

CHAPTER ONE: INTRODUCTION	1
CONTROLLED-RELEASE TECHNOLOGIES: ESTABLISHED AND EMERGING MARKETS	1
STUDY GOAL AND OBJECTIVES	1
REASONS FOR DOING THE STUDY	2
INTENDED AUDIENCE.....	2
SCOPE OF REPORT	3
METHODOLOGY	4
INFORMATION SOURCES	5
ANALYST'S CREDENTIALS.....	5
RELATED BCC PUBLICATIONS	5
BCC ONLINE SERVICES.....	6
DISCLAIMER	6
CHAPTER TWO: EXECUTIVE SUMMARY.....	7
<i>SUMMARY TABLE GLOBAL MARKET FORECAST FOR CONTROLLED-RELEASE BARRIER MATERIALS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	8
<i>SUMMARY FIGURE GLOBAL MARKET FOR CONTROLLED- RELEASE BARRIER MATERIALS BY ECONOMIC REGION, 2008- 2015 (\$ MILLIONS)</i>	8
CHAPTER THREE: CONTROLLED-RELEASE TECHNOLOGIES.....	9
OVERVIEW OF CONTROLLED-RELEASE TECHNOLOGIES	9
OVERVIEW OF CONTROLLED-... (CONTINUED)	10
ESTABLISHED AND EMERGING APPLICATIONS	11
<i>TABLE 1 TYPICAL APPLICATIONS FOR ACTIVE AGENTS AND BARRIER MATERIALS IN AREAS OTHER THAN AGRICULTURE AND HEALTHCARE</i>	12
<i>TABLE 1 (CONTINUED)</i>	13
ACTIVE AGENTS	13
<i>TABLE 2 COMMONLY USED ACTIVE AGENTS</i>	14
<i>TABLE 3 ACTIVE AGENTS SUITABLE FOR MICROENCAPSULATION</i>	14
<i>TABLE 3 (CONTINUED)</i>	15
BARRIER MATERIALS.....	15
Barrier Materials (Continued)	16
COATINGS.....	17
ENCAPSULATION.....	18
ENCAPSULATION (CONTINUED)	19
ENCAPSULATION (CONTINUED)	20
COATINGS AND ENCAPSULATION	21
Coatings and Encapsulation (Continued).....	22
CHAPTER FOUR: CONTROLLED-RELEASE MARKETS	23

THE GLOBAL MARKET FOR CONTROLLED-RELEASE TECHNOLOGY	23
DEMAND BY REGION	24
TABLE 4 GLOBAL INCOME RANGES BY ECONOMIC REGION (\$).....	25
TABLE 5 HIGH-INCOME NATIONS.....	25
TABLE 6 MIDDLE-INCOME NATIONS.....	26
TABLE 7 LOW-INCOME NATIONS.....	26
TABLE 7 (CONTINUED).....	27
DEMAND BY APPLICATION	27
TABLE 8 GLOBAL MARKET FORECAST FOR CONTROLLED RELEASE IN AGRICULTURE BY APPLICATION, THROUGH 2015 (%).....	27
TABLE 9 GLOBAL MARKET FORECAST FOR CONTROLLED RELEASE IN CONSUMER PRODUCTS BY APPLICATION, THROUGH 2015 (%).....	28
TABLE 10 GLOBAL MARKET FORECAST FOR CONTROLLED RELEASE IN ENERGY PRODUCTION BY APPLICATION, THROUGH 2015 (%).....	28
TABLE 11 GLOBAL MARKET FORECAST FOR CONTROLLED RELEASE IN FOOD PROCESSING BY APPLICATION, THROUGH 2015 (%).....	28
TABLE 12 GLOBAL MARKET FORECAST FOR CONTROLLED RELEASE IN INDUSTRIAL APPLICATIONS BY APPLICATION, THROUGH 2015 (%).....	29
TABLE 13 GLOBAL MARKET FORECAST FOR CONTROLLED RELEASE IN INFRASTRUCTURE PROTECTION BY APPLICATION, THROUGH 2015 (%).....	29
THE GLOBAL MARKETPLACE	29
INFRASTRUCTURE REQUIRED TO ENTER THE GLOBAL MARKET	30
TABLE 14 THE MARKETING STRUCTURE OF CHEMICAL MANUFACTURING	31
Infrastructure Required to ... (Continued).....	32
TABLE 15 NATIONAL CHEMICAL PRODUCTION CAPABILITIES: COUNTRIES WITH GREATER THAN 1% (%).....	33
COUNTRIES POISED TO LEAD THE EXPORT MARKET	34
TABLE 16 TOP TIER CHEMICAL PRODUCING COUNTRIES, 2009	35
TABLE 17 PUBLICATION OF SIGNIFICANT SCIENTIFIC ARTICLES BY ECONOMIC REGION OFFER A LEADING INDICATOR OF CONTROLLED-RELEASE DEVELOPMENT CAPACITY, THROUGH 2015 (NO. OF PAPERS)	36
ENVIRONMENTAL REGULATIONS SHAPE REGIONAL MARKETS.....	36
Environmental Regulations Shape ... (Continued).....	37

Environmental Regulations Shape ... (Continued).....	38
LIMITED BENEFIT FOR U.S. CHEMICAL WORKERS.....	39
POTENTIAL IMPACT OF THE GREEN CHEMISTRY MOVEMENT.....	40
TABLE 18 MEMBERS OF THE EU.....	41
FORECASTING THE CONTROLLED-RELEASE MARKET.....	42
TABLE 19 COUNTRIES WITH UNIQUE CONDITIONS THAT WILL IMPEDE THE DEVELOPMENT OF A CONTROLLED-RELEASE INDUSTRY.....	43
TABLE 19 (CONTINUED).....	44
TABLE 20 COUNTRIES WITH THE GREATEST DEMAND FOR CONTROLLED-RELEASE TECHNOLOGY IN CONSUMER, INDUSTRIAL, AND INSTITUTIONAL PRODUCTS, THROUGH 2015 (BASED ON GDP IN \$ BILLIONS).....	45
TABLE 20 (CONTINUED).....	46
TABLE 21 COUNTRIES WITH THE HIGHEST DEMAND FOR CONTROLLED-RELEASE TECHNOLOGY FOR AGRICULTURAL APPLICATIONS IN 2010 (BASED ON BCC RESEARCH FORECAST).....	46
CHAPTER FIVE: THE AGRICULTURE MARKET.....	47
THE AGRICULTURE MARKET.....	47
TABLE 22 GLOBAL FORECAST OF CROP PRODUCTION INDEX BY ECONOMIC REGION, THROUGH 2015 (1999–2001 = 100).....	48
TABLE 23 GLOBAL FORECAST OF THE FOOD PRODUCTION INDEX BY ECONOMIC REGION, THROUGH 2015 (1999–2001 = 100).....	49
TABLE 24 WHAT THE WORLD GROWS: MAJOR CASH CROPS, EXCLUDING ILLEGAL VEGETATION.....	49
TABLE 25 GLOBAL AGRICULTURAL LAND MEASUREMENTS BY COUNTRY.....	50
TABLE 25 (CONTINUED).....	51
TABLE 25 (CONTINUED).....	52
TABLE 25 (CONTINUED).....	53
TABLE 25 (CONTINUED).....	54
TABLE 26 GLOBAL FORECAST OF AGRICULTURAL LAND BY ECONOMIC REGION, THROUGH 2015 (% OF LAND AREA).....	55
TABLE 27 GLOBAL FORECAST OF ARABLE LAND BY ECONOMIC REGION, THROUGH 2015 (% OF LAND AREA).....	55
TABLE 28 GLOBAL FORECAST OF MECHANIZATION OF AGRICULTURAL ACTIVITIES BY ECONOMIC REGION, THOUGH 2015 (TRACTORS PER 100 SQ. KM OF ARABLE LAND).....	56
TABLE 29 GLOBAL FORECAST OF AGRICULTURAL WORKER VALUE-ADDED BY ECONOMIC REGION, THROUGH 2015 (PER WORKERS IN CONSTANT 2000 DOLLARS).....	56
CONTROLLED-RELEASE TECHNOLOGY FOR AGRICHEMICALS.....	56
CONTROLLED-RELEASE ... (CONTINUED).....	57

CONTROLLED-RELEASE ... (CONTINUED).....	58
<i>TABLE 30 GLOBAL MARKET FORECAST FOR CONTROLLED- RELEASE BARRIER MATERIALS FOR AGRICULTURE BY APPLICATION, THROUGH 2015 (\$ MILLIONS)</i>	59
FERTILIZERS.....	60
<i>TABLE 31 RAW MATERIALS USED TO MANUFACTURE FERTILIZER AND THEIR FUNCTIONS</i>	60
<i>TABLE 32 MAJOR FERTILIZER FORMULATIONS</i>	60
Nitrogen Fertilizers	60
Nitrogen Fertilizers (Continued).....	61
<i>TABLE 33 GLOBAL NITROGEN SUPPLY AND DEMAND FORECAST, 2007-2012 (THOUSAND MT)</i>	62
Phosphate Fertilizers	63
<i>TABLE 34 GLOBAL PHOSPHATE SUPPLY AND DEMAND FORECAST, 2007-2012 (THOUSAND MT)</i>	63
Potash (Potassium-based) Fertilizers	64
<i>TABLE 35 GLOBAL POTASH SUPPLY AND DEMANDFORECAST, 2007-2012 (THOUSAND MT)</i>	64
GLOBAL VALUE OF BARRIER MATERIALS USED IN MAJOR AGRICULTURAL APPLICATIONS.....	64
<i>TABLE 36 FACTORS EFFECTING DEMAND FOR CONTROLLED- RELEASE TECHNOLOGY IN AGRICULTURE</i>	65
<i>TABLE 36 (CONTINUED)</i>	66
HOW CONTROLLED RELEASE BENEFITS THE POOREST NATIONS.....	66
HOW CONTROLLED RELEASE ... (CONTINUED).....	67
<i>TABLE 37 COUNTRIES WITH THE MOST CRITICAL NEED FOR IMPROVEMENTS IN AGRICULTURAL PRACTICES BASED ON USE OF CHILD LABOR (% OF ECONOMICALLY ACTIVE CHILDREN AGES 7-14)</i>	68
HOW CONTROLLED RELEASE CONTRIBUTES TO SUSTAINABILITY	68
HOW CONTROLLED RELEASE ... (CONTINUED).....	69
<i>TABLE 38 HUMAN-INDUCED SOIL DEGRADATION BY GLOBAL REGION (MILLION HECTARES, %)</i>	70
<i>TABLE 39 EFFECT OF CONTROLLED-RELEASE FERTILIZER ON ONIONS: YIELD, OF MEDIUM JUMBO AND COLOSSAL ONIONS (CWT PER ACRE)</i>	71
DEMAND FOR BARRIER MATERIALS FOR AGRICULTURE	71
<i>TABLE 40 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN AGRICULTURAL APPLICATIONS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	72

<i>FIGURE 1 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN AGRICULTURAL APPLICATIONS, 2008-2015 (\$ MILLIONS)</i>	73
<i>TABLE 41 GLOBAL MARKET FORECAST FOR CEREAL PRODUCTION BY ECONOMIC REGION, THROUGH 2015 (KG/HECTARE)</i>	74
CONTROLLED RELEASE IN GRAIN PRODUCTION.....	74
<i>TABLE 42 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN GRAIN PRODUCTION BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	75
CONTROLLED RELEASE IN OIL SEED PRODUCTION.....	75
<i>TABLE 43 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN OIL SEED PRODUCTION BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	75
CONTROLLED RELEASE IN CITRUS, FRUIT, AND NUT PRODUCTION.....	76
<i>TABLE 44 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN CITRUS, FRUIT, AND NUT PRODUCTION BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	76
CONTROLLED RELEASE IN TURF GRASS PRODUCTION.....	76
<i>TABLE 45 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN TURF GRASS PRODUCTION BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	77
CONTROLLED RELEASE IN GARDEN, GREENHOUSE, AND NURSERY PRODUCTION.....	77
<i>TABLE 46 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN GARDEN, GREENHOUSE, AND NURSERY PRODUCTION BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	77
CONTROLLED RELEASE IN COTTON PRODUCTION.....	78
<i>TABLE 47 COUNTRIES IN WHICH CONTROLLED-RELEASE TECHNOLOGY WOULD HAVE A MODERATE IMPACT ON COTTON HARVEST</i>	78
<i>TABLE 48 COUNTRIES IN WHICH CONTROLLED-RELEASE TECHNOLOGY WILL LIKELY HAVE A MINIMAL IMPACT ON COTTON HARVEST</i>	79
<i>TABLE 49 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN COTTON PRODUCTION BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	80
CONTROLLED RELEASE IN OTHER AGRICULTURAL PRODUCTION.....	80
<i>TABLE 50 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN OTHER AGRICULTURAL PRODUCTION BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	80
CHAPTER SIX: THE FOOD PROCESSING MARKET.....	81

THE FOOD PROCESSING MARKET	81
<i>TABLE 51 LARGEST PROCESSED AND PACKAGED FOOD SUPPLIERS BY MARKET CAPITALIZATION, 2005 (\$ BILLIONS)</i>	82
<i>TABLE 52 THE NINE MAJOR SECTORS OF FOOD PROCESSING</i>	82
OVERVIEW OF THE FOOD-PROCESSING INDUSTRY	83
<i>TABLE 53 MAJOR TYPES OF FLAVORS AND FRAGRANCES</i>	84
<i>TABLE 54 MAJOR FLAVOR AND FRAGRANCE SUPPLIERS</i>	84
<i>TABLE 54 (CONTINUED)</i>	85
<i>TABLE 54 (CONTINUED)</i>	86
CONTROLLED RELEASE FOR FLAVORINGS AND FOOD ADDITIVES	86
<i>TABLE 55 GLOBAL MARKET FORECAST FOR CONTROLLED-RELEASE BARRIER MATERIALS IN FOOD PROCESSING BY APPLICATION, THROUGH 2015 (\$ MILLIONS)</i>	87
A VARYING GLOBAL OUTLOOK	87
<i>TABLE 56 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN FOOD PROCESSING BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	87
<i>FIGURE 2 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN FOOD PROCESSING, THROUGH 2015 (\$ MILLIONS)</i>	88
HOW FOOD PROCESSORS USE CONTROLLED RELEASE	89
CONTROLLED RELEASE FOR CONCENTRATES, SAUCE, AND FRUITS AND VEGETABLES.....	90
<i>TABLE 57 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS FOR CONCENTRATES, SAUCE, AND FRUITS AND VEGETABLES BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	90
CONTROLLED RELEASE IN BREAD AND BAKERY PRODUCTS MANUFACTURING.....	91
<i>TABLE 58 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN BREAD AND BAKERY PRODUCTS, EXCEPT FROZEN, MANUFACTURING BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	91
CONTROLLED RELEASE FOR CHOCOLATES, CONFECTIONERY, ICE CREAMS, AND DESSERTS.....	91
<i>TABLE 59 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN CHOCOLATES, CONFECTIONERY, ICE CREAMS, AND DESSERTS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	92
CONTROLLED-RELEASE BARRIER MATERIALS FOR DRY, CONDENSED, AND EVAPORATED DAIRY PRODUCTS	92
<i>TABLE 60 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS FOR DRY, CONDENSED, AND EVAPORATED DAIRY PRODUCTS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	92

CONTROLLED-RELEASE BARRIER MATERIALS IN ALL OTHER FOOD MANUFACTURING	93
TABLE 61 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS IN ALL OTHER FOOD MANUFACTURING BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)	93
CHAPTER SEVEN: THE CONSUMER PRODUCTS MARKET	94
TABLE 62 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN CONSUMER PRODUCTS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS).....	94
FIGURE 3 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN CONSUMER PRODUCTS, 2008-2015 (\$ MILLIONS).....	95
TABLE 63 GLOBAL MARKET FORECAST FOR CONTROLLED- RELEASE BARRIER MATERIALS CONSUMER PRODUCTS BY APPLICATION, THROUGH 2015 (\$ MILLIONS).....	95
CONTROLLED RELEASE FOR COSMETICS.....	96
TABLE 64 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN COSMETICS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS).....	97
CONTROLLED RELEASE FOR PERSONAL CLEANING PRODUCTS.....	97
TABLE 65 GLOBAL MARKET FORECAST FOR PERSONAL CLEANING PRODUCTS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS).....	98
CONTROLLED RELEASE FOR HOUSEHOLD CLEANING PRODUCTS	98
TABLE 66 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN HOUSEHOLD CLEANING PRODUCTS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)	99
CONTROLLED RELEASE IN ADVANCED TEXTILES	99
TABLE 67 STRUCTURE OF THE TEXTILE AND APPAREL INDUSTRY.....	99
TABLE 67 (CONTINUED).....	100
CONTROLLED RELEASE IN ... (CONTINUED)	101
TABLE 68 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN ADVANCED TEXTILES BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS).....	102
CONTROLLED RELEASE FOR AROMA PACKAGING	102
TABLE 69 AROMA PACKAGING FORMATS	103
TABLE 70 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN PRINT-BASED AROMA PACKAGING BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)	104
CONTROLLED RELEASE FOR SMART PACKAGING	104
TABLE 71 REPRESENTATIVE SMART PACKAGING SYSTEMS.....	104
TABLE 71 (CONTINUED).....	105

<i>TABLE 72 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN SMART PACKAGING BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	106
CHAPTER EIGHT: THE INFRASTRUCTURE MARKET.....	107
<i>TABLE 73 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN MAJOR INFRASTRUCTURE, INDUSTRIAL AND ENERGY APPLICATIONS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	107
<i>FIGURE 4 GLOBAL MARKET FORECAST FOR INFRASTRUCTURE APPLICATIONS, 2008-2015 (\$ MILLIONS)</i>	108
<i>TABLE 74 GLOBAL MARKET FORECAST FOR CONTROLLED- RELEASE BARRIER MATERIALS FOR INFRASTRUCTURE- RELATED APPLICATIONS, THROUGH 2015 (\$ MILLIONS)</i>	108
CONTROLLED RELEASE FOR NEW INFRASTRUCTURE	108
<i>TABLE 75 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS FOR NEWLY CONSTRUCTED INFRASTRUCTURE BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	109
CONTROLLED RELEASE FOR STRUCTURE PAINTING	109
<i>TABLE 76 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS FOR STRUCTURE PAINTING BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	109
CONTROLLED RELEASE FOR OTHER STRUCTURE MAINTENANCE	110
<i>TABLE 77 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS FOR OTHER STRUCTURE MAINTENANCE BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	110
CONTROLLED RELEASE FOR REMEDIATION.....	110
CONTROLLED RELEASE ... (CONTINUED).....	111
<i>TABLE 78 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN REMEDIATION-RELATED USES BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	112
CONTROLLED RELEASE IN INFRASTRUCTURE SECURITY	112
<i>TABLE 79 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN INFRASTRUCTURE SECURITY-RELATED APPLICATIONS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	113
CHAPTER NINE: THE INDUSTRIAL PRODUCTS MARKET.....	114
<i>TABLE 80 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN INDUSTRIAL APPLICATIONS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)</i>	114
<i>FIGURE 5 GLOBAL MARKET FORECAST FOR INDUSTRIAL PRODUCTS APPLICATIONS, THROUGH 2015 (\$ MILLION)</i>	114

CONTROLLED RELEASE IN PAINTS, PIGMENTS, AND COATINGS	115
CONTROLLED-RELEASE BARRIER MATERIALS FOR PAINTS, PIGMENTS, AND COATINGS	116
TABLE 81 CHEMICALS USED IN PAINT PIGMENT MANUFACTURING	116
TABLE 81 (CONTINUED).....	117
TABLE 82 GLOBAL MARKET FORECAST FOR CONTROLLED- RELEASE BARRIER MATERIALS FOR INDUSTRIAL APPLICATIONS, THROUGH 2015 (\$ MILLIONS)	117
TABLE 83 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN PAINT-, PIGMENT-, AND COATING-RELATED APPLICATIONS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS).....	118
CONTROLLED RELEASE IN OTHER INDUSTRIAL APPLICATIONS.....	118
TABLE 84 SEGMENTS OF THE PAINT AND PIGMENT MARKET THAT WOULD BENEFIT FROM CONTROLLED-RELEASE TECHNOLOGY.....	118
TABLE 85 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN OTHER INDUSTRIAL APPLICATIONS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)	119
CHAPTER TEN: THE ENERGY MARKET	120
TABLE 86 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN ENERGY APPLICATIONS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS).....	120
FIGURE 6 GLOBAL MARKET FORECAST FOR ENERGY APPLICATIONS, 2008-2015 (\$ MILLION).....	120
TABLE 87 GLOBAL MARKET FORECAST FOR CONTROLLED- RELEASE BARRIER MATERIALS FOR ENERGY APPLICATIONS, THROUGH 2015 (\$ MILLIONS).....	121
CONTROLLED-RELEASE BARRIER MATERIALS IN OILFIELD DEVELOPMENT.....	121
TABLE 88 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN OIL AND GAS EXTRACTION AND OPERATIONS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS)	122
CONTROLLED-RELEASE BARRIER MATERIALS IN BIOFUELS.....	123
CONTROLLED-RELEASE ... (CONTINUED).....	124
CONTROLLED-RELEASE ... (CONTINUED).....	125
TABLE 89 GLOBAL FORECAST OF CO ₂ EMISSIONS BY ECONOMIC REGION, THROUGH 2015 (KT)	126
TABLE 90 GLOBAL MARKET FORECAST FOR BARRIER MATERIALS USED IN BIOFUELS BY ECONOMIC REGION, THROUGH 2015 (\$ MILLIONS).....	126

CHAPTER ELEVEN: CONTROLLED-RELEASE COMPANY PROFILES.....	127
3M CORPORATE HEADQUARTERS	127
A&E CONNOCK PERFUMERY & COSMETICS, LTD.	128
AGRISENSE TECHNOLOGIES	129
AGRIUM, INC.....	129
AGRIUM, INC. (CONTINUED)	130
AGRIUM, INC. (CONTINUED)	131
AGRIUM, INC. (CONTINUED)	132
ALFA CHEM	133
ALZO INTL., INC.	133
AMCOL HEALTH & BEAUTY SOLUTION.....	133
AMERICAN THERMAL INSTRUMENTS.....	134
ANALYTICAL RESEARCH SYSTEMS.....	134
THE ANDERSONS, INC.....	135
APPLETON/PAPERWEIGHT DEVELOPMENT CORP.	135
ARCADE MARKETING	136
APPLIED MINERALS, INC.....	137
ASAHI KASEI CHEMICALS	137
AUSTRALIAN NUCLEAR SCIENCE AND TECHNICAL ORGANISATION.....	138
AVEKA	138
BALCHEM ENCAPSULATES	139
BASF.....	139
BELL FLAVORS & FRAGRANCES	140
BELMAY	141
BIOGUARD TECHNOLOGIES.....	141
BIOMEDICAL MATERIALS PROGRAM.....	142
BRACE GMBH.....	142
CAPSULATED SYSTEMS, INC.	143
CARGILL.....	143
CENTERCHEM	144
CERAMISPHERE.....	144
CF INDUSTRIES HOLDINGS, INC.....	145
CHONGQING AGRICULTURAL SCIENCE RESEARCH INSTITUTE	145
CIBA SPECIALTY CHEMICALS	146
THE CLOROX CO.	146
COFFEYVILLE RESOURCES.....	146
COGNIS GMBH.....	147
CONTROL RELEASE SOCIETY.....	148
COUNCIL OF TEXTILE AND FASHION INDUSTRIES	149
CP KELCO	149
DANISCO A/S	150
DOW CHEMICAL.....	151
DOW CHEMICAL (CONTINUED)	152

DOW WOLFF CELLULOSICS	153
DUPONT DE NEMOURS.....	154
EASTMAN CHEMICAL CO.....	154
FIRMENICH	155
FLAVOR AND EXTRACT MANUFACTURERS ASSOC.	155
THE FRAGRANCE FOUNDATION	156
FRAGRANCE MATERIALS ASSOCIATION (FMA) OF THE UNITED STATES.....	156
FRUTAROM INDUSTRIES, LTD.....	157
GEMINNOV	157
GENENCOR INTL.....	158
GIVAUDAN S.A.....	159
HAIFA CHEMICAL CO.....	160
HALLSTAR, INC.	161
HANFENG EVERGREEN, INC.....	161
HANFENG EVERGREEN, INC. (CONTINUED)	162
HANFENG EVERGREEN, INC. (CONTINUED)	163
HARPER INTL. CORP.	164
HENKEL AG & CO.....	165
HYDROMER, INC.	165
ICC INDUSTRIES, INC.	166
IMC GLOBAL	166
INTERNATIONAL FLAVORS & FRAGRANCES, INC.	166
INTERNATIONAL FRAGRANCE ASSOCIATION (IFRA).....	167
INTERNATIONAL SPECIALTY PRODUCTS, INC.....	168
INTERVET/SCHERING-PLOUGH ANIMAL HEALTH	169
JAPAN FLAVOR & FRAGRANCE MATERIALS ASSOCIATION (JFFMA).....	169
JOHN DEERE LANDSCAPES/LESCO	170
JRP INTL., INC.	170
J.R. SIMPLOT CO.	171
KAO CORP.....	172
KG CHEMICAL CO. CORP.....	172
KOBO PRODUCTS, INC.....	172
LABORATOIRES SEROBIOLOGIQUES	173
LEBANON SEABOARD CORP.....	173
LIPO CHEMICALS, INC.....	173
LIPO TECHNOLOGIES, INC.	174
LUBRIZOL CORP.....	175
MANE USA	175
MICROTEK LABORATORIES, INC.	175
MICROTRACE, INC.....	176
THE MOSAIC CO.	177
NATIONAL STARCH	177

NOVOZYMES A/S.....	178
NU-GRO TECHNOLOGIES.....	178
THE PROCTER & GAMBLE CO.....	178
PURSELL TECHNOLOGIES	179
QUEST INTL.	179
READE ADVANCED MATERIALS.....	179
REGENESIS	179
RESEARCH INSTITUTE FOR FRAGRANCE MATERIALS.....	180
RHODIA	181
ROBERTET FRAGRANCES	182
ROHM AND HAAS	182
RONALD T. DODGE CO.....	182
ROYSTER-CLARK.....	183
SALVONA TECHNOLOGIES, INC.....	183
SALVONA TECHNOLOGIES, INC. (CONTINUED).....	184
SENSIENT TECHNOLOGIES CORP.	185
SCENTSATIONAL TECHNOLOGIES, LLC.....	185
THE SCOTTS CO.	186
SHENZHEN BATIAN ECOTYPIC ENGINEERING CO, LTD.....	186
SOUTHWEST RESEARCH INSTITUTE.....	187
SUMITOMO CHEMICAL.....	187
SUN GRO HORTICULTURE.....	188
SUNSTORM RESEARCH CORP.....	189
SUTERRA, LLC	190
SYMRISE AG	190
TAKASAGO INTL. CORP.....	191
TASTETECH.....	191
TERRA.....	192
TMC HALLCREST, LTD.....	193
TRI-K INDUSTRIES, INC.....	193
ULTRA CHEMICAL, INC.....	194
YARA INTL. ASA.....	194
WOLFF WALSRÖDE.....	195

CHAPTER TWELVE: KEY CONTROLLED-RELEASE PATENTS, 1957–	
2010.....	196
KEY CONTROLLED-RELEASE PATENTS ISSUED SINCE 2000	196
PH TRIGGERED TARGETED CONTROLLED RELEASE	
SYSTEMS FOR THE DELIVERY OF PHARMACEUTICAL	
ACTIVE INGREDIENTS	197
RADIOSENSITIZER FORMULATIONS AND METHODS FOR	
USE.....	197
LITHIUM SECONDARY BATTERY CONTAINING CAPSULE	
FOR CONTROLLED-RELEASE OF ADDITIVES.....	198

COMPOSITIONS AND METHODS FOR THE TREATMENT AND REPAIR OF DEFECTS OR LESIONS IN ARTICULAR CARTILAGE USING SYNOVIAL-DERIVED TISSUE OR CELLS	198
ORAL DOSAGE FORMS	199
COMPOSITIONS FOR CONTROLLED RELEASE OF PEST CONTROL PRODUCTS IN AQUATIC ENVIRONMENTS	199
CONTROLLED RELEASE HYDROCODONE FORMULATIONS.....	200
COMBINATION OF POLYVINYL ACETATE WITH WATER-INSOLUBLE, ACID-INSOLUBLE, OR ALKALI-INSOLUBLE POLYMERS USED FOR THE PRODUCTION OF FILM COATINGS WITH HIGHLY CONTROLLED RELEASE AND HIGH STABILITY	200
PHARMACEUTICAL COMPOSITION FOR CONTROLLED RELEASE OF ACTIVE SUBSTANCES AND MANUFACTURING METHOD THEREOF	200
CHRONOTHERAPEUTIC DILTIAZEM FORMULATIONS AND THE ADMINISTRATION THEREOF	201
PHARMACEUTICAL PREPARATION, METHOD FOR ITS PRODUCTION AS WELL AS ITS USE	201
MANDREL WITH CONTROLLED RELEASE LAYER FOR MULTI-LAYER ELECTROFORMED INK-JET ORIFICE PLATES.....	202
COMPOSITION AND METHOD FOR MAINTAINING HEALTHY MOBILE JOINTS AND CARTILAGE.....	203
SYSTEM FOR RELEASING ENCAPSULATED ACTIVE INGREDIENTS.....	203
METHODS FOR MAKING CONTROLLED-RELEASE AMMONIUM PHOSPHATE FERTILIZER.....	203
COMPOSITIONS COMPRISING A DISPERSANT AND MICROCAPSULES CONTAINING AN ACTIVE MATERIAL AND A STABILIZER.....	204
SELF-WARMING OR SELF-HEATING COSMETIC AND DERMATOLOGICAL COMPOSITIONS AND METHOD OF USE.....	205
MULTI COMPONENT CONTROLLED DELIVERY SYSTEM FOR SOAP BARS.....	205
METHOD OF TREATING A HYDROCARBON BEARING FORMATION	206
CONTROLLED DELIVERY SYSTEM FOR FABRIC CARE PRODUCTS.....	206
MULTI COMPONENT CONTROLLED RELEASE SYSTEM FOR ANHYDROUS COSMETIC COMPOSITIONS	207

MULTI COMPONENT MOISTURE TRIGGERED CONTROLLED RELEASE SYSTEM THAT IMPARTS LONG LASTING COOLING SENSATION ON THE TARGET SITE AND/OR PROVIDES HIGH IMPACT FRAGRANCE OR FLAVOR BURST	207
HERBICIDE POTENTIATORS.....	208
CONTROLLED RELEASE FORMULATIONS OF ANIONIC HERBICIDES	208
GRANULAR COATED FERTILIZER	209
MICROENCAPSULATED FRAGRANCES AND METHODS OF COATING MICROCAPSULES	209
A CONTROLLED-RELEASE ADDITIVE COMPOSITION FOR USE IN AQUEOUS SYSTEMS.....	209
MICROENCAPSULATED PARTICLES AND MANUFACTURING PROCESS.....	210
CONTROLLED-RELEASE PESTICIDE COMPOSITION	210
HYDROCAPSULES AND METHOD OF PREPARATION.....	211
SUSPENSIONS OF PARTICLES IN NON-AQUEOUS SOLVENTS	211
CONTROLLED-RELEASE PESTICIDAL COMPOSITION	212
CONTROLLED RELEASE COMPOSITIONS.....	212
POLYMERIC CONTROLLED RELEASE COMPOSITIONS	213
POLYURETHANE FOAM PRODUCTS WITH CONTROLLED RELEASE OF AGENTS AND ADDITIVES	213
CONTROLLED RELEASE COMPOSITIONS.....	214
CROSS-LINKED HIGH AMYLOSE STARCH FOR USE IN CONTROLLED-RELEASE	214
MICROENCAPSULATED PARTICLES AND MANUFACTURING PROCESS.....	214
METHOD OF FORMING COATING MATERIALS.....	215
CONTROLLED RELEASE POLYACRYLIC ACID GRANULES	215
CONTROLLED RELEASE COMPOSITIONS AND METHOD.....	215
ENCAPSULATION OF ACTIVE INGREDIENTS	216
METHOD OF FORMING COATING MATERIALS.....	216
METHOD FOR PRODUCING GRANULAR COATED FERTILIZER.....	217
SURFACE COATINGS	217
ALKALINE SOLUBLE MIXTURE COMPOSED OF CELLULOSE DERIVATIVES.....	217
TREATED TEXTILE FABRIC	218
FEEDSTOCK FOR RUMINANTS WITH CONTROLLED- RELEASE NON-PROTEIN NITROGEN.....	218
PROCESS FOR PREPARING CONTROLLED-RELEASED CHITOSAN MICROCAPSULE.....	219

SLOW RELEASE OF FRAGRANT COMPOUNDS IN PERFUMERY USING A KETO ESTERS	220
TIME RELEASE FRAGRANCE SACHET	220
DISPERSIONS COMPRISING AN OIL-BASED BILIQUID FOAM AND AN AQUEOUS GEL	221
OPTICALLY ACTIVE ESTERS AND THEIR USE AS PERFUMING INGREDIENTS	221
VACUUM COATED PARTICULATE FERTILIZERS	221
SLOW RELEASE OF FRAGRANT COMPOUNDS IN PERFUMERY USING 2-BENZOYL BENZOATES, 2- ALKANOYL BENZOATES OR .ALPHA.-KETO ESTERS	222
METHOD AND APPARATUS FOR PROVIDING LONG TERM PROTECTION FROM INTRUSION	222
CONTROLLED RELEASE COATING COMPRISING BLEND OF SILICONE POLYMER AND ADHESION PROMOTER	223
CONTROLLED RELEASE SUPPLEMENTAL COOLANT ADDITIVE.....	223
KEY CONTROLLED-RELEASE PATENTS ISSUED IN THE 1990S.....	224
METHOD FOR COUPLING CONDUITS USING MICROENCAPSULATABLE SOLVENT ADHESIVE	224
LIQUID CLEANING COMPOSITIONS CONTAINING AN ORGANIC ESTER FOAM CONTROL AGENT.....	224
PH-SENSITIVE MODIFIED CELLULOSE ESTER.....	225
SILICONE-CONTAINING FLUOROPOLYMERS FOR CONTROLLED RELEASE OF ORGANIC LEACHANTS.....	225
CONTROLLED RELEASED FABRIC CARE.....	226
PH-SENSITIVE COATINGS BASED ON CELLULOSE ACETOACETATE.....	226
CONTROLLED RELEASE PLANT NUTRIENTS	226
CONTROLLED-RELEASE INSECT REPELLENT DEVICE	227
TIME-RELEASE DELIVERY MATRIX COMPOSITION.....	227
PET TOY PRODUCT WITH ACTIVATABLE SCENT.....	228
CONTROLLED RELEASE FORMULATIONS COATED WITH AQUEOUS DISPERSIONS OF ACRYLIC POLYMERS	228
COSMETIC DEODORANT PRODUCTS CONTAINING A POLYMER/FRAGRANCE-ENCAPSULATED BICARBONATE INGREDIENT	229
CONTROLLED-RELEASE FORMULATIONS COATED WITH AQUEOUS DISPERSIONS OF ETHYLCELLULOSE	229
CONTROLLED-RELEASE DELIVERY SYSTEM	229
CONTROLLED-RELEASE MICROBE NUTRIENTS AND METHOD FOR BIOREMEDIATION	230
FRAGRANCE USE OF DIHYDROMETHYL JASMONIC ACID.....	230

BIOLOGICALLY-ACTIVE COMPOUNDS COMPRISING A BIOLOGICALLY-ACTIVE ANIONIC PORTION	230
PIGMENT DISPERSIONS	231
GRANULAR SLOW RELEASE FERTILIZER COMPOSITION	232
METHOD OF PREPARING CONTROLLED RELEASE FERTILIZERS AND PRODUCTS.....	232
NOVEL POLYMER COATED BLEACHING COMPOSITION	233
PROCESS FOR PREPARING MICROCAPSULES WITH CONTROLLED-RELEASE	233
ONE-STEP METHOD OF COATING NUTRIENT PARTICLES.....	233
WATER-DISPERSIBLE POLYMERIC COMPOSITIONS.....	234
KEY CONTROLLED-RELEASED PATENTS ISSUED IN THE 1980S.....	234
CONTROLLED RELEASE FORMULATING EMPLOYING RESILIENT MICROBEADS	234
ENCAPSULATED BLEACH PARTICLES FOR MACHINE DISHWASHING COMPOSITIONS.....	235
CONTROLLED-RELEASE COMPOSITION HAVING A MEMBRANE COMPRISING SUBMICRON PARTICLES.....	235
CONTROLLED RELEASE FORMULATION FOR FERTILIZERS	235
GRANULAR FERTILIZER COMPOSITION HAVING CONTROLLED RELEASE.....	236
FERTILIZERS CONTAINING NITROGEN AND MICRONUTRIENTS	236
TREATMENT OF FOULING WITH MICROCAPSULES	237
MICROENCAPSULATED EPOXY ADHESIVE SYSTEM	237
MICROEMULSION OF NUTRIENT SUBSTANCES.....	237
PRESSURE SENSITIVE COPYING PAPER	238
PROCESS OF CULTURING MICROORGANISMS USING A MICROEMULSION	238
HYDROLYZED ETHYLENE VINYL ACETATE ENCAPSULATING COATING	239
METHOD OF MODIFYING A SUBSTRATE	239
RESIN MOLDED PRODUCTIONS DESIGNED TO DISPLAY EXTINCTION OF ACTIVITY	240
IMPREGNATED POROUS GRANULES WITH SLOW RELEASE PORE MEMBRANES.....	241
KEY CONTROLLED-RELEASED PATENTS ISSUED IN THE 1970S.....	241
CONTROLLED RELEASE FORMULATIONS OF DOUGLAS- FIR BEETLE ANTI-AGGREGATIVE PHEROMONE.....	241
ENCAPSULATED BLEACHES AND METHODS FOR THEIR PREPARATION	242
BLEACHING PROCESS	242

ENCAPSULATED BLEACHES AND METHODS FOR THEIR PREPARATION	243
ENCAPSULATED PARTICLES.....	243
PROCESS FOR THE PREPARATION OF UREA-FORMALDEHYDE CONDENSATES	244
OSMOTIC SYSTEM FOR DELIVERING SELECTED BENEFICIAL AGENTS	244
PROCESS FOR THE PRODUCTION OF HOT MELT COATING COMPOSITIONS CONTAINING MICROCAPSULES.....	245
METHOD OF PRODUCING MICROCAPSULES.....	245
SINTERED HERBICIDE-FILLED CELLULOSE ESTER PARTICLES HAVING IMPROVED RESISTANCE TO WATER.....	246
ENCAPSULATED BLEACHES	246
DEPLETION INDICATOR FOR CONTROLLED-RELEASE PESTICIDE FORMULATIONS	246
PARTICULATE UREA-FORMALDEHYDE FERTILIZER COMPOSITION AND PROCESS.....	247
PARTICULATE PEROXYGEN COMPOUNDS.....	248
ENCAPSULATION PARTICLES	248
CONTROLLED RELEASE DELIVERY SYSTEM BY AN OSMOTIC BURSTING MECHANISM.....	249
PREPARATION FOR MAKING HYDROCARBON AND FATS INTO BIODEGRADABLE EMULSIONS.....	249
DETERGENT COMPOSITION CONTAINING COATED BLEACH PARTICLES	249
PROCESS OF FORMING MINUTE CAPSULES	250
FOAMED FERTILIZER AND COMBINATION PRODUCTS.....	250
PROCESS OF FORMING MINUTE CAPSULES AND THREE-PHASE CAPSULE-FORMING SYSTEM	251
KEY CONTROLLED-RELEASE PATENTS ISSUED IN THE 1960S.....	251
PROCESS FOR FORMING MINUTE CAPSULES EN MASSE	251
SLOW RELEASE FERTILIZER COMPRISING A DISPERSION OF UREA-WAX ADDUCT IN WAX.....	251
SLOW RELEASE FERTILIZER WITH A PLURALITY OF EPOXY/POLYESTER RESIN COATINGS.....	252
SLOW RELEASE FERTILIZERS AND METHOD OF MAKING	252
GRANULAR FERTILIZER HAVING A PLURALITY OF COATINGS.....	252
ENCAPSULATION PROCESS AND ITS PRODUCTS.....	253
KEY CONTROLLED-RELEASE PATENTS ISSUED IN THE 1950S.....	253
SLOW-ACTING FERTILIZER COMPOSITIONS	253
OIL-CONTAINING MICROSCOPIC CAPSULES	253