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Objective:

In recent years, research and development of biodegradable plastics has rapidly grown. Their advantages over other traditional plastic materials are their high tensile strength to weight ratio, ability to be molded into various states, potential resistance to environmental conditions, recyclability, and their potential to biodegrade. Our object is to formulate Polyactic Acid (PLA) using a conventional industrial method.

SWOT Analysis

Strengths
- Reduce flavor scraping
- Stretch ratio is 9:1 to 16:1
- Can be run on PET orientation equipment without any hardware modification
- Non-toxic product
- Sustainability, Environmentally friendly
- Can be done in factories on a large scale
- Recyclable, Biodegradable
- Production only uses about 0.15% of the total corn for grain production in the USA

Weakness
- To decompose requires a temperature of 284 degrees.
- Very few consumers have access to the sort of composting facilities that can recycle PLA
- High density, High polarity, difficult to adhere without tie layers to non-polar PE and PP in multilayer structures
- Cycle times for injection molding PLA performs are longer than for PET

Opportunities
- More green technology, reducing harmful environmental effects
- If not recycled, can decomposed

Threats
- High demand for corn
- Competitor plastics are cheaper PET $.70/lb vs PLA $1/lb

Market Analysis

High growth to over 6 billion USD in 2015 and 12.5 billion by 2025

Less than 3 percent of all waste plastic worldwide gets recycled, compared with 30 percent of paper, 35 percent for metals and 18 percent of glass.

Currently cover 10-15 percent of the total plastics market

By 2020, the market share is projected to increase 25-30 percent.

Current selling price of PLA $1/lb.

Process

1. Fermentation

\[ C_6H_{12}O_6 \rightarrow \]

2. Lactide Formation

3. Polymerization

Catalyst Used: Tin Octanoate

Polymerization

Design Scale Up

Process Flow Diagram

C6H12O6 →

Fermentation

References:


Sponsor: ABE Dept., Purdue University

Budget

Equipment Costs (in Millions)

- Compressors: 3.86
- Exchangers: 80.83
- Pumps: 1.34
- Reactors: 97.3
- Tanks: 1.51
- Towers: 2.47
- Vessels: 77.3
- Total: 265

Utility Costs (in Millions)

- Exchangers: 68.22
- Pumps: 0.23
- Reactors: 38.03
- Vessels: 19.4
- Type: 13.95
- Cooling Water: 0.23
- Electricity: 82.88
- High Pressure Steam: 1.22
- Refrigeration: 27.6
- Total: 126

Production

Making 300 Million Pounds Per Year

Profit: 300

Future Opportunities for Price Reduction
- Using wind energy
- Using solar energy
- Optimization of process
- Increasing demand (projected increase up to 30%)

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