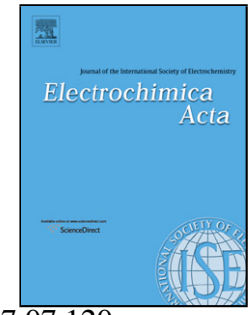

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Microbial electrochemical recovery of zinc

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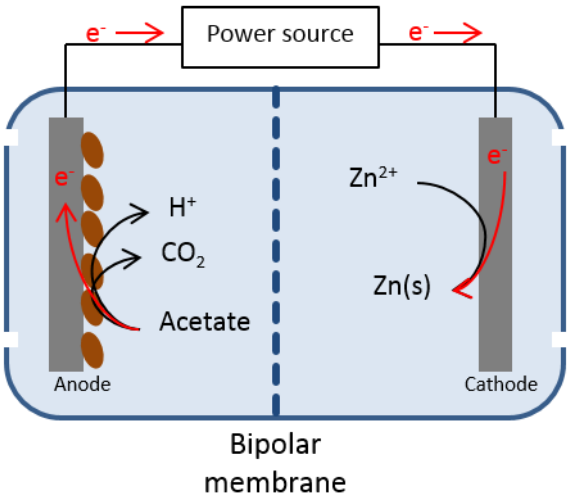
Graphical Abstract



Highlights

- Metallic Zn was electrochemically recovered from dilute Zn^{2+} solutions
- The lowest energy consumption for microbial electrolysis was 0.59 kWh/kg Zn
- The applied voltage was 0.75 V
- Operational strategies were discussed

Abstract

Electrolytic recovery of zinc (Zn) from aqueous solutions is an energy intensive process carried out using highly concentrated Zn^{2+} solutions. To reduce the energy consumption and make Zn recovery possible from dilute waste streams, a more energy-efficient process is needed. In this study, we tested a microbial electrolysis cells for Zn recovery from acidic solutions. The reactors contained biological anodes that generated current by oxidizing acetate. The reactors were operated with either controlled anode potential or controlled cathode potential. During operation with controlled anode operation, the energy efficiency for Zn recovery was highly variable and depended on the biologically generated current and the Zn^{2+} concentration in the catholyte. During operation with controlled cathode potential, a relatively stable energy consumption of 0.59-0.72 kWh kg^{-1}Zn was obtained. This was about three times lower than the energy consumption for Zn recovery under abiotic conditions.

Keywords: Bioanode; bioelectrochemical systems; electrowinning; metal recovery; wastewater treatment

1. Introduction

Microbial electrochemical systems have received a lot of attention recently as an environmentally friendly platform of technologies that potentially can be applied in several different areas such as wastewater treatment, sensing, bioremediation, and chemicals production [1, 2]. Using microbial electrochemical reactors to recover metals from dilute