# EFFECT OF PVDF MEMBRANE PORE STRUCTURE ON PROTEIN IMMOBILIZATION: A STUDY USING IMMOBILON – PSQ AND IMMOBILON – FL

## MOHAMAD SIDIQ BIN MOHD BASIR

This report is submitted in partial fulfilment of the requirements needed for the award of Bachelor in Chemical Engineering (Hons)

FACULTY OF CHEMICAL ENGINEERING UNIVERSITI TEKNOLOGI MARA SHAH ALAM SEPTEMBER 2016

## ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious and the Most Merciful

Alhamdulillah, all praises to Allah for the strengths and His blessing in completing this thesis. Special appreciation goes to my supervisor, Dr Norhidayah Ideris, for her supervision and constant support. Her invaluable help of constructive comments and suggestions throughout the experimental and thesis works have contributed to the success of this research. I am very indebted to her patience and invaluable advices that inspired me to see things positively and felt honoured with her confidence and trust on my ability. My acknowledgement also goes to all the lecturers, technicians and office staffs Faculty of Chemical Engineering UiTM for their co-operations along my journey in completing this thesis. Special thanks to Ain, Mia and Faizah for their help and support and also to all my friends for their kindness and moral support during my study. Thanks for the friendship and memories. Last but not least, my deepest gratitude goes to my beloved mother; Juhar Binti Ismail for her support in every aspect and also to my family for their endless prayers and encouragement. To those who indirectly contributed in this research, your kindness means a lot to me. Thank you very much.

#### ABSTRACT

Membrane study is one of the most important field that is related with the adsorption science and biomedical research. Membrane has many applications in industry such as waste water treatment, medical application that immunoassay and etc. There are many types of membrane with different characteristic that can be applied in similar application, but in order to know which type of membrane is suitable for the application, the membrane morphology must be study. Membrane morphology such as porosity, hydrophobicity, pore structure and etc. play an important role in the effectiveness of the membrane. This paper is evaluating the membrane pore structure on protein immobilization. The membrane that was used for this study is polyvinylidene fluoride (PVDF). Two different types of PVDF membrane were selected: immobilon – PSQ and immobilon – FL. This two types of membrane were study by comparing their morphology using FTIR, water contact angle and porosity test. Protein binding experiment was performed using the two membrane to compared the performance of protein adsorption of the two membrane. From the result, it can be concluded the morphology of different PVDF membrane can affect the amount of protein immobilazation to the membrane.

# TABLE OF CONTENTS

			PAGE
DECLARATION			ii
CERTIFICATION			iii
AKNOWLEDGEMENT			iv
ABSTRACT			v
TABLE OF CONTENT	S		vi
LIST OF TABLES			viii
LIST OF FIGURES			ix
LIST ( ABBREVIATIONS	)F		Х
LIST OF SYMBOLS			xi
CHAPTER 1	INTR	RODUCTION	
	1.1	Background Study	16

1.1	Background Study	10
1.2	Problem Statement	17
1.3	Objectives	17
1.4	Scope of Study	17

# **CHAPTER 2**

# LITERATURE REVIEW

2.1	Introduction			
2.2	Membrane Overview			
	2.2.1	Definition of Membrane	19	
	2.2.2	History of Membrane	20	
2.3	Memb	orane Adsorption	21	
	2.3.1	Adsorption	21	
	2.3.2	Adsorption in the Membrane	21	
	2.3.3	Membrane Adsorption in Protein Binding	22	
2.4	Polyv	inylidene Fluoride (PVDF)	23	
	Memt	orane	• •	
	2.4.1	Structure and Properties of	23	
		PVDF		

#### **CHAPTER 1**

### **INTRODUCTION**

### **1.1 BACKGROUND STUDY**

Generally, membrane is a thin pliable sheet that acts as a selective barrier that allows some substance to pass and stop others (Intratec, 2012). There are two types of membrane that is biological membrane and synthetic membrane. Membrane technology has become popular over the past few decades. There are many significance advantages of using membrane for industrials processes, for example, no phase changes or chemical additives, modular module which is easy to scale up, relatively low energy consumption and etc (Guo do Kang and Yi-ming Cao, 2014).

Membrane technology is particularly used in the separation and adsorption process. For membrane adsorption, membrane is widely used as an adsorbent to bind the particle such as protein so that it could be separated, as such in a process of immunoassay. In the protein adsorption, the common membrane that is usually used is the polymeric PVDF membrane. This is contributed by some characteristic in the PVDF membrane such as high durability and strong binding capacity making it suitable for the development of diagnostic-kit through adsorption process.

Generally, protein binding is defined as the accumulation process of protein particle to the surface due to the major forces that drives the protein adsorption such as surface energy, hydrophobicity and etc (Ghosh S., Henry B. Bull, 1963).