

Recovery of silver from mixed metals solution using a bio-electrochemical system / Aukrawut Seenuan, Thatapol Charoensukpatana, Natcha Chamchoy, Ngo Anh Dao Ho, Sandhya Babel

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Abstrak

ABSTRACT

There are many conventional technologies used for recovery of precious metals from wastewater, but most of them are chemical intensive and consume high energy. This paper focuses on silver recovery using bio-electrochemical system (BES), which basically consists of two separated chambers, the anode and cathode chamber. The anolyte, containing either acetate or glucose as substrate, was fed into the anode chamber, in which microorganisms were employed to produce electrons through anaerobic oxidation. The catholyte was a synthetic mixed metals solution containing silver Ag(I), copper Cu(II), and iron Fe(III), which acted as terminal electron acceptors. Two BES reactors, in which anion exchange membrane (AEM) and a cation exchange membrane (CEM) served as separators, were investigated. Experiments were conducted at different initial Fe(III) concentrations (10 mM and 20 mM), while the concentrations of Ag(I) (10 mM), and Cu(II) (1 mM), were kept constant. The silver recovery obtained in the CEM-based reactor (> 99%) was higher than that in AEM-based reactor (58-75%). However, diffusion of Ag(I), Fe(III), and Cu(II) through the CEM was unavoidable. In terms of power generation, a power density of 4515.63 mW/m³ was found in AEM-based reactor, which was higher than that in CEM-based reactor (1542.56 mW/m²). However, the substrate loss was found in the AEM-based reactor due to the transport of negative-charged organic matter through the AEM, which caused a fast decrease of cell voltage. This study successfully demonstrated the feasibility of using a bio-electrochemical system to recover silver coupled with power generation from a synthetic mixed metals solution.