UNIVERSITI TEKNOLOGI MARA

THE BIOSENSING PERFORMANCE AND ELECTROCHEMICAL PROPERTIES OF CARBONISED ELECTROSPUN NANOFIBER

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JULY 2019

ACKNOWLEDGEMENT

First and foremost, a great blessed to the almighty Allah for giving me this huge opportunity to complete this thesis as one of the necessities upon graduating from the university as a chemical engineer. Not to forget with my wholehearted gratitude to deliver my thanksgiving and superior appreciation to both of my parents and sibling that were being supportive all time along the unforgettable years of my study. I would also like to express my sincere gratitude to my supervisor, Dr. Tan Huey Ling for the continuous support and numerous of helps toward this research and to the University and the faculty as well. Finally, the limitless appreciation to all my helpful friends and colleagues who were together took the obligations as a chemical engineering student upon the exceptional and outstanding journey

ABSTRACT

This research project is important in order to study the performance of biosensing technology toward carbonised electrospun nanofiber. Biosensor is one of the most important analytical devices to be used in analysing analyte where the analyte is referring to any substance whose chemical constituents are being identified and measured. There are few available biosensors that is commonly used such as glucose monitoring device that works to monitor glucose level in human blood of a diabetic patient. There are several compulsory components to make up a fully functional biosensor. By principle, a biosensor must consist of sample, analyte, bioreceptor and transducer. Transducer plays an important role in biosensing as it converts physical quantitative and qualitative measurement and convert those values into electrical signal. Transducer is also known as sensing platform. In order transducer to become biologically capable in detecting the presence of analyte, bioreceptors or biosensing elements are required to be integrated with the support of transducer. In this research, our main concern is to find the best type of electrospun nanofiber that will be used to become the support for the transducer of the glucose monitoring biosensor. Thus, there were several PAA/PAN-based electrospun nanofibers used and each of the nanofibers has different associated nanoparticle fabricated together with the PAA/PAN polymer. The nanofibers were used to be immobilised with (GOx) enzyme. (GOx) enzyme is the biosensing element which detect the presence of glucose. Biosensing performance of the electrospun nanofiber that has been used is reflecting conductivity of the nanofiber itself. Better conductivity gives better electrochemical properties and biosensing ability. The biosensing performance were analysed by using several analyses mainly electro impedence spectroscopy (EIS), capacitance-voltage profiling (CV-plot) which consist of scan rate dependent study with potassium ferrocyanide solution. As the result, Sample (2) PAA/PAN rGONps had showed the suitable nanofiber to fabricate a biosensor as it the most conductive nanofiber and has good electrochemical properties due to its responsiveness to interact with electrolyte and analyte. Sample (C) PAA/PAN AuNps in the second place is also a suitable nanofiber for a biosensor.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

The application of biosensing devices become widely used especially in medical and food industry. For instance, biosensor helps in patients' diagnosis with short time interval required to identify certain parameters involved in comparison with conventional methods of diagnosing patients' diseases that is significantly need advance skills and complicated procedures to be complied. Several type of biosensors namely, hCG pregnancy test strip where the strip itself acts as a biosensor which is able to determine the presence of (hCG) human chorionic gonadotrophin in urine sample where the hCG is normally present in pregnant woman [2]. Another example of biosensor is glucose in blood biosensor provide ease to the patients to analyse their glucose level by monitoring glucose concentration in blood. Nevertheless, in term of food production industry, biosensors play in a big role for analyse food quality product. As in fact, by consuming contaminated food with harmful bacteria present, it will lead to foodborne illness. As a prevention method used in solving this issue, biosensor is used in bacteria or any other harmful microorganism detection for past decades [3].

Undeniably, as biological technology is becoming advance on par with current globalized health issues, lots of sophisticated health monitoring devices were developed and one of them is biosensor. Biosensor is basically a type of sensor which implemented the functionality of biological element or bio-receptor such as enzyme and antibody in order to detect analyte such as glucose. Monitoring blood glucose level is one of the importance tasks which is necessary for diabetic patient in order to ensure patient's blood glucose level is in normal range. Monitoring glucose in Malaysia is already becoming a common routine for people either healthy or with diabetic disease. Nowadays, diet pattern illustrates the unhealthy lifestyle that contributed such a huge number of diabetic patients. By according to International Diabetes Federation, a study