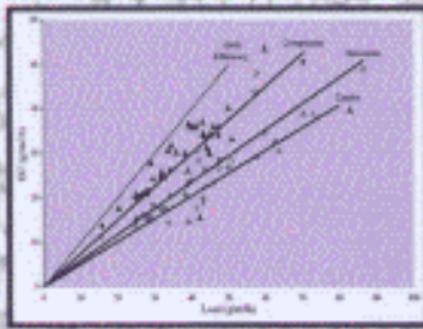
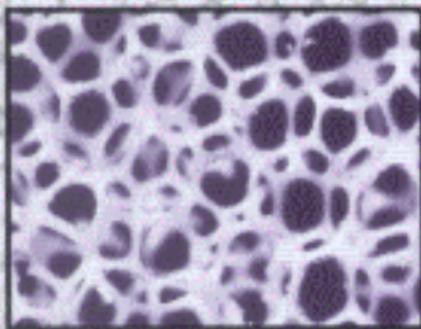
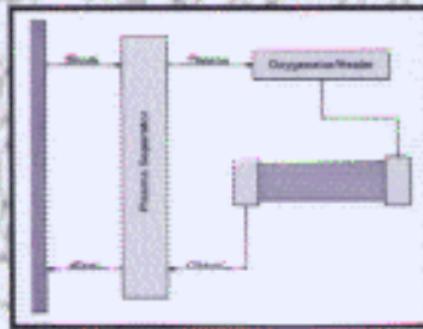


Polyurethanes as Specialty Chemicals

Principles and Applications



T. Thomson



CRC PRESS

Table of Contents

Chapter 1	Introduction	1
An Environmental Example.....	4	
Another Environmental Application	9	
Immobilization of Enzymes.....	13	
A Medical Example	14	
Summary	16	
Chapter 2	Polyurethane Chemistry in Brief.....	17
Primary Building Blocks of Polyurethane	18	
Isocyanates	18	
Polyols	20	
Basic Polyurethane Reaction	22	
Reticulation	29	
History and Current Status of Polyurethanes.....	31	
Chapter 3	Structure–Property Relationships	37
Analysis of Polyurethanes and Precursors	38	
Density	39	
Compression.....	40	
Compression Set	42	
Tensile Strength.....	42	
Air Flow	43	
Structure–Property Aspects of Polyurethane Design	47	
Tensile Strength.....	48	
Compressive Strength	52	
Cell Size and Structure	52	
Special Cases: Hydrophilic Polyurethane Foams.....	55	
Factors Affecting Chemical Properties of Polyurethane	56	
Control of Reservoir Capacity	57	
Biocompatibility	58	
Ligand Attachment.....	60	
Chapter 4	Extraction of Synthetic Chemicals	61
Introduction	61	
Treatment of Sanitary Waste.....	63	
Section Summary	65	
Treatment of Environmental Problems by Extraction.....	66	

Theory of Extraction	68
Uses for Extraction	68
Mechanisms and Mathematics of Extraction	69
Application of Extraction Principles to Removal of Environmental Pollutants.....	70
Extraction from Aqueous Media.....	71
Extraction of Pesticides	72
Development of Broad-Based Extraction Medium	75
Case Studies	76
Use of CoFoam to Extract MtBE from Water	77
Combination of Carbon Adsorption and Enthalpic Extraction by Polyurethane	78
Chapter 5 Additional Environmental Applications	85
Biochemical Conversion	87
Biochemical Reactors	88
Suspended Growth Bioreactors.....	88
Attached Growth Bioreactors	89
Biochemical Processes	90
Development of Biofilm in Attached Growth Bioreactor	91
Biochemical Transformation of Wastewater: Summary.....	95
Conventional Reticulated Polyurethane as Scaffold for Microorganisms	97
Use of Hydrophilic Polyurethane in Aquaculture	99
Use of Hydrophilic–Hydrophobic Composite in Air Biofilter.....	101
Other Projects.....	103
Chapter 6 Biomedical Applications of Polyurethane	111
Biocompatibility	112
Interactions of Proteins with Foreign Materials.....	114
Avoiding Coagulation Cascade	117
Summary	119
Biodegradability	120
Solvent Casting–Particulate Leaching	121
Gas Foaming	121
Fiber Meshes and Fiber Bonding	121
Freeze Drying.....	121
Properties and Biodegradation of Polyurethanes	122
Cell Adhesion	123
Conclusion.....	127
Chapter 7 Development of Artificial Organs	129
Current and Anticipated Technologies in Treatment of Liver Disease.....	131
Surgical Approaches.....	131
Cell-Based Approaches	132

Cell Sourcing.....	132
Cell Transplantation	133
Tissue Engineered Implants	133
Extracorporeal Devices	134
Design of Ideal Scaffold for Extracorporeal BAL or Implantable Artificial Organ.....	134
Biocompatibility and Hemocompatibility	135
Strength of Material	136
Pore Size and Structure	136
Surface-to-Volume Ratio.....	137
Mass Transport through Device.....	137
High Degree of Interconnected Cells	137
Void Volume	138
Allowance for High Flux Membrane	138
Shape of Colonizing Surface	138
Attachment of Ligands.....	139
Cell Adhesion.....	139
Current Clinical Activity in Scaffold-Based Artificial Liver Development	140
Summary	146
Chapter 8 Other Applications	147
Immobilization of Enzymes and Cells	147
Techniques for Immobilization	150
Immobilization of Lipases on CoFoam Hydrophilic Polyurethane	153
Immobilization of Cells	155
Immobilization Studies: Summary	157
Use of Hydrophilic Polyurethane for Controlled Release	158
Skin Care Delivery Application.....	158
Clinical Studies	159
Inclusion and Exclusion Criteria.....	159
Instructions to Participants	159
Results.....	160
Agricultural Applications	160
Artificial Muscle Development.....	161
Gel Preparations	164
Polyurethane Hydrogel	164
Cross-Linked Polyacrylamide Gels	164
Cross-Linked Polyacrylic Acid Gels	164
Contraction Experiments.....	165
Conclusions	166
References.....	167
Index	175