

CONTENTS

	Page
TITLE	i
ORIGINAL LITERARY WORK DECLARATION	ii
ABSTRACT	iii
ACKNOWLEDGEMENTS	vii
CONTENTS	viii
LIST OF TABLES	xiii
LIST OF FIGURES	xiv
ABBREVIATIONS	xvi
CHAPTER 1: INTRODUCTION	1
CHAPTER 2: LITERATURE REVIEW	
2.1 Overview on bone	3
2.1.1 Nanostructure of bone	3
2.1.2 Microstructure of bone	5
2.1.3 Macrostructure of bone	5
2.2 Bone cells and bone remodelling	6
2.2.1 Osteoblasts	7
2.2.2 Osteocytes	7
2.2.3 Osteoclasts	8
2.3 Osteoinduction and its importance for bone healing	9
2.4 Anatomy of rabbit teeth	11

2.5	Tissue engineering	13
2.6	Guided bone regeneration	14
2.7	Bone substitutes	15
2.8	Bone graft characteristics	16
2.8.1	Osteogenesis, osteoinduction and osteoconduction	16
2.9	Types of bone graft substitutes	17
2.9.1	Autograft	17
2.9.2	Allograft	18
2.9.3	Xenograft	19
2.9.4	Alloplast	19
2.9.4.1	Polymers	20
2.10	Biodegradable polymers	21
2.10.1	Overview	21
2.10.2	Biodegradable polymer as a substitute for plastic	24
2.11	Polyhydroxyalkanoate (PHA)	25
2.11.1	PHA composition and properties	28
2.11.2	PHA biosynthetic pathway	31
2.11.3	Biodegradation of PHA	33
2.11.4	Applications and commercial aspects of PHAs	35
2.11.5	Applications of PHAs in medicine	36
2.11.5.1	PHA as drug carrier	39
2.11.5.2	PHA as scaffold material in tissue engineering	40

2.11.6 Biocompatibility of PHAs	41
2.12 Production of PHAs using saponified palm kernel oil as a carbon substrates	42
2.13 Objectives of study	43

CHAPTER 3: MATERIALS AND METHODS

3.1 Overview	45
3.2 Production of PHA	45
3.2.1 Bacteria strain	45
3.2.2 Preservation of the bacteria	45
3.2.3 Inoculum	46
3.2.4 Media and growth conditions	47
3.2.5 Palm kernel oil	49
3.2.6 Saponification of palm kernel oil (SPKO)	49
3.2.7 Extraction, purification and casting of PHA	50
3.3 Sterilization of the PHA films	50
3.4 Study on biocompatibility of PHA and bone reaction	51
3.4.1 Animal model	51
3.4.2 Surgical procedures	51
3.5 Postoperative care	56
3.6 Euthanasia	56
3.7 Fixation	58
3.8 Radiography of excised bone specimens	58

3.9	Histological processing	59
3.9.1	Dehydration and infiltration process	59
3.9.2	Embedding/ Blocking (Light Polymerization Unit)	60
3.9.3	Attachment of first slide to specimen block	62
3.9.4	Gross grinding of slide block	62
3.9.5	Preparation of sandwich slide block (with Adhesive Press)	63
3.9.6	Sectioning	65
3.9.7	Fine grinding (with EXAKT Grinding System)	67
3.9.8	Polishing	67
3.10	Histological analysis	68
3.10.1	Staining technique	68
3.10.1.1	Haematoxylin and Eosin staining	68
3.10.1.2	Periodic Acid-Schiff (PAS) technique	69
3.11	Histological study	70
3.12	Histomorphometric study	71
3.13	Statistical analysis	72

CHAPTER 4: RESULTS

4.1	Preparation of PHA membrane	73
-----	-----------------------------	----

4.2	Clinical and physical examination	74
4.3	Critical size defect	74
4.4	Observations of the test animals and implanted PHA	74
4.5	Histological findings	79
4.6	Histomorphometric findings	79
4.7	Photomicrographs of PHA groups and controls	82
4.7.1	PHA groups	82
4.7.2	Controls	87
CHAPTER 5: DISCUSSION		93
CHAPTER 6: CONCLUSION		104
APPENDIX		107
REFERENCES		112