AUTOMATIC STRATEGY FOR A MICROBIAL FUEL CELL COLONIZATION

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Introduction. Microbial fuel cells (MFC) are bio-electrochemical devices which can transform the chemical energy from the wastewater directly to electrical energy by biocatalysis from some electro-active microorganism by means of redox reaction on the electrodes in solid phase (Rabaey et al 2006). The automation of such a system is a useful tool that may help increase their performance and robustness. However, there are very few works related to automation of MFC.

Methods. An automatic system for two different colonization strategies of low cost microbial fuel cells (MFC) is presented. One microbial fuel cell was colonized considering an external fixed load R_f=1500 Ω. Another microbial fuel cell was colonized with an external variable load. Software to operate the MFC was developed considering a variable time strategy to synchronize the different phases of the process. The main features of the software are to measure the voltage on line and, to make polarization and power curves periodically in order to define the MFC optimal external load. Both MFCs were inoculated with wastewater from the treatment plant of the UNAM campus and operated in batch mode.

Results. The colonization test was performed in both cells using raw wastewater entering to the university campus treatment plant. The test lasted around one month. Contrary to what was expected, the best results were obtained for the MFC -F. This was explained because the static load resistance improves the electro-active microorganism growing up over the anode surface (Katuri 2010). The following operational parameters were obtained: average voltage of 85 ± 38 mV, a current density of 21 ± 9 mA/m^2, a power density of 2 ± 1 mW/m^2, a coulombic efficiency of 0.017 ± 0.017 % and a removal COD efficiency of 74%. Fig. 1 shows the MFC-F voltage performance.

For the MFC-V an average voltage of 47 ± 29 mV, a current density of 2 ± 5 mA/m^2, a power density of 0.2 ± 0.2 mW/m^2, a coulombic efficiency of 0.107 ± 0.077 % and removal COD efficiency of 73% were obtained. This may be due to the high external load resistance configured for the MFC, since the peak power determined after the tests resulted in high resistances. Another type of microorganisms may therefore be growing on the anode surfaces, which are not necessarily the electro-active ones.

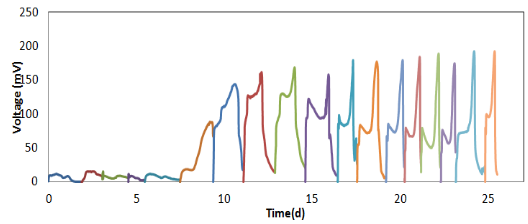

Fig.1 MCF-F Voltage performance

Conclusions. In this work an automation system was used to colonize the anode of MFC. The best colonization strategy was the one with fixed load resistance (MFC-F). In order to allow the correct electro-active microorganism growth on the anode, the MFC-F was maintained under low and static load resistance. Furthermore, a constant generation of voltage, current and power was reached. Nevertheless, the use of automation to enhance the colonization by changing the load periodically makes sense, and possibly other strategies than the one assessed here may be more successful.

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