Simultaneous electricity generation and Remazol Brilliant Blue Reactive decolourisation in a cathode chamber microbial fuel cell

Cristiane Ottoni[1] Instituto de Pesquisa Tecnológica do Estado de São Paulo (PG), Rodrigo Souza[2] Instituto de Pesquisas Energéticas e Nucleares (PG), Almir Neto[2] Instituto de Pesquisas Energéticas e Nucleares (PQ), António G. Brito[3] University of Lisbon (PQ), João Poço[4] Centro Universitário da FEI (PQ), Alfredo E. Maiorano[1]* Instituto de Pesquisa Tecnológica do Estado de São Paulo (PQ).

[1] Laboratório de Biotecnologia Industrial, Instituto de Pesquisas Tecnológicas do Estado de São Paulo, 05508-901 São Paulo, Brasil.
[2]Instituto de Pesquisas Energéticas e Nucleares, IPEN/CNEN-SP, 05508-000 São Paulo, SP, Brasil.
[3] Department of Biosystems Sciences and Engineering, Institute of Agronomy, University of Lisbon, Tapada da Ajuda, 1349-017 Lisbon, Portugal
[4] Departamento de Engenharia Química, Centro Universitário FEI, 09850-901 São Paulo, Brasil

Palavras Chave: Microbial fuel cell, Pleurotus ostreatus, Laccase, Remazol Brilliant Blue R

Introduction

Microbial fuel cells (MFCs) are a promising approach for applications in wastewater treatment, electricity production, pollutant removal, and as biosensors[1]. The advantages of this technology include non-pollution, high energy efficiency, mild operating conditions, strong biocompatibility and great application potential in various areas, which have received a great deal of attention from scientists[2]. Recently, the use of biocathode to assist in electron transfer eliminates the use of noble metal, such as platinum, and eliminates the need for replenishment of the electron mediator, resulting in greatly improved MFC and enzymatic fuel cell sustainability[3]. Biological catalysts may offer a solution to this limitation by catalyzing cathodic oxygen reduction reactions at high onset potentials under conditions compatible with microbial activity[4]. In this regard, the application of white-rot fungus (Wrf) in a biocathode was described. According the authors, Wrf are able to secrete lacase (Lcc), which can catalyze the four-electron reduction of O_2 to H_2O, and meanwhile to oxidize some small organic substrates. In this context, the main focus from this study was the simultaneous improvement of the textile dye Remazol Brilliant Blue Reactive (RBBR) decolourisation and electricity generation using the Wrf *P. ostreatus* URM4809 in the cathode chamber MFC.

Results and discussion

The decolourisation of the solution containing the RBBR was confirmed by visual observation and spectrophotometric scans. Removal dye in presence of URM4809 was higher than 50%, whereas the control without the fungus reached 2%.
According the results, Lcc was responsible for the RBBR decolourisation. The maximum Lcc activities were found in the first day for this study range 535, 3 UL^{-1}. Utilization of the URM4809 in the cathode chamber reduced the power density up to 60%.

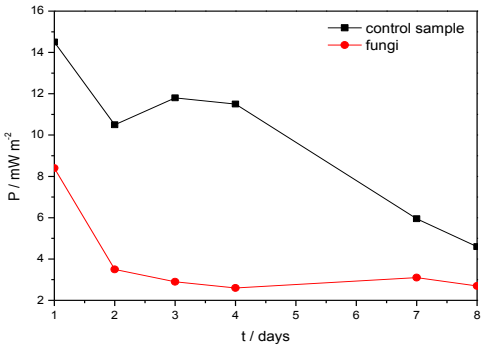

Figure1. Variation in maximum power density versus time.

Conclusion

Although the power density detected was lower than the control, the dye decolourisation was significant which corresponds to an environmental advantage. Since these are preliminary tests, become necessary some evaluations about microorganism cultivation in the cathodic chamber and MFC configuration and operation.

Acknowledgement

Cristiane Ottoni: Programas Novos Talentos, Instituto de Pesquisa do Estado de São Paulo.
Rodrigo Souza: Fundação de Amparo à Pesquisa do Estado de São Paulo: Projeto 2012/03516-5

[1]Xia X, Tokash JC, Zhang F, Liang P, Huang X, Logan BE. *Environ Sci Technol*. **2013**, *47*, 2085.
[2]Izadi P, Rahimnejad M. *Biofuel Res. J*. **2014**, *1*, 34.
[3]Hou B, Hu Y, Sun J. *Bioresour. Technol*. **2012**,*111*, 105.
[4]Strack G, Luckarift HR, Sizemore SR, Nichols RK, Farrington KE, Technol. **2013**, *128*, 222.