

UNIVERSITI TEKNOLOGI MARA

**Effect of Hydroxyapatite (HA) Content to the Pore
Characteristic of Porous Polycaprolactone/
Hydroxyapatite (PCL/HA) Composite Analyze by
Software Image J**

**MUHAMAD FIKRI BIN
MUHAMAD NORA**

**Bachelor of Engineering
(Chemical and Process)**

June 2018

ABSTRACT

The objective of this study is to investigate the effect of the HA content to the pore characteristic of porous PCL/HA composite. To achieve this objective, the foaming condition which are temperature, pressure and depressurized rate are manipulated. The foaming process was performed in the 35, 40 and 45 °C temperature range and pressure 10, 20, 30 MPa in order to control the final morphology, porosity and pore structure of the composite foams. The depressurized rate and duration PCL/HA are constant at less than 1 min & 4 hour respectively. The result in this study found that present of HA content significantly affect the pore structure and characteristic.

ACKNOWLEDGEMENT

Firstly, I wish to thank God for giving me the opportunity to embark on my Degree and for completing this long and challenging journey successfully. My gratitude and thanks go to my supervisor Madam Suffiyana Akhbar. Special thanks to my group member and friends for helping me with this project.

Finally, this thesis is dedicated to the loving memory of my very dear late father and mother for the vision and determination to educate me. This piece of victory is dedicated to both of you. Alhamdulillah.

TABLE OF CONTENT

	Page
TABLE OF CONTENT	vi
CHAPTER ONE: INTRODUCTION	
1.1 Background Study	1
1.2 Problem Statement	4
1.3 Objectives	6
1.4 Scope of Research	6
CHAPTER TWO: LITERATURE REVIEW	
2.1 Introduction	7
2.2 Polycaprolactone (PCL)	7
2.3 Hydroxyapatite (HA)	8
2.4 Bone Scaffolds Tissues	8
2.5 Gas Foaming	10
2.6 Other Technique to Produce Porous PCL/HA Composite Scaffolds	10
2.7 Pore Characterization	12
CHAPTER THREE: RESEARCH METHODOLOGY	
3.1 Foaming Process by Using Supercritical CO2	15
3.2 Sample preparation for FESEM analysis	15
3.3 FESEM Characterization	16
3.4 Characterization by Sofware Image J	17
3.4.1 Morphology of Porous PCL/HA composite	17
3.4.2 Porosity of Porous PCL/HA composite	18
3.4.3 Mean Pore Size	18

CHAPTER ONE

INTRODUCTION

1.1 Background Study

The utilization of bone grafts is the way to recovery the skeletal fractures, break, substitute and regenerated the lost bone. It already shown by the highest amount of bone graft process that already performed over the world. The common way and standard of these is the autograft, but it can lead to many difficulty or problem (complication) such as, scar, sick, feel pain, blood loss, infection and donor-site morbidity. The other option is allografts, but they lack the osteoactive capacity of autografts which has the risk to carrying infectious disease or immune rejection. The different methodologies, for example the bone graft substitutes, have focused on improved the efficiency of bone grafts and growth factors to stimulate the development of cells. The ideal bone graft or sometimes called as scaffold come from the biomaterials that impersonate the structure and properties or composition of natural bone. The most common and popular of bone grafts is the autograft, this process it will take (transplant) the bone or any tissues from the body to another body of the same patient. About 2.2 million bone grafts used in orthopedic procedures average for every years come from the high incident that has happened (Annis, Mosher, & Roberts, 2009). There have three main procedure or process of bone grafts which are the autographs, allografts and bone graft substitutes (Brydone A, Meek D, 2010). The tissue regeneration limit of these bone grafts can be determined by their own properties of osteogenic, osteoconductive and osteoinductive potential. The osteogenic potential and the capability of a bone graft driven by cells which take part in hte bone formation, for example osteoblasts, mesenchymal stem cells (MSCs), and osteocytes. The term osteoconductive stand to the matrix which stimulates cells of the bone to grow on the surface of bone. The important is osteoinductive capacity which in bone graft its needed and act as bone healing. It is refers to the stimulation or development of MSCs cell to differentiate into preosteoblasts which the beginning process of bone-forming process.

Tissue or bone engineering scaffold has developed as the main fields and