



Synergetic interactions improve cobalt leaching from lithium cobalt oxide in microbial fuel cells

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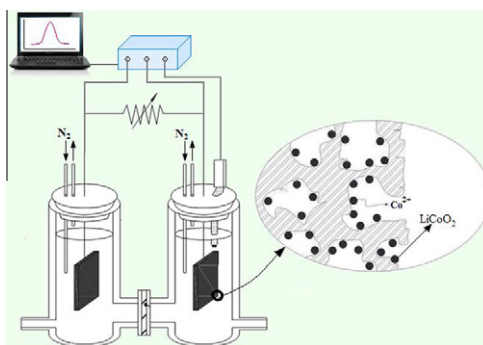
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HIGHLIGHTS

- ▶ Cobalt leaching from lithium cobalt oxide was successfully achieved in MFCs.
- ▶ Synergetic interactions were observed for cobalt leaching in MFCs.
- ▶ External resistor, solid/liquid ratio and solution conductivity affected performance.
- ▶ A pH of 1.0 and a temperature of 35 °C improved cobalt leaching.
- ▶ Apparent activation energy of 30.6 kJ/mol was estimated.

GRAPHICAL ABSTRACT



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ABSTRACT

Cobalt leaching from lithium cobalt oxide is a promising reduction process for recovery of cobalt and recycle of spent lithium ion batteries, but suffers from consumption of large amount of reductants and energy, and generation of excess secondary polluted sludge. Thus, effective and environmental friendly processes are needed to improve the existing process limitations. Here we reported microbial fuel cells (MFCs) to effectively reduce Co(III) in lithium cobalt oxide with concomitant energy generation. There was a synergetic interaction in MFCs, leading to a more rapid Co(III) leaching at a rate 3.4 times the sum of rates by conventional chemical processes and no-acid controls. External resistor, solid/liquid ratio, solution conductivity, pH and temperature affected system performance. This study provides a new process for recovery of cobalt and recycle of spent lithium ion batteries with concomitant energy generation from MFCs.

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1. Introduction

The decline of valuable metal resources, together with the increased future valuable metals demand gives an impetus for increased metal recovery from wastes such as fly ash, sewage sludge, spent batteries and electronic scrap materials, as well as the hydroprocessing catalysts (Marafi and Stanislaus, 2008). Lithium cobalt oxide (LiCoO₂) is the most commonly used cathode material in lithium ion batteries, which have been extensively

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