

CHAPTER ONE: INTRODUCTION.....	1
STUDY BACKGROUND	1
STUDY GOALS AND OBJECTIVES.....	1
INTENDED AUDIENCE.....	2
SCOPE OF REPORT	2
INFORMATION SOURCES AND METHODOLOGY.....	3
ANALYST CREDENTIALS.....	3
RELATED BCC RESEARCH REPORTS.....	3
BCC ONLINE SERVICES.....	4
DISCLAIMER	5
 CHAPTER TWO: EXECUTIVE SUMMARY.....	 6
<i>SUMMARY TABLE GLOBAL MARKET FOR MICROBES AND</i>	
<i>MICROBIAL PRODUCTS, THROUGH 2016 (\$ MILLIONS)</i>	6
<i>SUMMARY FIGURE TRENDS IN GLOBAL MARKET FOR MICROBES</i>	
<i>AND MICROBIAL PRODUCTS, 2010–2016 (\$ MILLIONS)</i>	7
 CHAPTER THREE: OVERVIEW	 8
GENERAL DESCRIPTION OF MICROBES.....	8
DEFINITIONS	8
Microbes	8
Bacteria	8
Fungi	8
Archaea.....	9
Protists	9
Micro-Animals and Micro-Plants	9
Commercial Microbes	10
Microbial Products.....	10
PROPERTIES.....	10
Temperature Range.....	10
<i>TABLE 1 MICROBE TEMPERATURE RANGES</i>	11
Psychrophiles	11
Mesophiles.....	11
Thermophiles and Hyperthermophiles	12
Acidity	12
Osmotic Pressure.....	13
Oxygen	13
Water.....	14
Metabolite Production	14
OCCURRENCE AND PRODUCTION	14
Habitats	14
Culture	15
Isolation.....	15
Sterilization.....	15

Culture	16
Genetic Engineering	16
HISTORY	17
History (Continued)	18
END USES AND APPLICATIONS	19
<i>TABLE 2 END USES/APPLICATIONS OF COMMERCIAL MICROBES</i>	20
AGRICULTURE	20
HEALTHCARE	21
MANUFACTURING	21
ENERGY	21
ENVIRONMENT	22
MARKET SIZE AND SEGMENTATION	22
MARKET SIZE AND GROWTH TRENDS	22
<i>FIGURE 1 GLOBAL MARKET TRENDS FOR MICROBIAL PRODUCTS,</i> <i>2010–2016 (\$ BILLIONS)</i>	22
<i>FIGURE 1 (CONTINUED)</i>	23
END USES	23
<i>TABLE 3 GLOBAL MARKET FOR MICROBIAL PRODUCTS BY END-</i> <i>USE SECTOR, THROUGH 2016 (\$ MILLIONS)</i>	23
<i>FIGURE 2 GLOBAL MARKET FOR MICROBES AND MICROBIAL</i> <i>PRODUCTS BY END-USE SECTOR, 2010–2016 (%)</i>	24
CHAPTER FOUR: AGRICULTURAL MARKET FOR MICROBES AND MICROBIAL PRODUCTS	25
SUMMARY	25
<i>TABLE 4 GLOBAL AGRICULTURAL MARKETS FOR PRODUCTS</i> <i>MADE FROM MICROBES BY APPLICATION TYPE, THROUGH 2016</i> <i>(\$ MILLIONS)</i>	25
<i>FIGURE 3 GLOBAL AGRICULTURAL MARKETS FOR PRODUCTS</i> <i>MADE FROM MICROBES BY APPLICATION TYPE, 2010–2016 (\$</i> <i>MILLIONS)</i>	26
<i>FIGURE 4 GLOBAL MARKET SHARES OF AGRICULTURAL</i> <i>PRODUCTS MADE FROM MICROBES BY APPLICATION, 2010–</i> <i>2016 (%)</i>	27
MICROBIAL PESTICIDES	27
TYPES OF MICROBIAL PESTICIDES	27
Bacteria	28
Bacillus Thuringiensis	28
“Milky Spore”	29
Agrobacterium Radiobacter	30
Fungi	31
Beauveria Bassiana	31
Verticillium Lecanii	31
Lagenidium Giganteum	32
Other Fungi	32

Protozoa.....	33
Nosema Locustae	33
Nematodes	33
Steinernema feltiae.....	34
Steinernema scapterisci	34
Steinernema riobraviss	34
Steinernema carpocapsae	35
Heterorhabditis bacteriophora	35
Heterorhabditis indica.....	35
Heterorhabditis megidis	35
SUPPLIERS	36
<i>TABLE 5 SUPPLIERS OF MICROBIAL PESTICIDES.....</i>	<i>36</i>
MARKETS	37
<i>FIGURE 5 GLOBAL MICROBIAL PESTICIDE MARKET BY SEGMENT,</i> <i>2010 (%).....</i>	<i>37</i>
<i>TABLE 6 PROJECTED GLOBAL SALES OF MICROBIAL PESTICIDES</i> <i>BY SEGMENT, THROUGH 2016 (\$ MILLIONS)</i>	<i>38</i>
Bacterial Biopesticides	38
<i>FIGURE 6 GLOBAL TRENDS IN ORGANICALLY FARMED AREAS,</i> <i>2005-2016 (MILLION HECTARES).....</i>	<i>39</i>
<i>TABLE 7 PROJECTED GLOBAL SALES OF BACTERIAL</i> <i>BIOPESTICIDES, THROUGH 2016 (\$ MILLIONS).....</i>	<i>39</i>
Other Biopesticides.....	40
MICROBIAL FERTILIZERS	40
TYPES OF BIOFERTILIZERS	40
Nitrogen Biofertilizers.....	40
Rhizobium	40
Azospirillum.....	41
Azotobacter.....	41
Blue-Green Algae	42
Phosphorus	42
Phosphate Solubilizing Microorganisms.....	42
Compost Treatment.....	43
Cellulolytic Fungal Culture	43
SUPPLIERS	43
<i>TABLE 8 SUPPLIERS OF BIOFERTILIZERS.....</i>	<i>43</i>
MARKETS	44
<i>TABLE 9 PROJECTED GLOBAL SALES OF MICROBIAL</i> <i>FERTILIZERS BY SEGMENT, THROUGH 2016 (\$ MILLIONS).....</i>	<i>44</i>
ANIMAL FEED ADDITIVES	45
TYPES OF MICROBIAL ANIMAL FEED	45
Bacteria.....	45
Algae.....	45
SUPPLIERS	46

<i>TABLE 10 SUPPLIERS OF MICROBIAL ANIMAL AND FISH FEED ADDITIVES</i>	46
MARKETS	46
<i>TABLE 11 PROJECTED GLOBAL SALES OF MICROBIAL FEED SUPPLEMENTS, THROUGH 2016 (\$ MILLIONS)</i>	47
CHAPTER FIVE: HEALTHCARE MARKET FOR MICROBES AND	
MICROBIAL PRODUCTS	48
SUMMARY.....	48
<i>TABLE 12 GLOBAL HEALTHCARE MARKETS FOR MICROBES AND MICROBIAL PRODUCTS, THROUGH 2016 (\$ MILLIONS)</i>	48
<i>FIGURE 7 GLOBAL MARKETS FOR MICROBES AND MICROBIAL PRODUCTS USED IN HEALTHCARE APPLICATIONS, 2010–2016 (\$ MILLIONS)</i>	49
<i>FIGURE 8 GLOBAL HEALTHCARE MARKET FOR MICROBES AND MICROBIAL PRODUCT SHARES, 2010–2016* (%)</i>	49
<i>FIGURE 8 (CONTINUED)</i>	50
MICROBIAL BIOPHARMACEUTICALS.....	50
TECHNOLOGY	50
Direct Extraction from Natural Sources	50
Recombinant DNA Technology	51
SUPPLIERS	52
<i>TABLE 13 BIOPHARMACEUTICAL SUPPLIERS</i>	52
MARKETS	52
<i>TABLE 14 GLOBAL MARKET FOR MICROBIAL BIOPHARMACEUTICALS, THROUGH 2016 (\$ MILLIONS)</i>	53
THERAPEUTICS.....	53
PROBIOTICS	53
Types of Probiotics.....	53
Recent Developments.....	54
New Coating Techniques.....	54
Suppliers	54
<i>TABLE 15 SELECTED SUPPLIERS OF THERAPEUTIC PROBIOTICS</i>	55
Markets.....	55
<i>TABLE 16 GLOBAL MARKET FOR PROBIOTICS, THROUGH 2016 (\$ MILLIONS)</i>	55
<i>TABLE 17 GLOBAL MARKET FOR PROBIOTICS BY GEOGRAPHIC REGION, THROUGH 2016 (\$ MILLIONS)</i>	56
<i>FIGURE 9 GLOBAL MARKET FOR PROBIOTICS BY GEOGRAPHIC REGION, 2010–2016 (%)</i>	56
<i>FIGURE 9 (CONTINUED)</i>	57
CHAPTER SIX: MANUFACTURING MARKET FOR MICROBES AND	
MICROBIAL PRODUCTS	58
SUMMARY.....	58

<i>TABLE 18 GLOBAL MANUFACTURING MARKETS FOR MICROBES AND MICROBIAL PRODUCTS, THROUGH 2016 (\$ MILLIONS)</i>	58
<i>FIGURE 10 GLOBAL MARKETS FOR MICROBIAL PRODUCTS USED IN MANUFACTURING APPLICATIONS, 2010–2016 (\$ MILLIONS)</i>	59
<i>FIGURE 11 GLOBAL MICROBIAL MANUFACTURING-RELATED PRODUCT MARKET SHARES, 2010–2016 (%)</i>	60
FOOD PROCESSING	60
TECHNOLOGIES	61
Baking	61
Brewing	61
Winemaking	61
Cultured Dairy Products	61
SUPPLIERS	62
<i>TABLE 19 SELECTED SUPPLIERS OF YEAST AND OTHER FOOD PROCESSING MICROBES</i>	62
MARKETS	63
<i>TABLE 20 GLOBAL MARKET FOR YEASTS USED IN FOOD PROCESSING, THROUGH 2016 (\$ MILLIONS)</i>	63
ENZYMES	63
TECHNOLOGIES	63
APPLICATIONS.....	64
SUPPLIERS	65
<i>TABLE 21 MANUFACTURERS OF INDUSTRIAL ENZYMES</i>	65
MARKETS	65
<i>TABLE 22 GLOBAL MARKET FOR MICROBIALLY PRODUCED INDUSTRIAL ENZYMES, THROUGH 2016 (\$ MILLIONS)</i>	65
COMMODITY AND SPECIALTY CHEMICALS	66
TECHNOLOGIES	66
Natural Metabolic Products as Commodity Chemicals	66
<i>TABLE 23 REPRESENTATIVE CHEMICALS PRODUCED FROM MICROBES</i>	66
Metabolically Engineered Microbes	67
SUPPLIERS	68
<i>TABLE 24 COMPANIES THAT MICROBIALLY PRODUCE BULK CHEMICALS</i>	68
MARKETS	68
<i>TABLE 25 GLOBAL MARKET FOR MICROBIALLY PRODUCED COMMODITY AND SPECIALTY CHEMICALS, THROUGH 2016 (\$ MILLIONS)</i>	69
BIOPOLYMERS.....	69
TECHNOLOGIES	69
Polyhydroxyalkanoates	69
Polylactic Acid.....	70
Hyaluronic Acid	70

Other Microbial Bioplastics.....	70
Bacterial Cellulose	70
Pullulan.....	71
Xanthan.....	71
APPLICATIONS.....	72
TABLE 26 MICROBIAL BIOPOLYMER APPLICATIONS.....	72
SUPPLIERS	72
TABLE 27 BIOPOLYMER SUPPLIERS	73
MARKETS	73
TABLE 28 GLOBAL MARKET FOR MICROBIAL BIOPOLYMERS BY TYPE OF POLYMER, THROUGH 2016 (\$ MILLIONS).....	74
CHAPTER SEVEN: ENERGY MARKET FOR MICROBES AND	
MICROBIAL PRODUCTS	75
SUMMARY.....	75
TABLE 29 GLOBAL ENERGY MARKETS FOR MICROBES AND MICROBIAL PRODUCTS, THROUGH 2016 (\$ MILLIONS).....	75
FIGURE 12 GLOBAL MARKET FOR MICROBES AND MICROBIAL PRODUCTS USED IN ENERGY APPLICATIONS, 2010–2016 (\$ MILLIONS).....	76
FIGURE 13 GLOBAL MICROBIAL ENERGY-RELATED PRODUCTS SHARES, 2010–2016* (%).....	77
BIOFUELS PRODUCTION.....	77
TECHNOLOGY.....	77
Ethanol.....	78
Sugar- and Starch-Based Ethanol	78
Cellulosic Ethanol (Bioethanol).....	78
Bacterial Bioethanol	78
Fungal Bioethanol.....	79
Algal Bioethanol.....	79
Biodiesel.....	79
Bacterial Biodiesel	80
Algal Biodiesel	80
Fungal Biodiesel	81
APPLICATIONS.....	81
SUPPLIERS	82
TABLE 30 SUPPLIERS OF ETHANOL AND BIODIESEL PRODUCTS AND TECHNOLOGIES.....	82
TABLE 30 (CONTINUED).....	83
MARKET	83
TABLE 31 VALUE OF GLOBAL BIOFUELS PRODUCED USING MICROBIAL TECHNOLOGIES, THROUGH 2016 (\$ MILLIONS).....	83
Ethanol.....	83
Starch- and Sugar-Based Ethanol	83

<i>TABLE 32 GLOBAL MICROBIAL PRODUCTION OF STARCH AND SUGAR-BASED ETHANOL, THROUGH 2016 (MILLIONS)</i>	84
Bioethanol	84
<i>TABLE 33 GLOBAL MICROBIAL BIOETHANOL PRODUCTION, THROUGH 2016</i>	85
Biodiesel.....	85
<i>TABLE 34 GLOBAL MICROBIAL BIODIESEL PRODUCTION, 2010–2016 (TONS/\$ MILLIONS)</i>	86
MICROBIAL ENHANCED OIL RECOVERY	86
TECHNOLOGY	86
Technology (Continued).....	87
APPLICATIONS.....	88
SUPPLIERS	88
<i>TABLE 35 SUPPLIERS OF MICROBIAL ENHANCED OIL RECOVERY PRODUCTS AND SERVICES</i>	88
MARKET	88
<i>TABLE 36 GLOBAL MARKET FOR MICROBIAL ENHANCED OIL RECOVERY PRODUCTS AND SERVICES, THROUGH 2016 (\$ MILLIONS)</i>	89
MICROBIAL FUEL CELLS	89
TECHNOLOGIES	90
Mediator Microbial Fuel Cells	90
Mediator-Less Microbial Fuel Cells.....	90
Microbial Electrolysis Cells.....	90
Soil-Based Microbial Fuel Cells	91
Recent Developments	91
Benthic Unattended Generators	91
Granular Activated Carbon-Based MFCs.....	91
APPLICATIONS.....	92
SUPPLIERS	93
<i>TABLE 37 SELECTED DEVELOPERS AND SUPPLIERS OF MICROBIAL FUEL CELLS</i>	93
MARKETS	93
<i>TABLE 38 GLOBAL MARKET FOR MICROBIAL FUEL CELLS, THROUGH 2016 (\$ MILLIONS)</i>	94
HYDROGEN PRODUCTION	94
TECHNOLOGIES	94
Photobiological Water Splitting	94
“Dark” Fermentation	95
Combined Fermentation.....	96
SUPPLIERS	97
<i>TABLE 39 SELECTED DEVELOPERS OF MICROBIAL HYDROGEN PRODUCTION TECHNOLOGIES</i>	97
MARKETS	97

CHAPTER EIGHT: ENVIRONMENTAL MARKET FOR MICROBES AND MICROBIAL PRODUCTS	98
SUMMARY	98
<i>TABLE 40 GLOBAL MARKETS FOR MICROBIAL PRODUCTS USED IN ENVIRONMENTAL APPLICATIONS, THROUGH 2016 (\$ MILLIONS)</i>	98
<i>FIGURE 14 GLOBAL MARKETS FOR MICROBIAL PRODUCTS USED IN ENVIRONMENTAL APPLICATIONS, 2010–2016 (\$ MILLIONS)</i>	99
<i>FIGURE 15 GLOBAL MICROBIAL ENVIRONMENTAL PRODUCT SEGMENTS, 2010–2016* (%)</i>	100
ENVIRONMENTAL MONITORING	100
TECHNOLOGIES	101
Microbial Respiration	101
Microbial Toxic Concentration	101
Biological Oxygen Demand	102
Genetically Engineered Organisms	102
APPLICATIONS.....	103
SUPPLIERS	103
<i>TABLE 41 SELECTED SUPPLIERS OF MICROBIAL ASSAYS</i>	103
MARKETS	104
<i>TABLE 42 GLOBAL SALES OF MICROBE-BASED BIOSENSORS, THROUGH 2016 (\$ MILLIONS)</i>	104
<i>TABLE 43 GLOBAL MARKET FOR MICROBE-BASED BIOSENSORS BY GEOGRAPHIC REGION, THROUGH 2016 (\$ MILLIONS)</i>	104
<i>FIGURE 16 GLOBAL MARKET FOR MICROBE-BASED BIOSENSORS BY GEOGRAPHIC REGION, 2010-2016 (%)</i>	105
BIOREMEDIATION	105
TECHNOLOGIES	106
<i>In Situ</i> Bioremediation	106
<i>In Situ</i> Bioremediation of Groundwater	106
Direct Groundwater Bioremediation.....	106
Pumping and On-Site Remediation.....	106
<i>Ex Situ</i> Bioremediation	107
Bioreactors	107
Enzyme Treatment.....	107
MARKETS	108
<i>TABLE 44 GLOBAL SALES OF MICROBIAL AND ASSOCIATED BIOREMEDIATION PRODUCTS, THROUGH 2016 (\$ MILLIONS)</i>	109
RECYCLING	109
TECHNOLOGIES	109
Plastic-Eating Bacteria	109
MARKETS	110
OIL SPILLS AND RESIDUES CLEANUP.....	110
TECHNOLOGIES	110

Oil-Eating Bacterial Preparations.....	110
Genetically Modified Oil-Degrading Microbes.....	111
APPLICATIONS.....	112
SUPPLIERS	112
<i>TABLE 45 SUPPLIERS OF OIL-DEGRADING MICROBES</i>	<i>112</i>
MARKETS	113
<i>TABLE 46 GLOBAL SALES OF OIL-DEGRADING MICROBIAL</i>	
<i>PRODUCTS, THROUGH 2016 (\$ MILLIONS).....</i>	<i>113</i>
WASTEWATER/SEWAGE TREATMENT	113
TECHNOLOGIES	113
Public Wastewater and Sewage	113
Cold Weather Bacteria	114
Bacteria for Foaming and Bulking Control	115
Phosphate Reduction and Control.....	115
Industrial Process Wastes.....	115
Food Processing Wastes.....	116
Pulp and Paper Wastewater.....	116
Other Industrial Wastewater.....	116
APPLICATIONS.....	117
SUPPLIERS	117
<i>TABLE 47 SUPPLIERS OF MICROBIAL PRODUCTS FOR</i>	
<i>WASTEWATER/SEWAGE TREATMENT</i>	<i>117</i>
<i>TABLE 47 (CONTINUED).....</i>	<i>118</i>
MARKETS	118
<i>TABLE 48 GLOBAL SALES OF MICROBIAL WASTEWATER</i>	
<i>TREATMENT PRODUCTS USED IN THE PUBLIC AND</i>	
<i>INDUSTRIAL SEGMENTS, THROUGH 2016 (\$ MILLIONS)</i>	<i>119</i>
CHAPTER NINE: REGULATION.....	120
UNITED STATES.....	120
DEPARTMENT OF AGRICULTURE	120
Animal and Plant Health Inspection Service (APHIS).....	120
ENVIRONMENTAL PROTECTION AGENCY.....	121
Federal Insecticide, Fungicide, and Rodenticide Act	
(FIFRA).....	121
Federal Food, Drug, and Cosmetics Act as Amended by	
the Food Quality Protection Act	121
Toxic Substances Control Act.....	122
Resource Conservation and Recovery Act and	
Comprehensive Environmental Response,	
Compensation, and Liability Act.....	123
FOOD AND DRUG ADMINISTRATION.....	123
Federal Food, Drug, and Cosmetic Act.....	124
STATE-LEVEL REGULATIONS	124
EUROPEAN UNION	125

DIRECTIVE 98/81/EC ON THE CONTAINED USE OF GENETICALLY MODIFIED MICROORGANISMS	125
DIRECTIVE 2001/18/EC ON THE DELIBERATE RELEASE INTO THE ENVIRONMENT OF GMOS	126
REGULATION (EC) NO. 1107/2009 ON THE PLACING OF PLANT PROTECTION PRODUCTS ON THE MARKET	126
REGULATION (EC) NO 726/2004 ON PROCEDURES FOR THE AUTHORISATION AND SUPERVISION OF MEDICINAL PRODUCTS FOR HUMAN AND VETERINARY USE.....	127
JAPAN.....	127
FOOD SANITATION LAW	127
FEED SAFETY LAW	127
OTHER COUNTRIES.....	128
BRAZIL.....	128
CHINA	128
INDIA	129
RUSSIA.....	129
AFRICAN COUNTRIES	130
APPENDIX A: COMPANY PROFILES	131
AGRICULTURAL APPLICATIONS	131
BIOPESTICIDES	131
AgraQuest, Inc.	131
Certis USA, LLC.....	131
Laverlam International.....	131
Valent BioSciences Corp.	132
BIOFERTILIZERS	132
Becker Underwood.....	132
BioOrganics.....	132
JH Biotech.....	133
Mycorrhizal Applications, Inc.	133
Novozymes Biologicals	133
Ruchi Biochemicals.....	134
ANIMAL FEED ADDITIVES	134
Earthrise Nutritionals, LLC	134
METabolic EXplorer S.A.	134
Solarium Biotechnology.....	135
Taiwan Chlorella Manufacturing Co, Ltd.	135
HEALTHCARE APPLICATIONS	136
MICROBIAL BIOPHARMACEUTICALS	136
Amgen	136
Genzyme Corp.....	136
Novo Nordisk A/S	137
PROBIOTICS	137

Ardeypharm GmbH Pharmazeutische Fabrik	137
Osel, Inc.	137
Procter & Gamble Co.....	138
Sigma-Tau Pharmaceuticals, Inc.....	138
MANUFACTURING APPLICATIONS	138
FOOD PROCESSING	138
AB Mauri.....	138
Lallemand, Inc.	139
Lesaffre et Compagnie.....	139
INDUSTRIAL ENZYMES.....	139
Genencor International, Inc.	139
Novozymes A/S	140
Specialty Enzymes and Biochemicals Co.	140
BULK CHEMICALS	141
Allilyx, Inc.....	141
Amyris, Inc.....	141
Genomatica	142
Gevo.....	142
MICROBIAL BIOPLASTICS.....	143
Cardio Polymers	143
Cereplast, Inc.....	143
DURECT Corp.	143
ENERGY APPLICATIONS	144
BIOFUELS	144
Algae Biosciences Corp.....	144
Algenol	144
Amyris, Inc.....	145
Coskata, Inc.	145
Desert Sweet Biofuels.....	146
Energy Derived	146
Iogen Corp.....	146
LS9, Inc.	147
PetroSun	147
Qteros, Inc.....	148
Sapphire Energy	148
Waltham Technologies	148
XL Renewables	149
MICROBIAL ENHANCED OIL RECOVERY.....	149
Environmental BioTechnologies, Inc.....	149
Glori Oil, Ltd.....	149
Microbes, Inc.....	150
Rawwater Engineering Co., Ltd.....	150
Synthetic Genomics ,Inc.....	150
Titan Oil Recovery	151

HYDROGEN PRODUCTION	151
Biohydrogen, Ltd.	151
NanoLogix, Inc.	152
Sapporo Breweries, Ltd.	153
Solarvest BioEnergy	153
MICROBIAL FUEL CELLS	153
Cambrian Innovation	153
Emefcy, Ltd.	154
HydroQual, Inc.	154
Hy-SyEnce.....	155
Microbial Fuel Cell Technologies, LLC.....	155
Trophos Energy.....	156
ENVIRONMENTAL APPLICATIONS	156
MICROBIAL ASSAYS	156
CheckLight Ltd.....	156
NCIMB, Ltd.	156
Strategic Diagnostics, Inc.....	157
BIOREMEDIATION	157
BIO-SYSTEMS International	157
Catalina BioSolutions.....	157
USA BioProducts Co.....	158
OIL-EATING MICROBES	158
Altogen Labs	158
Aabaco Industries	158
Bioremediation, Inc.	159
Evolugate, LLC	159
Microbial Discovery Group.....	159
Microsorb Environmental Products, Inc.....	160
Micro-TES, Inc.	160
Osprey Biotechnics	160
WASTEWATER/SEWAGE TREATMENT.....	161
Alken-Murray Corp.	161
Applied Biotech Industries.....	161
Aquafix, Inc.....	162
BioConversion Technology	162
Bio-Systems International	162
Custom Biologicals, Inc.	162
General Environmental Science	163
Natural Environmental Systems, LLC.....	163
APPENDIX B: PATENT ANALYSIS.....	164
<i>FIGURE 17 U.S. MICROBIAL PRODUCT PATENTS BY APPLICATION</i>	
<i>AREA, ISSUED TO MARCH 8, 2011 (%)</i>	164
<i>FIGURE 18 TRENDS IN U.S. MICROBIAL PRODUCT PATENTS</i>	
<i>AWARDED ANNUALLY, 2006–2010 (NUMBER OF PATENTS)</i>	165