CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME II

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Department of Biotechnology Engineering
Faculty of Engineering
International Islamic University Malaysia

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CHAPTER 25

DEVELOPMENT OF *IN-VIVO* BIOFUEL CELL FOR IMPLANTABLE MEDICAL DEVICES

Hamzah Mohd. Salleh[1], Nur Syaheera Mohd Yusoff[1], Raihan Othman[2] and Mohd. Firdaus Abd. Wahab[1]

[1]Department of Biotechnology Engineering,
[2]Department of Science in Engineering,
Faculty of Engineering,
International Islamic University Malaysia, P.O. Box 10, 50728 Kuala Lumpur, Malaysia

ABSTRACT

The electrochemical activity of human leukocytes (white blood cells and platelets) was investigated by measuring the current output and open circuit potential produced from a biofuel cell (BFC). White blood cells and platelets were isolated from whole human blood, suspended in phosphate buffered saline solution and introduced to the anode compartment of the biofuel cell. Red blood cells were isolated and introduced to the cathode. Measurements of current and open circuit potential were conducted once the BFC was assembled. The results of this study indicate the possibility of functionalizing an *in-vivo* biofuel cell utilizing human blood as the energy source.

Keywords: biofuel cell, human blood, *in vivo*, current, battery

INTRODUCTION

Many new implantable medical devices are currently under development. Much work has been conducted to find an acceptable power source, including rechargeable and biological batteries for these devices (Holmes and Owens, 2006; Mano *et al.*, 2003; Katz and Willner, 2003; Palmore and Whitesides, 1994). One of the most reliable power sources for any electronic device is the lithium ion battery. Yet the battery unit must be replaced once its fuel content has been utilized (Justin, 2007). Apart being undesirable for a patient to undergo surgical procedure to replace the implanted battery unit, the patient himself is subjected to unwanted risk. Rechargeable batteries would require the patient to be responsible for the recharging process. Recharging can be done through several method such as radiofrequency and optical method. However, in placing this responsibility in the hands of the patient, compliance becomes a major problem (Greatbatch and Holmes, 1991).