INOCULUM ASSESSMENT FOR BIOHYDROGEN PRODUCTION IN MICROBIAL ELECTROLYSIS CELLS

Claudia Paz-Mireles, Elías Razo-Flores, Bibiana-Cercado
Instituto Potosino de Investigación Científica y Tecnológica, División de Ciencias Ambientales
San Luis Potosí, SLP, C.P. 78216. Correo electrónico: bibiana.cercado@ipicyt.edu.mx

Key words: Microbial electrolysis cells, biohydrogen, inoculum source

Introduction. Hydrogen is an important alternative energy source because it has high energy content and produces only heat and water as combustion products. Among hydrogen production bioprocesses we can find microbial electrolysis cells (MEC). This system requires a small energy impulse to trigger biochemical reactions producing biohydrogen. MECs are composed of two chambers: in the cathodic chamber H_2 is collected while in the anodic chamber biogas is collected [1].
The aim of this work was to evaluate different inoculum sources in a range of applied potential in order to select the inoculum with the best performance for future studies.

Methods. The MEC was constructed with two glass flasks (100 mL) joined by a proton exchange membrane (Ø=5 cm). Platinum mesh (6.2 cm^2) and carbon felt (4 cm^2) were used as cathode and anode, respectively. Catholyte was composed by a buffer phosphate solution 50 mM, pH 7. Domestic wastewater (DWW), anaerobic sludge dilution (AS), and compost leachate were used as inocula in the anodic chamber, with 20 mM $C_2H_3NaO_2$ as substrate. The MECs were conserved at 35°C in a water bath and connected to a potentiostat to apply the selected potential. The electrolytes were monitored for COD and pH at starting and final test time. The gas composition was monitored throughout the test by gas chromatography in both the anodic and the cathodic chambers. The volume of gas produced was quantified by headspace displacement in a buret. Biofilm observations were performed using scanning electron microscopy. The experimental design consisted in the test of the three inoculum at two imposed potentials; 0.6 y 1.0 V.

Results. The MEC performance related to H_2 yield and H_2 rate production is shown in Table 1. It was observed that the high imposed potential (1.0 V), affected the performance negatively, regardless of the inoculum tested. On average the H_2 production was higher using AS than DWW; moreover, the highest H_2 production rate was 0.018 m^3 H_2/ m^3 anolyte / d with AS at 0.6V.

Table 1. MEC performance with two inoculum sources.

Assay	Experimental conditions	H_2 accumulated (mmol)	Yield (g H_2/ g DQO)
MEC 1	DWW - 0.6 V	12.50	0.3973
MEC 2	DWW - 1.0 V	2.19	0.0696
MEC 3	AS - 0.6 V	19.24	0.6115
MEC 4	AS - 1.0 V	13.48	0.4286

The observed current generation must be proportional to the protons produced in the anodic chamber and the H_2 gas formed in the cathodic chamber. In this sense, the MEC 4 had the best performance reaching 4 mA/m^2, which was stable for almost 12 days.

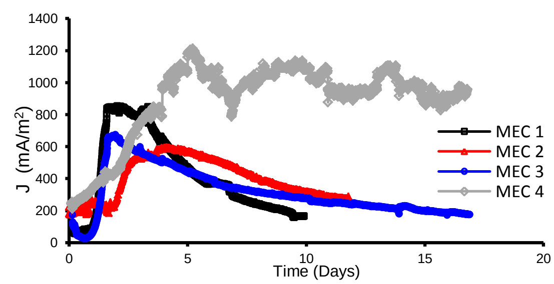

Fig.1 Current production in MECs as a function of inoculum source and imposed potential.

Conclusions. The anaerobic sludge at low imposed potential showed the best performance for both production and H_2 yield. The previous anaerobic condition in sludge and more dense microbial community led to these results. On the other hand, the high current observed with AS at 1.0V suggests that this system may have a higher H_2 production, but it is probably hindered by membrane fouling.

Acknowledgements. This research was supported by the SEP-Conacyt 177441 and 132483 projects. We thank the assistance of D. Partida, JP Rodas, G. Vidriales and G. Labrada from IPICYT, and Ing. Olvera for DWW supply.

References.

1. Logan B, Call D, Cheng S, Hamelers H, Sleutels T, Jeremiasse A, Rozendal R. (2008). *Environ. Sci. Technol.* vol (42): 8630:8640.