Maestría en Ingeniería en Diseño de Bioprocesos

Title

Implementation of microbial fuel cells for the recovery of metals from industrial effluents

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Implementation of microbial fuel cells for the recovery of metals from industrial effluents

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Abstract

This paper focuses on the use of microbial fuel cell for metal recovery. To which were built four prototype microbial fuel cell model "H" with an operating volume of 1-liter batch type culture, where used as inoculum samples wet sludge with electrogenic capacity to testing electrolysis and the implementation of a monitoring and control system for cells.

Introduction

There is a serious shortage of resources in which metals are included, this due to the widespread use that have been given over the last century, to the lack of efficient processes and treatments for recovery and reuse, which in once a serious problem of pollution in the environment due to its high toxicity.

Because this has been paid much attention to the implementation of sustainable processes for the removal of scrap metal, where bioelectric systems are the most investigated and specifically the microbial fuel cell (MFC).

A MFC can operate at temperatures below 15 º C to 35 º C, with low substrate concentrations. Microbial species used are resistant to acidic pH conditions, can employ any type of organic material as a carbon source without a gas pump.

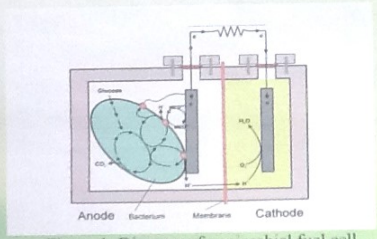


Figure 1. Diagram of a microbial fuel cell

General objective

Implement microbial fuel cells for the recovery of metals from industrial effluents.

Specific objectives

Build and characterize a prototype of Microbial fuel cell for degradation of organic matter and metals recovery.

Design and implement a system for control and monitoring system MFC.

Electrolysis tests in the system

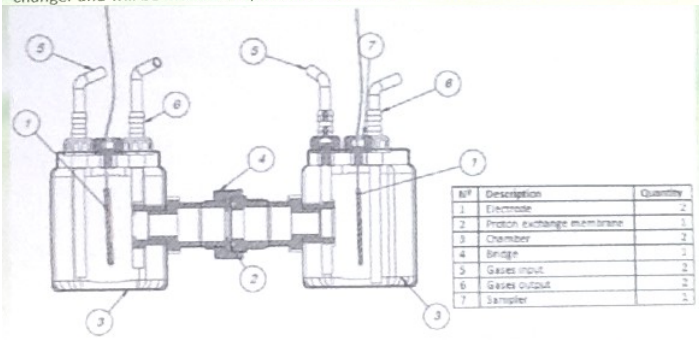
Characterize samples industrial wastewater with high organic content and metal compounds.

Adapt and stabilize a mixed culture samples with high organic content with scrap metal interaction in a MFC.

Characterize and quantify the products generated from the process.

Results

4 prototypes of dual-chamber separation bridge or "type H" of microbial fuel cell were built The models have a operation volume of a liter per chamber, the system will be homogenized by magnetic stirring, with inlet and outlet gas, inlet for sampling, without heat exchanger and will be modified input and output to allow further use in continuous culture.



N°	Description	Quantity
1	Electrode	2
2	Proton exchange membrane	1
3	Chamber	2
4	Bridge	1
5	Gases input	2
6	Gases output	2
7	Sampler	1

Figure 2. Plane of the microbial fuel cell designed

For their construction thermoplastic polyester containers, hydraulic parts and accessories pvc and rubber gaskets were used. As inoculum will be used a sample of sludge from a pond "wetlands" with proven electrogenic nature.taken from a dam for irrigation located on the shores of Rancho Santa Fe in the municipality of Atlixco Puebla.

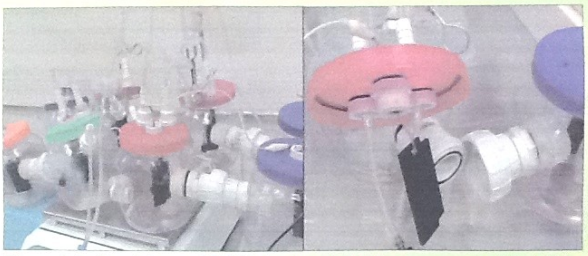


Figure 3. Left prototypes of MFC developed. Right: components of the MFC

The control system developed is discrete type which is responsible for measuring the voltage generated by the cells, its basic function is to control the value of the output current to perform electrolysis process.

The monitoring system is composed by a microcontroller, a potenciometerr, a computer and it has an interface with the labview software.

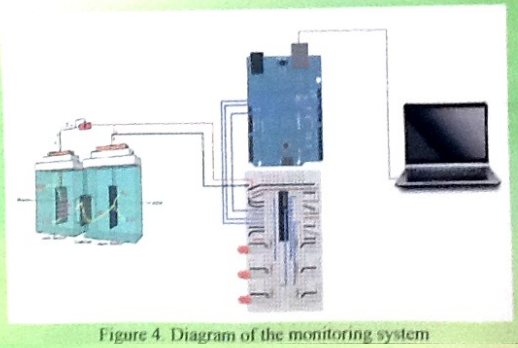


Figure 4. Diagram of the monitoring system

Conclusions

The prototypes and control system are ready for implementation in adaptive testing and testing electrolysis, and they have to be characterized under operating conditions and they will be compared to existing models of similar characteristics.

The prototypes have a choice of didactic and practical study and application to MFCs in electrolysis tests because their parts are easily interchangeable and replaceable, have a low economic value and are easy to assemble, facilitating their construction and application, but still there elements whose materials are not easy to replace and require more time for optimization.

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