MASTER'S THESIS

Algae grown anode microbial fuel cell and its application in power generation and biosensor

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Algae Grown Anode Microbial Fuel Cell and Its Application in Power Generation and Biosensor

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Philosophy

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Declaration

I hereby declare that this thesis represents my own work which has been done after registration for the degree of MPhil at Hong Kong Baptist University, and has not been previously included in a thesis or dissertation submitted to this or any other institution for a degree, diploma or other qualifications.

Signature:_____

Date: August 2015

Abstract

Live green microalgae *Chlorella pyrenoidosa* was introduced in the anode of microbial fuel cell (MFC) to act as an electron donor. The electrogenic capability of algae *Chlorella pyrenoidosa* was investigated in two models of algal microbial fuel cells (MFCs) constructed with carbon electrodes and no mediator. The mechanism was studied by results of ATP inhibitor (Resveratrol) and protonophore (2, 4-dinitrophenol), which supporting the important role of mitochondria in electricity generation. The results of different light intensity and algae concentration indicate that low concentration of 10^6 (OD680nm) and low light intensity (2500 Lux) generated higher electricity. In the oxygen controlled study, it was found that oxygen generated by algae in anode was a limiting factor for electricity generation. Electricity generation was observed in two chamber algae MFC lasting at least for 24 hours. Results might provide a platform for the development of self-sustainable algal culturing microbial fuel cell (MFC). Electricity was found to increase in response to 4-nitrophenol (4NP) and 4-nitroanaline (4NA) for both measurements of current and open circle voltage (OCV). The positive response of algae to 4NP in increasing the 4NP production and electricity generation in MFC proposed the possible application in the detection of *E.coli*, as 4NP is involved in the intermediate step of the detection process. Results indicate Algae MFC was suitable for the detection of *E. coli*. of concentration higher than 10^6 using OCV measurement.

Keywords: *Electricity generation, Chlorella pyrenoidosa, Microbial fuel cell.*

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