumption. Subsequently, ammonium benzoate was added to the leachate to selectively precipitate the co-extracted aluminium as $C_{21}H_{15}AlO_6$. The pH and the amount of ammonium benzoate were optimised to remove > 94% of aluminium from the solution. The remnant leachate with > 95% lithium will be subsequently treated using an electrolysis step to obtain battery grade precursor of lithium carbonate.

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