

## TABLE OF CONTENTS

<b>S.No.</b>	<b>Chapter(s)</b>	<b>Page No.</b>
a.	LIST OF FIGURES	i
b.	LIST OF TABLES	v
c.	Symbols used	vi
d.	Preface	viii
1.	INTRODUCTION	
1.1.	Biomaterials .....	1
1.1.1.	Biomaterials for Tissue Engineering .....	1
1.1.2.	Three dimensional (3D) scaffolds for tissue engineering.....	2
1.1.2.1.	Solvent casting and particulate leaching .....	2
1.1.2.2.	Freeze Drying .....	3
1.1.2.3.	Electrospinning.....	3
1.1.3.	Materials for Biomedical applications.....	4
1.1.4.	Biodegradable polymer.....	4
1.1.4.1.	Poly(lactic acid) (PLA) .....	5
1.1.4.2.	Star poly(lactic acid) .....	8
1.1.5.	Properties of poly(lactic acid).....	10
1.1.5.1.	Crystallinity and Thermal behavior of poly(lactic acid) .....	10
1.1.5.2.	Rheology and Mechanical Property .....	11

1.1.6.	Need for the modification of PLA .....	14
1.1.6.1.	Gelatin .....	14
1.2.	Scope of the Thesis .....	15
1.3.	Objective.....	16
2.	EXPERIMENTAL PROCEDURES	
2.1.	Chemicals and Materials.....	19
2.2.	Synthesis of gelatin grafted PDLLA (l-pLG and ss-pLG).....	19
2.2.1.	Synthesis of linear and star shaped poly(D,L-Lactide) (l-PDLLA and ss-PDLLA) .....	19
2.2.2.	Synthesis of carboxyl terminated PDLLA (l-PDLLA-COOH and ss-PDLLA-COOH) .....	20
2.2.3.	Synthesis of block copolymer Gelatin grafted PDLLA (l-pLG and ss-pLG) .....	21
2.2.4.	Synthesis of ss-pLG coated gold nanoparticles .....	21
2.2.5.	Synthesis of hybrid polymer .....	22
2.3.	Characterization of polymer .....	22
2.3.1.	<sup>1</sup> H NMR study .....	22
2.3.2.	Gel Permeation Chromatography (GPC).....	22
2.3.3.	X-Ray Diffraction (XRD) study .....	22

2.3.4.	FTIR study .....	23
2.3.5.	X-ray photoelectron spectroscopy (XPS) .....	23
2.3.6.	Thermogravimetric Analysis (TGA) .....	23
2.3.7.	Differential Scanning Calorimetry (DSC) analysis .....	24
2.3.8.	Water contact angle measurement .....	24
2.3.9.	Thioflavin T assay .....	24
2.3.10.	Circular dichroism (CD) spectroscopy .....	25
2.3.11.	AFM measurement.....	25
2.3.12.	UV-Visible spectrophotometry .....	25
2.3.13.	Spectrofluorometry .....	26
2.3.14.	Transmission Electron microscopy.....	26
2.4.	Protein adsorption study .....	26
2.5.	Fabrication of 3D scaffolds .....	27
2.5.1.	Characterization of Scaffolds .....	27
2.5.1.1.	Scanning Electron Microscopy (SEM).....	27
2.5.1.2.	<i>In vitro</i> degradation of 3D scaffolds.....	28
2.5.1.3.	Compression modulus .....	29
2.5.1.4.	<i>In vitro</i> biomolecule release study.....	29
2.5.1.5.	Silica release profile .....	30

2.6.	Cell Culture.....	30
2.6.1.	Cell adhesion and spreading analysis .....	31
2.6.2.	Fluorescent staining of cell nuclei and actin filaments.....	31
2.6.3.	Cell viability and Proliferation .....	32
2.6.4.	Neuroprotection Assay in MC65 Cells.....	33
2.7.	Haemocompatibility of scaffolds .....	33
2.7.1.	Blood sample .....	33
2.7.2.	Haemolysis .....	33
2.7.3.	Evaluation of erythrocyte membrane Integrity.....	34
2.7.4.	Activated Partial Thromboplastin Time (APTT) and Prothrombin Time (PT) measurement.....	35
2.8.	Subcutaneous <i>in vivo</i> implantation of scaffolds and their immune response .	35
2.9.	Statistical Analysis.....	36
3.	<b>TAILORING THE CHEMICAL PROPERTIES OF 4 ARM STAR SHAPED POLY(D,L-LACTIDE)</b>	
3.1.	OUTLOOK.....	37
3.2.	RESULTS AND DISCUSSION.....	40
3.2.1.	Synthesis and characterization of gelatin grafted copolymer (ss-PDLLA-b- Gelatin) .....	40

3.2.1.1.	Crystalization behaviour of ss-pLG .....	44
3.2.1.2.	Thermal peroperties of ss-pLG.....	44
3.2.2.	Influence of gelatin grafting on protein adsorption and cell adhesion .....	46
3.2.3.	Characterization of 3D scaffolds .....	49
3.2.4.	Degradation kinetics .....	50
3.2.5.	Influence of gelatin grafting on Biocompatibility and Cell-Matrix interaction of 3D scaffolds.....	53
3.2.6.	Influence of gelatin grafting on Haemocompatability.....	56
3.2.6.1.	Haemolysis .....	56
3.2.6.2.	Evaluation of erythrocyte membrane integrity.....	57
3.2.6.3.	Activated Partial Throboplastin Time (APTT) and Prothrombin Time (PT) .....	57
3.3.	CONCLUSION.....	59
4.	CELL PROLIFERATION INFLUENCED BY MATRIX COMPLIANCE OF GELATIN GRAFTED POLY(D,L-LACTIDE) THREE DIMENSIONAL SCAFFOLDS	
4.1.	OVERVIEW .....	61
4.2.	RESULTS AND DISCUSSION.....	62
4.2.1.	Synthesis and characterization of l-pLG.....	62
4.2.1.1.	Crystallinity and Thermal Properties of Polymers .....	64

4.2.2.	Characterization of 3D scaffolds .....	67
4.2.3.	<i>In vitro</i> biomolecule release and release kinetics .....	68
4.2.4.	Influence of gelatin grafting in degradation of 3D scaffolds .....	71
4.2.5.	Influence of mechanical property of 3D scaffolds in cell proliferation....	74
4.2.6.	Haemocompatibility.....	79
4.2.6.1.	Evaluation of erythrocyte membrane integrity.....	79
4.2.6.2.	Activated Partial Thromoplastin Time (APTT) and Prothrombin Time (PT) .....	81
4.3.	Conclusion .....	82
5.	GELATIN GRAFTED POLY(D,L-LACTIDE) AS A ANTI-AMYLOIDOGENIC AGENT.....	85
5.1.	Overview.....	83
5.2.	RESULTS AND DISCUSSION	
5.2.1.	Effects of ss-pLG on inhibition of protein fibrillation.....	84
5.2.2.	Interaction of ss-pLG with Bovine serum albumin (BSA).....	88
5.2.3.	Effects of polymer on rescuing toxicity of MC65 cells and amyloid- induced hemocompatibility .....	90
5.2.4.	Effects of polymer on amyloid-induced hemocompatibility .....	92
5.2.5.	ss-pLG as an efficient biocompatible capping agent.....	96

5.3.	Conclusion .....	98
6.	INCREASING THE STABILITY OF THE 3D SCAFFOLDS .....	85
6.1.	OVERVIEW .....	99
6.2.	RESULTS AND DISCUSSION.....	101
6.2.1.	Synthesis and characterization of hybrid gels .....	101
6.2.1.1.	Thermal properties of hybrid gels .....	103
6.2.2.	Cell spreading on 2D hybrid polymer coated film .....	104
6.2.3.	Fabrication and Characterization of scaffolds .....	106
6.2.4.	Cell proliferation within hybrid scaffolds.....	108
6.2.5.	Silica release .....	109
6.2.6.	Hemocompatibility .....	112
6.2.7.	Subcutaneous implantation of implantation of scaffolds and immune response114	
6.3.	Conclusion .....	116
7.	SUMMARY AND FUTURE DIRECTION.....	107
7.1.	Summary.....	117
7.2.	Future Direction.....	118
	References.....	121