TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER NO.</th>
<th>TITLE</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td></td>
<td>LIST OF TABLES</td>
<td>xii</td>
</tr>
<tr>
<td></td>
<td>LIST OF FIGURES</td>
<td>xiv</td>
</tr>
<tr>
<td></td>
<td>LIST OF ABBREVIATIONS</td>
<td>xix</td>
</tr>
</tbody>
</table>

1 INTRODUCTION 1
1.1 APPLICATIONS OF UV-CROSSLINKED POLYMERS 2
1.2 PHOTOINITIATORS 4
1.3 FREE-RADICAL POLYMERIZATION 6
  1.3.1 Ionic Photoinitiators 22
  1.3.2 Anionic Polymerization 22
  1.3.3 Photoinitiated Cationic Polymerization 22
1.4 LIGHT SOURCES 29
1.5 PREPOLYMERS/ OLIGOMERS 30
  1.5.1 Unsaturated Polyesters 30
  1.5.2 Acrylic Oligomers 30
  1.5.3 Epoxy Acrylates 33
  1.5.4 Urethane Acrylates 36
  1.5.5 Polyester Acrylates 38
  1.5.6 Epoxy Resins 39
  1.5.7 Other Oligomers 39
1.6 DILUENTS 40
  1.6.1 Reactive Diluents/Monomers 40
  1.6.2 Plasticizing Diluents 41
    1.6.2.1 Primary plasticizers 41
    1.6.2.2 Secondary plasticizers 41
1.7 THE KINETICS OF PHOTOPOLYMERIZATION 45
1.8 SCOPE AND OBJECTIVE OF THE PRESENT WORK 49

2 EXPERIMENTAL 57
  2.1 MATERIALS 57
  2.2 DILUENTS 58
  2.3 PHOTONIIITIATORS 59
  2.4 PURIFICATION OF REAGENTS 62
  2.5 PURIFICATION OF SOLVENTS 62
  2.6 SYNTHESIS OF UV-CURABLE PREPOLYMERS 63
  2.7 CHARACTERIZATION 68
  2.8 PHOTOCURING LAMP 74
  2.9 UV-CURING OF ACRYLATE AND METHACRYLATE PREPOLYMERS BY UV-RADIATION 75
  2.10 FORMULATIONS USED TO STUDY THE KINETICS OF PHOTOPOLYMERIZATION 75
      2.10.1 Influence of Photoinitiator Concentration 75
      2.10.2 Influence of Various Photoinitiators 76
      2.10.3 Influence of Diluent Concentration 80
      2.10.4 Influence of Functionality of Diluent 80
      2.10.5 Influence of Viscosity of System 80
      2.10.6 Influence of Prepolymers 83
      2.10.7 Influence of Temperature 83
      2.10.8 Comparison of Acrylate and Methacrylate Prepolymers 85
  2.11 FORMULATION, PHOTOCURING, SWELLING STUDY, DENSITY, GEL CONTENT (%) AND HARDNESS OF UV-CROSSLINKED POLYMERS 86
      2.11.1 Swelling Study 89
      2.11.2 Gel Content (%) 89
2.12 THERMOGRAVIMETRIC ANALYSIS 89
2.13 DIFFERENTIAL SCANNING CALORIMETRY 90
2.14 ACCELERATED WEATHERING TEST 90

3 RESULTS AND DISCUSSION 91
3.1 CHARACTERIZATION OF BISPHENOLS, DIGLYCIDYL ETHER OF BISPHENOLS AND ACRYLATE/METHACRYLATE PREPOLYMERS 91
3.1.1 FTIR Spectroscopy 94
3.1.2 $^1$H-NMR Spectroscopy 114
3.1.3 $^{13}$C-NMR Spectroscopy 136
3.2 THE KINETICS OF PHOTOPOLYMERIZATION 180
3.2.1 Percent Double Bond Conversion 180
3.2.2 The Rate of Photopolymerization 194
3.3 GEL CONTENT(%) 207
3.4 HARDNESS 211
3.5 DENSITY OF PHOTOCROSSLINKED POLYMERS 214
3.6 SWELLING STUDY 214
3.6.1 Swelling Coefficient 214
3.6.2 Crosslink Density 216
3.6.3 Molecular Weight between Crosslinks 216
3.7 ACCELERATED WEATHERING TEST 220
3.8 THERMAL STUDIES 222
3.8.1 Thermogravimetric Analysis 222
3.8.2 Differential Scanning Calorimetry 225
3.9 LIMITATIONS OF THE RESEARCH DESIGN AND KNOWLEDGE 226
3.10 FUTURE WORK 226

4 CONCLUSION 227
REFERENCES 229
LIST OF PUBLICATIONS 250