Biopolymers

October 2, 2008

Outline

- Jamplast Fast Facts
- Environmental Influences
- Biopolymers
- Natureworks PLA
- Cereplast Biopolymers
- JER Envirotech
- Oxodegradables
- What is on the Horizon
- Questions

Jamplast, Inc.

Distributor of Quality Polymers, Specialty Compounds and Concentrates

Supplying **Value** – *Delivering* **Solutions**

- Founded in 1994
- North America Market
- Diverse Product Offering
- 30 Million lbs of polymer sold last year
- 250 Active Accounts
- 10% of our business is Biopolymers (Natureworks, Cereplast, JER Envirotech & Additives)
- Prime, Custom Compounds, Widespec, Repro, Regrind, Scrap
- Cultural is customer relationship driven
- 75,000 Distribution Center in Indiana
  - Warehousing, Packaging, Bulk Transfer, Blending, Grinding
- Utilize 24 Contract Distribution Facilities throughout North America

Energy" Our Challenge for the 21st Century"

21st Century Influencing Factors

- Energy from Petroleum comes from a finite resource
  - Demand for oil based goods are rising for every 4 barrels used, only 1 new barrel discovered
  - Supplies to run short within the next 20 to 100 years
  - Petrochemical based plastics consume about 183 million barrels of oil annually
- Volatile Political Factors
- Global Warming our Carbon Footprint
  - Fear of the implications of Greenhouse gases
- Consumers want Environmentally Friendly Products
  - The Green Movement
- Retailers and Brand Owners Pushing to meet customers expectations

WAL★MART Save money. Live better.™

WHOLE FOODS MARKET

Biopolymers

Biopolymers Source

Sugars
- PLA, PHA

Starches
- Binders, Alloys

Plant Oils
- Castor Oil

Standards

ASTM Specifications

ASTM D6400
- *"Specification for Compostable Plastics"*
- For films and solid plastic products
- Demonstrates "biodegradability" under optimal aerobic conditions
- Revalidated in 2004

ASTM D6868
- *"Specification for Biodegradable Plastic used on Paper and other Compostable Substrates"*
- For packaging and food service items, made of plastic coated paper, board & other fibers

ASTM D6954
- Oxodegradables – Oxygen degradation standard

BPI Achievements

Certification
- 51 Products and growing
- Recognized in composting programs from SF to PEI
- Used in Brazil and Australia
- Require labeling consistent with FTC directions

Supported labeling legislation in California
- First state to recognize ASTM Specifications for labeling.
  - Bags in 2004
  - Foodservice containers & Cutlery in 2007
- Working with other states

Standards

BPI Mission & Membership

Not for profit association, started in 1999
Promote production, use and recovery biodegradable materials & organics recovery via composting
Support use of renewable feedstocks
52 active members
- Wealth of experience in application development & organics diversion

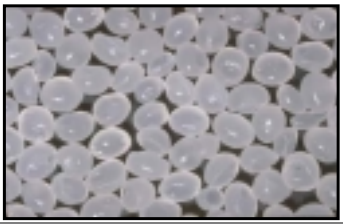
Affiliations with like minded organizations and labs in NA, Europe, Asia, and Australia

Rapid Volume Growth-Early Product Life Cycle

- Natureworks PLA – 10yr projections = 1 Billion lbs
- Cereplast – 500 Million lbs
- Metabolix – 120 Million lbs

NatureWorks PLA Biopolymer

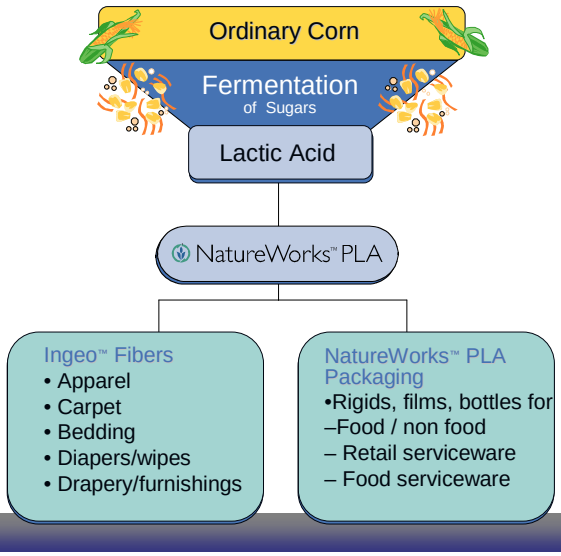
- 50/50 Joint Venture Between Cargill and Tejin Petrochemicals
- Corporate and Tech Services Lab based in Minnetonka
- 300 Million Production Plan based in Blair NE
- PLA technology has been around for a long time
- Cargill focused on the technology in the early 90's
- Brought Dow in for marketing and process technology 1997
- NW Geographical focus is in the North America, Europe and Asia



What is NatureWorks Polymer?

- A polymer material suitable for consumer packaging, fibers and durables
- A polymer material made from lactic acid
- Lactic acid is made from fermentable sugars
- Sugars are made from CO_2 via Photosynthesis

What PLA is….Polylactic acid polymer



JAMPLAST INC.

Service ware

Bottles

Rigid Containers

Flexible, Films & Coatings

Consumer Goods

Nonwovens

Home & Office Textile

Apparel

JAMPLAST INC.

Foundation of messaging

Environmental:
Reduce packaging footprint
- 68% less fossil energy use
- 80-90% less greenhouse gases
- 50% less water consumed
- Demonstrates environmental leadership by designing single use disposables from a renewable resource

Performance:
- Fit for use in most traditional produce applications
- Form and stiffness
- UV Stable
- Non-allergenic
- Printability
- Ability to reduce density

Emotional:
Appeal to consumer
- All natural origins
- Annually renewable, not oil
- Pure innovation. New and green

Can enhance brand image
- Makes them feel good about decision
- Supports the values and beliefs of the consumer
- Enables consumer to speak with their dollars

Value Proposition Aspects

Annually Renewable Resource Based

- Most often the value for commercial successes
- How much renewable resource based content?
  - 95% is showing traction broadly
  - <90% is showing traction in parts of Asia

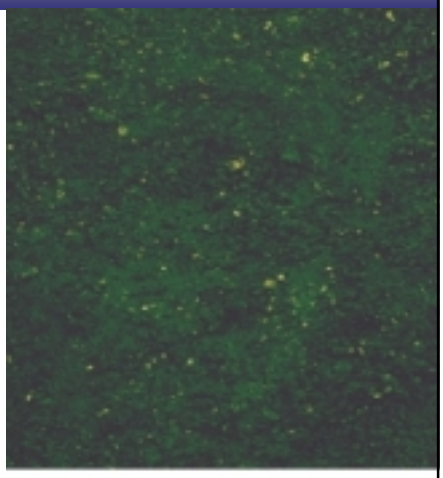
Low green-house gas emissions

Compostable

- Regionally important consideration
  - Asia
  - The Netherlands, Germany
  - San Francisco leading California
- Interesting potential in food service ware, accompanying food waste to the composter

How PLA is unmade

- Requires the specific conditions of high temperature and moisture found in municipal compost systems
- Professionally controlled conditions allow for products to be designed for normal use



Day 47

PLA 2000D* Properties vs. PS, PETand PP

	PLA	GPPS	PET	coPP
Break Tensile, psi	7700	6600	8500	5200
Elongation at Break, %	4.1	1.4	5.5	350
Tensile Modulus, psi	500,000	440,000	500,000	190,000
Izod Impact, ft-lb/in	0.3	0.4	0.5	0.9
Tg, Deg. C	60	102	74	-20
Specific Gravity	1.25	1.05	1.35	0.90

*PLA 2000D is a high Mw, low residual lactide PLA resin for extrusion/thermoformed applications

Properties measured on 125 mil thick injection molded tensile bars

Cereplast Overview

Cereplast, Inc. (**CERE**: "from cereal"; **PLAST**: "from plastic") is a leading specialty manufacturer of proprietary bio-resins

Our philosophy meets Sustainability with its three (3) core components

- Environmental
- Economic
- Social

Cereplast has developed two distinct families of bio-resins

- **Cereplast Compostables™**
- **Cereplast Hybrid Resins™**

HISTORY

Founded in 2001 by Frederic Scheer

- 15 years prior experience in bio-resins: Novamont, Cargill-Dow
- Founder & Chairman Emeritus of Biodegradable Products Institute (BPI)

2001 – 2005: R&D Focus

- Develop resin formulation and process
- Outsource compounding
- Test markets in food service to validate feasibility and demand with Coca-Cola, Whole Foods Market, Wild Oats, and Olympic Games

IPO in November 2005 – Ticker (OTC BB): CERP

2005 – 2007: Resin Commercialization Focus

- Develop in-house manufacturing facilities
- Negotiate contracts with customers
- Begin selling resin on a commercial scale

Ceroplastic Compostables™

Cereplast Compostables™ resins are renewable, ecologically sound substitutes for petroleum-based plastic products, replacing nearly 100% of the petroleum-based products used in traditional plastics.

Cereplast Compostables™ are starch-based, made from corn, wheat, tapioca and potato starches that primarily come from the Midwest (versus oil from the Middle East).

All Cereplast Compostables™ are certified as biodegradable and compostable in the United States and Europe, meeting BPI (Biodegradable Products Institute) standards for compostability (ASTM 6400 D99 and ASTM 6868), and European Bioplastics standards (EN 13432).

Cereplast Compostables™

Commercial Resin	Applications
EXTRUSION-THERMOFORMING (3)	Plates, containers, packaging
INJECTION MOLDING (4)	Utensils, cups, containers
EXTRUSION BLOW MOLDING (1)	Bottles, containers
BLOWN FILM (1) bags, can liners	Food packaging wrap, Straws
PROFILE EXTRUSION (1)	
EXTRUSION COATING (3)	Paper coatings




Cereplast Compostables™ Characteristics

Superior Performance Characteristics

Top quality performance, including rigidity
Higher thermo-resistance than PLA
Greater strength than PLA
Not brittle

Environmental Characteristics

- Biodegradable & Compostable
  - ASTM 6400- BPI compliant
- Bio-based Content
  - ASTM 6866-04a - +90% (Radio-Carbon process)
- GMO Analysis
  - GENESCAN -PCRQ: NEGATIVE
- FDA Compliant
  - KELLER & HECKMAN Compliance Opinion
- EN 13432 European Standard
  - European-Bioplastics organization

Cereplast Hybrid Resins™

- High bio-based content
- Proprietary compounds incorporating traditional petroleum based resins with Cereplast proprietary basket of starches
- Targeted towards durable good applications

What are Cereplast Hybrid Resins™?

Bio-based plastic resins containing more than 50% starch from natural, renewable, and sustainable resources, such as:

- Corn
- Tapioca
- Wheat
- Potato

What is Biopropylene™?

- Biopropylene™ is a patented/proprietary Cereplast Hybrid Resin™
- Contains polypropylene, starch, a compatibilizer for starch and PP, and a blend of selective plasticizers to facilitate starch processing
- Made via reactive twin-screw extrusion process
- Two-phase morphology: PP is the continuous phase with a dispersed starch phase.

Cereplast's Biopropylene™ Physical Properties
CP-Bio-PP-50 Vs. Homopolymer PP

Physical Property	ASTM Method	Units	CP-Bio-PP-50	Homo PP
Tensile Strength @ break	D 638	psi	**2,410**	1,650
Elongation @ break	D 638	%	9.5	130.1
Young's Modulus	D 638	psi	**299,280**	119,480
Flexural Modulus	D 790	psi	**139,940**	101,718
Notched Izod Impact (RT)	D 256	lb-ft/in	0.57	1.81
HDT @ 264 psi	D 648	^{0}F	**142.3**	129.9
MFI 190^{0}C @2.16 Kg	D 1238	g/10 min	3-6	3
Density	Calculated	g/cc	1.04	0.9

JER Envirotech

- 1997 – Founded
  - Co-developed thermoplastic biocomposite formulations with Canada's National Research Council (NRC)
  - JER holds exclusive global license
  - Headquartered North America
- 2004 - Public corporation (TSX-V: JER)
- 2005 - Initial pilot production facility
- 2006 - Commercialization initiated
- Total Capital Invested To Date:
  - Approx $18M

JER Biocomposite Advantages

New properties and performance capabilities:

Environmentally-preferable to pure plastic or wood

- Unprecedented uniformity and structural integrity
- Superior to pure plastic, pure wood or other composites
- Flexible enough to be extruded, injection molded or thermoformed

Chemically inert

Final products are stronger and cost-effective

Less susceptible to petroleum prices

Resists water, frost, fire, fungus and pests

Coloring Versatility

- Dyes introduced during production painted or treated with unique finishes (ie: faux wood finishes, etc)

JER Envirotech

Uses:

- **Injection-molded, extruded or thermoformed**
- **Direct replacement to plastic for injection-molded parts**
- **Both indoor and outdoor**
- **applications**
- **Unlimited applications as a raw material**

PHA Flexibility

- Chemistry to produce PHA is microbial bio-factories that allow flexibility to produce
  - Homopolymers, Copolymers and Terpolymers that vary in proportion of monomers
  - Range of physicals can vary from Rigid Thermoplastic to Elastomeric
  - PHA can also be used in paper coatings, waxes, adhesives and binders

Metabolix PHA

- Metabolix was founded in 1992 as a Biotechnology Company
- 2006 Metabolix and Archer Daniels Midland (ADM) Formed Telles 50-50 JV
- 110 Million lb Plant Coming on Stream later this year – Clinton IA
- Mirel* bioplastics Trade named

Ecoflex

Ecoflex® Biodegradable Plastic

Ecoflex® is BASF's completely biodegradable and compostable plastic.
It is ideal for trash bags or disposable packaging as it decomposes in compost within a few weeks or in soil without leaving any residues. Ecoflex is designed to process like Low Density Polyethylene into films, bags or coatings. It does not require drying and is shelf and warehouse stable for one year.

Global Certification

Ecoflex® biodegradable plastic is certified by the Biodegradable Products Institute in North American via ASTM D6400, and has biodegradable certifications with the European Standard EN 13432 on compostability as well as the Japanese standard GreenPla. Certification is very important for biodegradable materials, as they ensure materials will swiftly and safely biodegrade in the environment.

Oxo – Biodegradable's

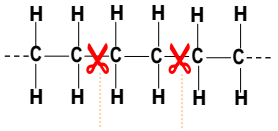
- Transition Metal Salts with Oxygen Stabilizers used as an additive
- Technology has been around for over 15 years – developed in England
- ASTM D6954-04 – guideline for Oxidative and Thermal biodegradation
- Commercial Producers
  - Wells Plastics
  - Symphony
  - Environmental Products Ltd.
  - Willow Ridge Plastics

Oxo-Degradable's

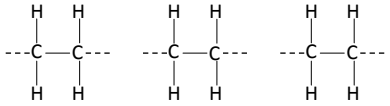
- Compatible with many Consumable Plastic Resins
- Used with virgin & recycled polymers
- Compatible with PP,PE,PS & PET consumable plastics
- Programmable for 6 MONTHS TO 5 YEARS SHELF LIFE
- No compromises in functionality: strength, clarity, barrier properties, sealability, print
- Comprehensively tested and proven

The Science behind the Oxo-degradation process

long chains / flexible material



oxidation



short chains / brittle

oxidation

microbial degradation

degradation is affected by Oxygen, heat, UV light and stress

CO_2 + H_2O + biomass

‘Fit for Purpose’ Fragmentation

- When stabilizers within the oxo-degradable plastics have been exhausted, the plastic will begin to fragment. “fit for purpose”
- Once the fragmentation process is initiated, The degradation process is extremely rapid and the polyolefin is no long classified as a plastic.
- The process degrades the polymer to H_2O, CO_2, and biomass

“What is on the horizon for biopolymers”

Almost every Major Petrochemical Producer is working on some type of “Biopolymer” Development

Brief Summary by Producer of development focus

Dow Chemical – JV in Brazil using Ethanol to make Ethylene for LLDPE

DSM $ 300 million earmarked for alternative Sustainable Chemistry current project working on low temperature catalysts to polymerize carbon monoxide and CO_2

Meridian – PHA technology purchased from P&G 30 million lb plant on line by 2009

Dupont
- Sorona PPT technology
- Biosourced PDO (1,2 propane diol) (feedstock for copolyester and nylon)
- JV with Plantic in Australia cornstarch technology to make cosmetic and food packaging

Purac – Lactic Acid technology to make better PLA’s

Total Petrochemicals – Lactic Acid JV with Galactic to make a better PLA

Novamont –
- Mater-Bi Starch resins – Nano-Starch
- Origo-Bi a clear biodegradable polyester

Musashino Chemical – JV with Tejin Chemical to develop heat resistant stereo –complex PLA