# **Biopolymers in Packaging**

#### Section I:

#### Introduction

- A. Study purpose
- B. Key definitions
  - 1. Biopolymers
  - 2. Synthetic polymers
  - 3. Thermoplastic property
  - 4. Biodegradability and compostability
- C. Study organization
- D. Geographic regions
- E. Study methodology
- F. Conventions

#### Section II:

## **Executive Summary**

- A. Technology
  - 1. Raw materials
  - 2. Production processes
  - 3. Biopolymer processing and product performance
  - 4. End-of-life alternatives
  - Biopolymer capacity
- B. Economic and environmental analysis
  - 1. Economics
  - 2. Environmental
- C. Market trends and drivers
  - 1. Greenhouse gas reduction
  - 2. Renewable sourcing
  - 3. Biodegradability
  - 4. Recyclability
  - 5. Drop-in replacements
  - 6. Synthetic polymer prices
- D. Market projections
  - 1. Global biopolymer resin value
  - 2. Global biopolymer resin value in packaging
  - 3. Global biopolymer resin consumption
  - 4. Biopolymer volume in packaging segmented by plant source
  - 5. Biopolymer volume in packaging segmented by end-use

- 6. Biopolymer volume in packaging segmented by package type
- 7. Biopolymer consumption in packaging by geographic region

### Section III:

# **Technology**

- A. Raw materials
  - 1. Starches
  - 2. Sugars
  - 3. Plant oils
  - 4. Proteins
  - Cellulose
- B. Monomers and polymers
  - 1. Polylactic acid (PLA)
  - 2. Polyhydroxyalkanoate (PHA)
  - 3. Polyethylene terephthalate (PET)
  - 4. Polytrimethylene terephthalate (PTT)
  - 5. Polyurethane (PU)
  - 6. Polyethylene (PE)
  - 7. Polypropylene (PP)
  - 8. Polyvinyl chloride (PVC)
  - 9. Polybutalene succinate (PBS)
  - 10. Cellulose ester (CE)
  - 11. Thermoplastic starch (TPS)
- C. Converting to packaging
  - 1. Polylactic acid (PLA)
  - 2. Polyhydroxyalkanoate (PHA)
  - 3. Thermoplastic starch (TPS)
- D. End-of-life options
  - 1. Biodegradability
  - 2. Composting
  - 3. Global compostable certifications
  - 4. Industrial and home composts
  - 5. Biopolymer compostability
  - 6. Petroleum based compostable materials
  - 7. Composting alternatives
- E. Research and development
  - 1. Improve biopolymer performance
  - 2. Reduced production cost
  - 3. Improved environmental metrics
  - 4. Other
- F. Biopolymer production capacities
  - 1. Polylactic acid (PLA)

- 2. Polyhydroxyalkanoate (PHA)
- Polytrimethylene terephthalate (PTT)
- 4. Polyethylene terephthalate (PET)
- 5. Polyurethane (PU)
- 6. Polyethylene (PE)
- 7. Polypropylene (PP)
- 8. Polybutalene succinate (PBS)
- 9. Cellulose ester (CE)
- 10. Thermoplastic starch (TPS)
- 11. Polyamide (PA)
- 12. Polyvinyl chloride (PVC)

#### Section IV:

# **Economic and Environmental Impact**

- A. Economics
  - 1. Economy of scale
  - 2. Pricing strategy
  - 3. Raw material costs
- B. Environmental impact
  - 1. Life cycle analysis
  - 2. Projection
  - 3. End-of-life alternatives

#### Section V:

## **Market Trends/Projections**

- A. Global biopolymer market
  - 1. Cellulose esters (CE)
  - 2. Polyamide (PA)
  - 3. Polybutalene succinate (PBS)
  - 4. Polyethylene (PE)
  - 5. Polyethylene terephthalate (PET)
  - 6. Polyhydroxyalkonates (PHA)
  - 7. Polylactic acid (PLA)
  - 8. Polypropylene (PP)
  - 9. Polytrimethylene terephthalate (PTT)
  - 10. Polyurethane (PU)
  - 11. Polyvinyl chloride (PVC)
  - 12. Thermoplastic starch (TPS)
  - 13. Other
- B. Biopolymers in packaging market drivers and trends
  - 1. Renewable sourcing

- 2. Biodegradability
- 3. Compostable certifications
- 4. Legislation
- 5. Environmental strategy
- 6. End-of-life alternatives
- 7. Manufacturing cost
- 8. Drop-in replacements
- 9. Consumer preference
- 10. Land use competition
- 11. Genetic research
- 12. Joint ventures
- 13. Environmental performance
- 14. Controlled waste markets
- 15. Market specific drivers
- C. Biopolymers in the packaging industry
- D. Cellulose ester (CE)
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Projection
  - 3. Suppliers
  - 4. Market value
  - 5. Cellulose ester volume segmented by end-use category
  - 6. Cellulose ester volume segmented by package type
  - 7. Cellulose ester volume segmented by geographic region
- E. Polyamides
- F. Polybutalene succinate (PBS)
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Projection
  - 3. Suppliers
  - 4. Market value
  - 5. Bio-PBS volume segmented by end-use category
  - Bio-PBS volume in packaging by package type
  - 7. Bio-PBS volume by geographic region
- G. Polyethylene (PE)
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Projection
  - 3. Supplier sales
  - 4. Market value
  - 5. Bio-PE volume segmented by end-use category
  - 6. Bio-PE volume segmented by package type
  - 7. Bio-PE volume by geographic region
- H. Polyethylene terephthalate (PET)
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Projection

- 3. Supplier sales
- 4. Market value
- 5. Bio-PET packaging volume segmented by end-use
- 6. Bio-PET packaging volume segmented by package type
- 7. Bio-PET volume segmented by geographic region
- I. Polyhydroxyalkonates (PHA)
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Projection
  - 3. Supplier sales
  - 4. Market value
  - 5. PHA volume segmented by end-use
  - 6. PHA volume segmented by package type
  - 7. PHA volume by geographic region
- J. Polylactic acid (PLA)
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Projection
  - 3. Supplier sales
  - 4. Market value
  - 5. PLA packaging volume segmented by end-use
  - 6. PLA volume segmented by package type
  - 7. PLA volume by geographic region
- K. Polypropylene (PP)
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Projection
  - 3. Supplier sales
  - 4. Market value
  - 5. Bio-PP packaging volume segmented by end-use
  - 6. Bio-PP volume segmented by package type
  - 7. Bio-PP volume by geographic region
- L. Polytrimethylene terephthalate (PTT)
- M. Thermoplastic polyurethane (TPU)
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Projection
  - 3. Supplier sales
  - 4. Market value
  - 5. Bio-TPU packaging volume segmented by end-use
  - 6. Bio-TPU volume segmented by package type
  - 7. Bio-TPU volume by geographic region
- N. Polyvinyl chloride (PVC)
- O. Thermoplastic starch (TPS)
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Projection

- 3. Supplier sales
- 4. Market value
- 5. TPS packaging volume segmented by end-use
- 6. TPS volume segmented by package type
- 7. TPS volume by geographic region

#### P. Other

- 1. Separate sales volume in packaging from total sales volume
- 2. Projections
- 3. Supplier sales
- 4. Market value
- 5. Other biopolymer packaging volume segmented by end-use
- 6. Other biopolymer volume segmented by package type
- 7. Other biopolymer volume by geographic region

#### Q. Summary

- 1. Packaging volume summary
- 2. Biopolymer sales summary segmented by supplier
- 3. Market value summary
- R. Biopolymer consumption in packaging by plant source
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Corn
  - 3. Other starch plants
  - 4. Sugar cane
  - 5. Other sugar plants
  - 6. Soybean
  - 7. Other oil based plants
  - 8. Other
- S. Biopolymer packaging volume segmented by end-use
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Retail food
  - 3. Retail non-food
  - 4. Foodservice
  - 5. Other
- T. Biopolymer volume segmented by package type
  - 1. Biopolymer volume by package type
  - 2. Bags and pouches
  - 3. Bottles, jars, and tubes
  - 4. Carrier and waste bags
  - 5. Cups, cartons, corrugated
  - Flexible film and lidstock
  - 7. Pots
  - 8. Transportation packaging
  - 9. Trays and bowls
  - 10. Other

- U. Biopolymer volume in packaging by geographic region
  - 1. Separate sales volume in packaging from total sales volume
  - 2. Asia
  - 3. Europe
  - 4. North America
  - 5. ROW

Section VI:

**Producer Profiles** 

**Section VII:** 

Glossary