

CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME II

Editors:

Ibrahim Ali Noorbatcha
Hamzah Mohd. Salleh
Mohamed Elwathig Saeed Mirghani
Raha Ahmad Raus



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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**Department of Biotechnology Engineering
Faculty of Engineering
International Islamic University Malaysia**



IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
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Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Ibrahim Ali Noorbatcha, Hamzah Mohd. Salleh, Mohamed Elwathig Saeed Mirghani & Raha Ahmad Raus: Current Research and Development in Biotechnology engineering at IIUM
Volume II

ISBN: 978-967-418-151-2

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

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CHAPTER 25

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

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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).