

WestminsterResearch

http://www.westminster.ac.uk/westminsterresearch

Degradation of azo dyes (Acid orange 7) in a microbial fuel cell: comparison between anodic microbial-mediated reduction and cathodic laccase-mediated oxidation

Kyazze, G., Mani, P., Bowman, K., Farahmand, N., Breheny, M. and Keshavarz, T.

A paper presented at the 4th European Meeting of the International Society for Microbial Electrochemistry and Technology, Newcastle University, Newcastle upon Tyne, 12 - 14 Sep 2018.

The WestminsterResearch online digital archive at the University of Westminster aims to make the research output of the University available to a wider audience. Copyright and Moral Rights remain with the authors and/or copyright owners.

Whilst further distribution of specific materials from within this archive is forbidden, you may freely distribute the URL of WestminsterResearch: ((<u>http://westminsterresearch.wmin.ac.uk/</u>).

In case of abuse or copyright appearing without permission e-mail repository@westminster.ac.uk



Degradation of azo dyes (Acid orange 7) in a microbial fuel cell: comparison between anodic microbial-mediated reduction and cathodic laccase-mediated oxidation

<u>Godfrey Kyazze¹</u>, Priyadharshini Mani¹, Heba Hamed², Reham Fathy², Marwa Gamal², Nabila Selim², Hussein Abd El Kareem², Kyle Bowman¹, Nasim Faramand¹, Mark Breheny¹, Taj Keshavarz¹, Ola Gomaa² ¹Department of Life Sciences, University of Westminster, London, United Kingdom, ²Egyptian Atomic Energy Authority (EAEA), Cairo, Egypt, Email: G.Kyazze@westminster.ac.uk

Microbial fuel cells (MFCs) are a promising technology for the simultaneous treatment of wastewater and electricity production. With regard to azo-dye containing wastewater (e.g. from textile manufacturing), the dyes may be fed via the anode chamber containing electrochemically active bacteria or via the cathode chamber containing laccase enzyme as catalyst for oxygen reduction. This study investigated which of the two approaches is the best with regard to rate of decolourisation of the dye (Acid orange 7), COD reduction and electricity production. The power density was higher for the MFC_{dve at cathode} (25 mW/m², COD reduction 80%) compared with 18 mW/m² (COD reduction 69%) for MFC_{dye at anode} (Shewanella oneidensis as catalyst). The decolourisation rate of the dye was not statistically significant between the two approaches with ca. 75% decolourisation achieved in 24 h. The anodic dye degradation products were unstable when exposed to air resulting in what seems to be induced diazotization and regaining of colour. In case of degradation by laccase in the cathode chamber, the decolourisation products were stable and simpler in chemical structure (e.g. presence of aliphatic compounds) as determined by GC-MS. This work suggests that feeding azo dyes in cathode chambers of MFCs containing laccase is a better way of treating the



dyes than the commonly used approach of feeding the dye in the anode chamber.

Key words: Azo dyes, laccase, microbial fuel cells, decolourisation, degradation.

EU-ISMET 1028, 21th-24th September 1028, Newcastle upon Tyne, United Kingdom