Silver recovery and removal using a Microbial Fuel Cell

Theofilos Kamperidis[1], Asimina Tremouli*[1], Pavlos K. Pandis[1], Petros E. Tsakiridis[2], Emmanuella Remoundaki[2], Gerasimos Lyberatos[1, 3]

[1]School of Chemical Engineering, National Technical University of Athens, Heroon Polytechniou 9, Athens, 15780, Greece

[2]School of Mining and Metallurgical Engineering, National Technical University of Athens Heroon Polytechniou 9, Athens 15780, Greece

[3]Institute of Chemical Engineering Sciences (ICE-HT), Stadiou Str., Platani, 26504, Patras, Greece

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Presenting author: kamp.theo@gmail.com

Abstract: Photovoltaic panels (PVs) are an emerging technology which during the past decade has grown exponentially. PV panels contain various heavy metals in their thin film. Along with their use, PVs are expected to generate big amounts of wastes given the average life cycle of a PV panel is 25-30 years and there is a need to recycle their materials, in order to avoid their dispersion to the environment and to recover the maximum of their quantities. Among others (Ag, Ti, Te, Cd, In, Se, Ga e.t.c.) silver is one of the heavy metals existing in panels. Though it is not as harmful to humans as the other heavy metals, the impact to the environment due to its mining makes the recycling of silver a necessity. Silver is used as a conductor in first generation PV panels. In the present study, a dual chamber microbial fuel cell was constructed and operated to study silver recovery, from a synthetic waste simulating a PV processed waste. Silver was used as the electron acceptor in the cathode chamber, at an initial concentration 50 ppm. The effect of conductivity and pH of the catholyte was examined. High silver recoveries were observed (>93%), at both pH 2 and 7. Silver reduction was delayed at lower conductivity (0.06 mS/cm 24 h versus 18.9 mS/cm 5 h). The system achieved higher power output (248 mW/m^2) at pH 2 versus pH 7 (202 mW/m^2). Using different supporting electrolytes (potassium chloride instead of sodium perchlorate) inhibited the reduction of silver due to the formation of silver chloride.

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