Presented at
From the Table to the Farm: Options for Diverting Food from Landfills
Atlanta, May 6, 2008

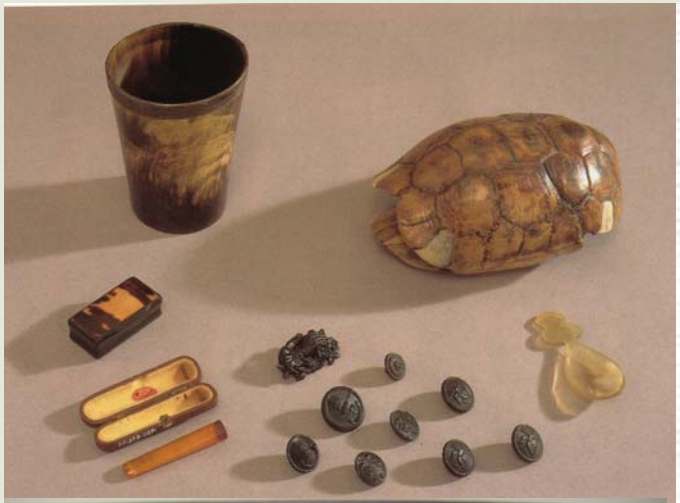
Biobased Packaging 101

By Brenda Platt
Institute for Local Self-Reliance
www.ilsr.org

Outline

- First Bioplastics
- Benefits of bioplastics
- Sample products
- Biodegradable vs. degradable
- Biobased vs. biodegradable
- “Sustainability” challenges for bioplastics
- Labeling
- Early adopters using and composting bioproducts
- Recommendations

Horn, Tortoiseshell, Amber



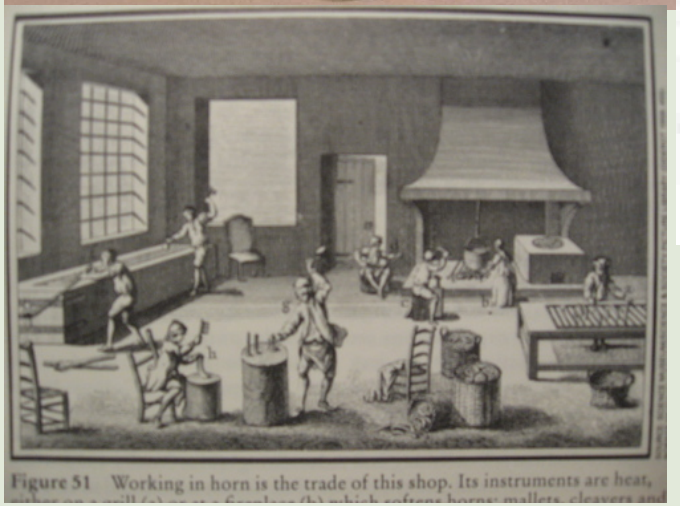


Figure 51 Working in horn is the trade of this shop. Its instruments are heat,

Source: Susan Mossman, ed., Early Plastics: Perspectives 1850-1950 (Science Museum, London: 1997), Plate 2 & Fig 51; www.horners.org.uk.

Gutta Percha

Source: Susan Mossman, ed., Early Plastics: Perspectives 1850-1950 (Science Museum, London: 1997), Plate 3; and Plastics Historical Society (London) http://www.plastiquarian.com/gutta.htm.

Shellac: Lac Beetle Secretion

Union Cases (1854-1870s)

Mirrors

Seals

Gramophone 78 rpms (1897-1940s)

Source: Susan Mossman, ed., Early Plastics: Perspectives 1850-1950 (Science Museum, London: 1997), Plate 4.

Cellulose Nitrate: Celluloid (derived from cotton)

Source: Plastics Historical Society (London) www.plastiquarian.com/xylonite.htm; and Susan Mossman, ed., Early Plastics: Perspectives 1850-1950 (Science Museum, London: 1997), Plate 9.

John Hyatt's Billiard Ball

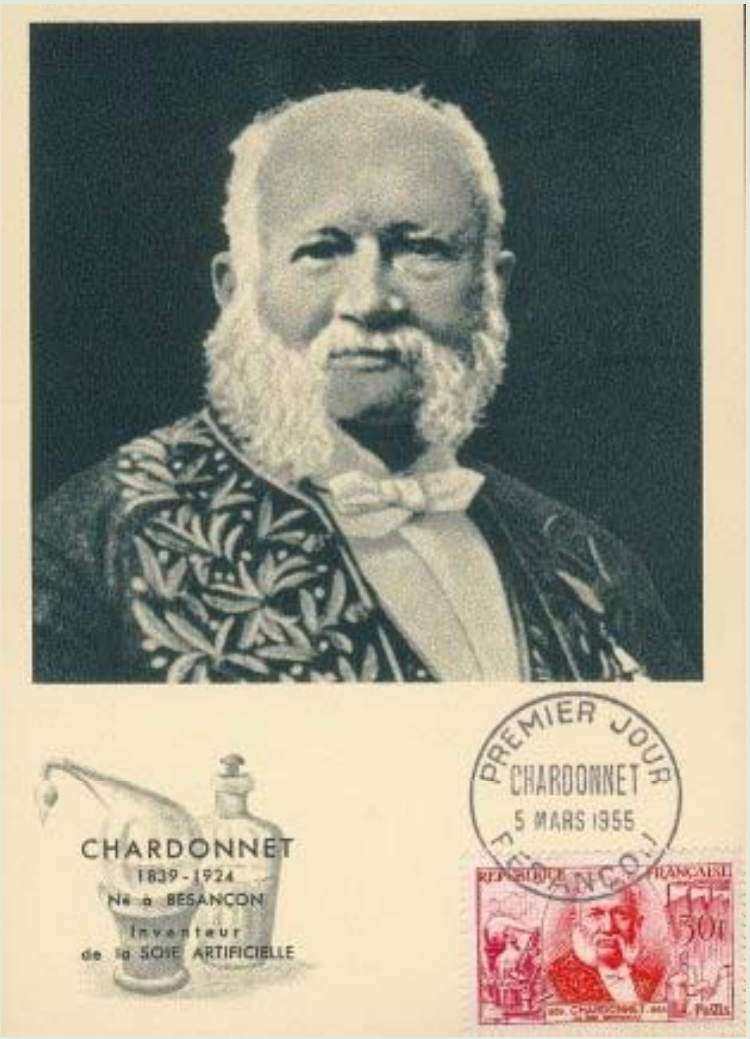
"Made in 1868 of Cellulose Nitrate, Celluloid. The Year John Wesley Hyatt Discovered This First Plastics Resin."

Casein

Made from milk curds or skimmed milk (protein based)

Source: Plastics Historical Society (London)
http://www.plastiquarian.com/casein1.htm

Chardonnet Silk



COUNT CHARDONNET'S SILK

IMMENSE VALUE CLAIMED FOR THE NEW INVENTION.

GOODS MADE OF THE QUEER FIBRE DISTINGUISHED FROM REAL SILK ONLY BY CERTAIN SUPERIORITIES.

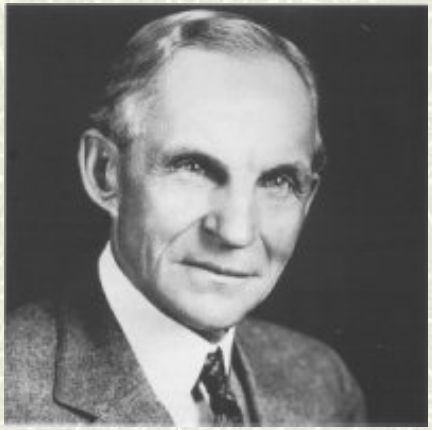
Some of the people who have been investigating the wonderful discovery of artificial silk by Count Chardonnet, a brief description of which was published in THE TIMES of Friday last, are inclined to accord it a much greater importance than was apparent upon first impression. Scientific and trade journals, as well as some of the silk manufacturers, felt that it was not likely to attain to much commercial importance because it was so like in its combustible properties to gun cotton, a form through which it passes in the process of manufacture. But since these views were published a process of "denitration" has been discovered which, without materially increasing the cost of the finished fibre, renders it quite as incombustible as pure silk or cotton.

That the discovery is accepted as something far above the ordinary accomplishments of the chemical world in the land of the discoverer is testified by the fact that the only grand medal of honor which was conferred at the Paris Exposition was given to Count Chardonnet for his

Nov. 21, 1889

Source: Plastics Historical Society (London) www.plastiquarian.com; www.museum-of-hosiery.org; and New York Times archives.

Henry Ford's Biological Car (1941)

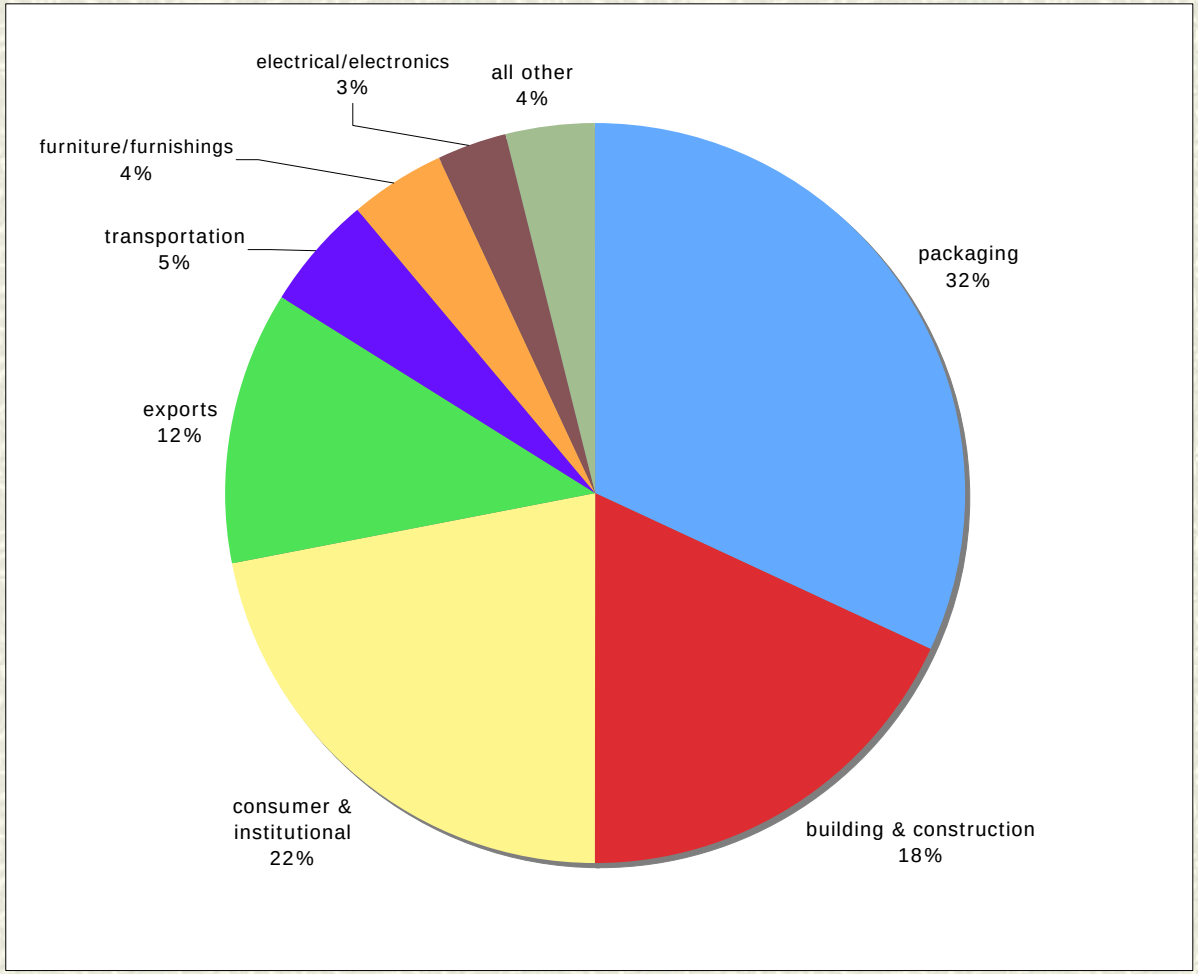


- body: variety of plant fibers
- dashboard, wheel, seat covers: soy protein
- tank: filled with corn-derived ethanol


JOSEPH E. LEVINE
MIKE NICHOLS
LAWRENCE TURMAN
This is Benjamin.
He's a little worried about his future.
THE GRADUATE
ANNE BANCROFT _ DUSTIN HOFFMAN · KATHARINE ROSS
CALDER WILLINGHAM _ BUCK HENRY PAUL SIMON
SIMON _ GARFUNKEL LAWRENCE TURMAN
MIKE NICHOLS TECHNICOLOR® PANAVISION®


LIBERTY FILMS
Frank CAPRA'S
IT'S A WONDERFUL LIFE
James STEWART
and Donna REED
FRANK CAPRA

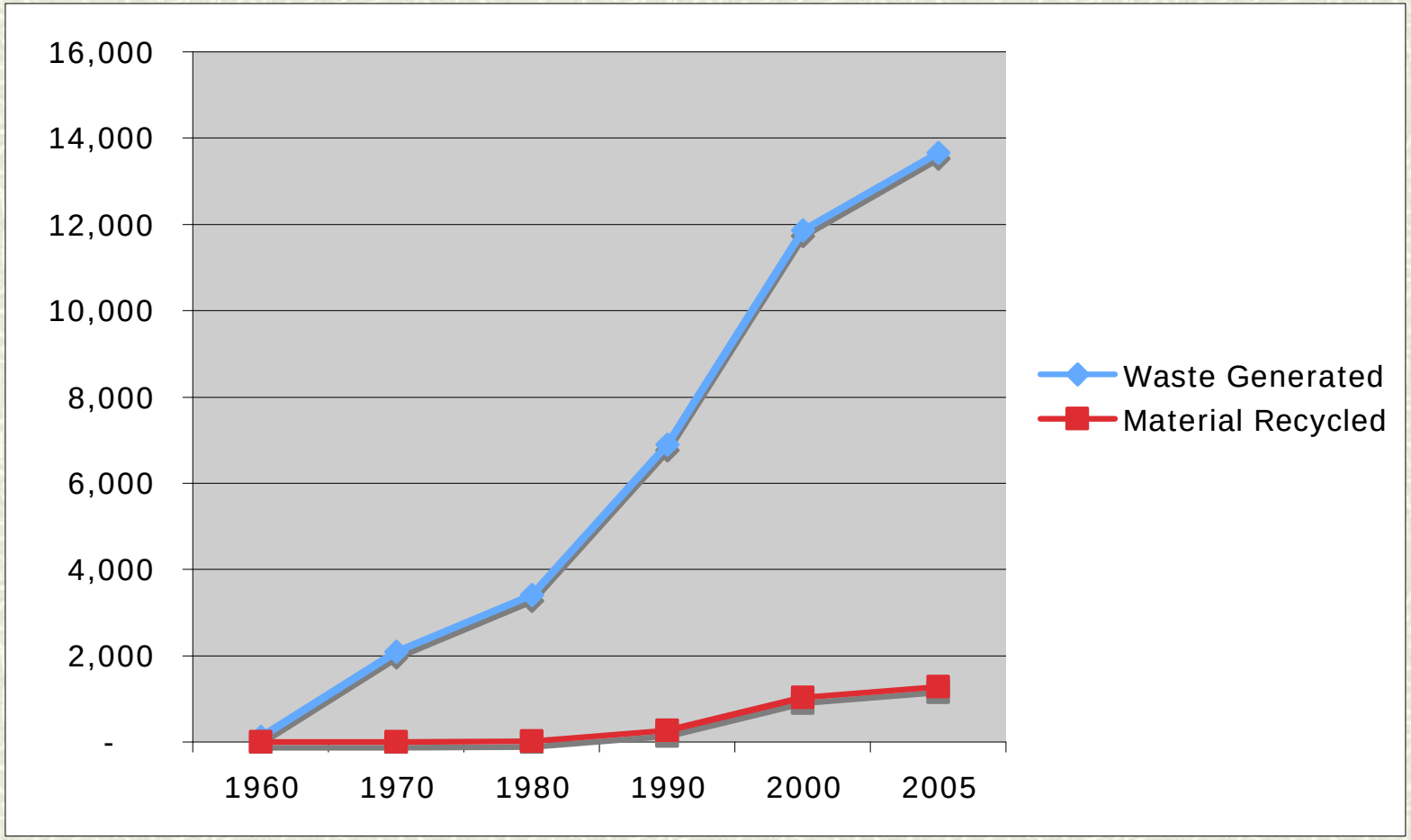
US Resin Sales by Market, 2006



Source: American Chemistry Council Plastics Industry Producers Statistics Group, as compiled by Veris Consulting, LLC.

Plastic Packaging Discarded

Thousands of tons



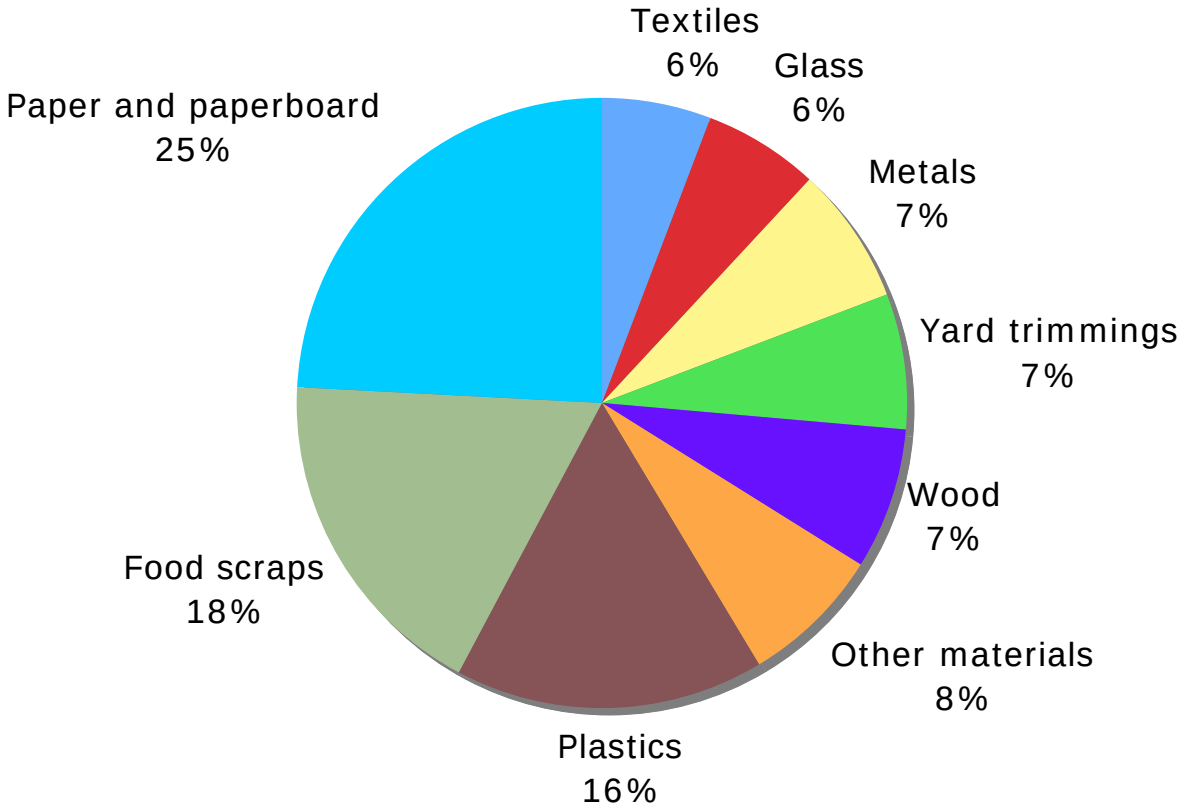
Source: US EPA, 2005 data (http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm)

Benefits of Bioplastics

- Can replace many harmful conventional plastics
- Can be fully biodegradable (capable of being utilized by living matter)
- Can be made from a variety of renewable resources
- Can be composted locally into a soil amendment
- Can help capture food discards and thus reduce methane from landfills
- Can contribute to healthier rural economies
- Can complement zero waste goals

169.5 million tons per year in 2006

Municipal waste disposed



Biodegradable Product Cos.

Novamont, Mater-Bi™	Variety of products from modified starch such as corn
Cereplast	Manufactures biodegradable resins for injection molding from wheat, corn, and potato starch
NatureWorks	Produces PLA from corn starch
Biosphere Industries	Rigid packaging primarily from starches such as tapioca and potatoes and a small amount of grass fiber
Innovia	Film packaging from wood-pulp derived cellulose
Earthcycle Packaging	Packaging from palm fiber
BASF, Eco-Flex™	Plastic film from aliphatic aromatic copolyester

Source: www.bpiworld.org and company Web sites

NatureWorks PLA Packaging Applications

Serviceware

Bottles

Rigid Containers

Flexible & Films

Sample Products

Greenware cups (PLA)

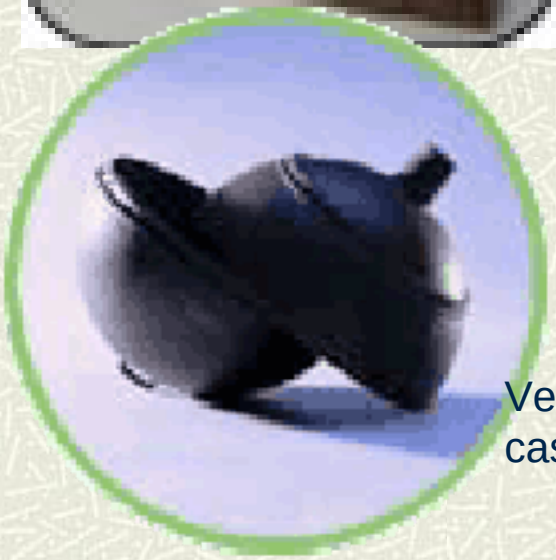
Biosphere Industries

BioBag (Mater-Bi)

Earthcycle

Other Bioplastic Products

CD case made from hemp plastics



Vegemat fireworks case

More Bioplastic Products

Plantic confectionery trays

Innovia film packaging

Not all bioproducts created equal

- Biobased content
- Material feedstock type
- Feedstock location
- Biodegradability
  - Commercial compost sites
  - Home composting
  - Marine environment
  - Anaerobic digestion
- Additives and blends
- Recyclability
- Performance
- Products

Belgian Certification/Labeling Program

- **OK compost**: compostable in a professional composting plant without affecting the quality of the compost.
- **OK compost Home**: compostable in a compost bin or heap. If the composting process runs correctly the material will break down within 16 weeks.
- **OK biodegradable**: biodegradable in a particular natural environment (e.g., soil, air, salt water, fresh water). It breaks down into carbon dioxide, mineral salts and biomass.

Biobased Products: The Good News

- Variety of biobased resins available
- Performance improving
- Experience and R&D growing
- Growth expected
- Programs such as the federal biobased procurement will open up new markets
- Standards in place
- Price competitiveness improving
- Demand increasing

Biodegradable vs. Biobased

Biobased Product: "A product determined by USDA to be a commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, or marine materials) or forestry materials."

Source: Federal Register, January 1, 2005.

ASTM Standards

- D 6866 – defines and quantifies biobased content
- D 7075 – evaluates and reports on environmental performance of biobased products using LCA methodology
- D 6400 – biodegradation specifications
- D 5338 – test method for biodegradation

Degradable Vs. Biodegradable

Degradable

- May be invisible to naked eye
- Fragment into smaller pieces
- No data to document biodegradability within one growing season
- Migrate into water table
- Not completely assimilated by microbial populations in a short time period

Biodegradable

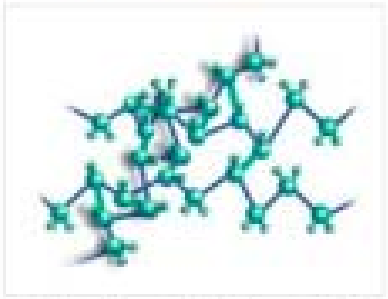
- Completely assimilated into food and energy source by microbial populations in a short time period
- Meet ASTM D6400 spec

Compostable Bags (mostly fossil-fuel based)

Nonbiodegradable bioplastics coming

MONDAY, JUNE 25, 2007

The bioeconomy at work: Braskem develops polyethylene from sugarcane ethanol



Braskem, the leading company in Latin America's thermoplastic resins segment and Brazil's second largest privately owned industrial company, announces it has produced the first internationally certified polyethylene made from sugarcane ethanol. Given the fact that petroleum-derived polyethylene is so widely used in our daily lives, this may be called an important breakthrough for the bioeconomy. 60 million tonnes per year of the polymer end up in hundreds of plastic products. We now have a bio-based, renewable alternative with a low carbon footprint.

Brazil has been ahead of most other countries in the development of a genuine bioeconomy in which oil-based products are replaced by renewable carbohydrate and vegetable oil based substitutes. Government initiative (with a fund of almost US$5 billion for the bioeconomy) as well as an innovative private sector that is being supported by a growing number of

Dow and Crystalsev Announce Plans to Make Polyethylene from Sugar Cane in Brazil

Renewable Resource Used in Production Process Will Significantly Re Footprint

(CSRwire) SAO PAULO, BRAZIL - July 24, 2007- The Dow Chemical Company, the world's large polyethylene, and Crystalsev, one of Brazil's largest ethanol players have announced plans for a wo manufacture polyethylene from sugar cane.

Under the terms of a memorandum of understanding agreed by the two companies, Dow and Crysta venture in Brazil to design and build the first integrated facility of its scale in the world. It is expecte in 2011 and will have a capacity of 350,000 metric tons. The venture will combine Dow's leading po with Crystalsev's know-how and experience in ethanol to meet the needs of Dow's customers in Bra be international interest.

"We are excited to partner with a great company like Crystalsev to build the first world-scale polyet will use a renewable feedstock," said Andrew Liveris, chairman and CEO of Dow. "This project is how Dow's innovation and industry leadership are creating outstanding opportunities to drive forwa agenda in a way that fully supports our 2015 Sustainability Goals commitments."

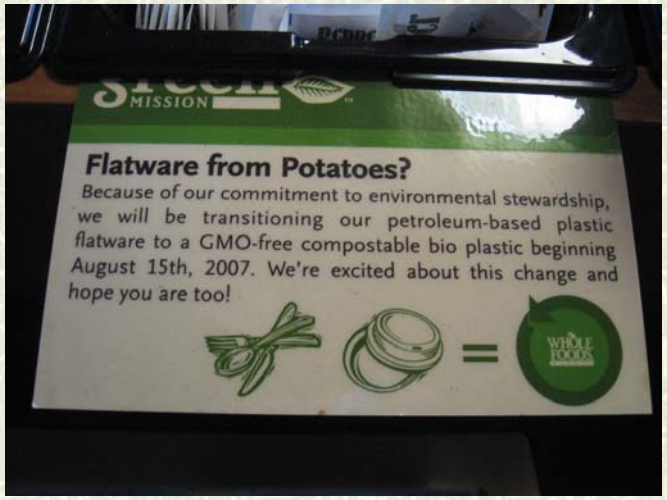
The new facility will use ethanol derived from sugar cane, an annually renewable resource, to proc raw material required to make polyethylene, the world's most widely-used plastic. Ethylene is traditi either naphtha or natural gas liquids, both of which are petroleum products. It is estimated that the n produce significantly less CO_2 compared to the traditional polyethylene manufacturing process.

"This joint venture will provide Crystalsev with an excellent opportunity to diversify its businesses th development of value-added products made from ethanol as part of an environmentally sustainable Lacerda Ferraz, president of Crystalsev. "This project will bring the optimization of synergies and t and professional growth opportunities. For such an important enterprise, we could not have found a Dow, the global leader in the polyethylene market and a company that works with state-of-the-art t

Special Event Composting

Courtesy of City of San Francisco

Whole Foods, San Francisco



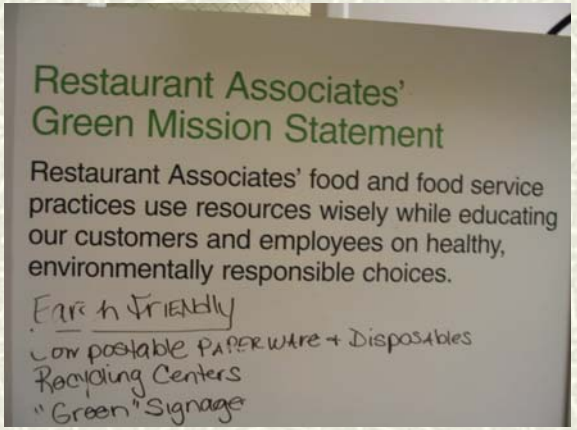
Whole Foods, San Francisco

Cedar Grove Composting

Boulder Farmers' Market


We're working to make this a Zero Waste market
All UTENSILS, STRAWS & CUPS sold here are made from cornstarch and are COMPOSTABLE.
eco-cycle
Bamboo Chopsticks
DISPOSABLE HYGIENIC

Green the Capitol Initiative



Compostable Foodservice Products

US Capitol


100% Compostable in Composting Facilities
Made with 100% Recycled Paper Fiber
Made from a Renewable Resource
Made in the USA
Made in the USA
Made with 100% Recycled Paper Fiber
Made from a Renewable Resource
100% Compostable in Composting Facilities

US Capitol


This cup is made from corn,
environmentally sustainable,
and 100% compostable.
GREENWARE


COMPOSTABLE

US Capitol, collection bins

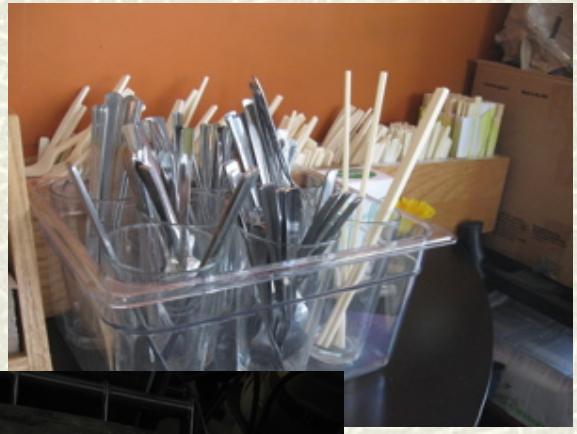
US Capitol, pulverizer

Chesterfield FARMS LLC

ORGANIC RECYCLING FACILITY

Crofton, Maryland

Java Green restaurant, DC



Java Green restaurant, DC

Challenges with Bioplastics

- Concern over genetically modified organisms (GMOs)
- Desire for sustainably grown biomass
- Need to develop composting programs
- Concern with nanocomposites and fossil-fuel-plastic blends
- Lack of adequate labeling
- Concern over contamination of recycling systems

Tiny #7 & PLA

Photo courtesy of Sunset Scavenger, San Francisco

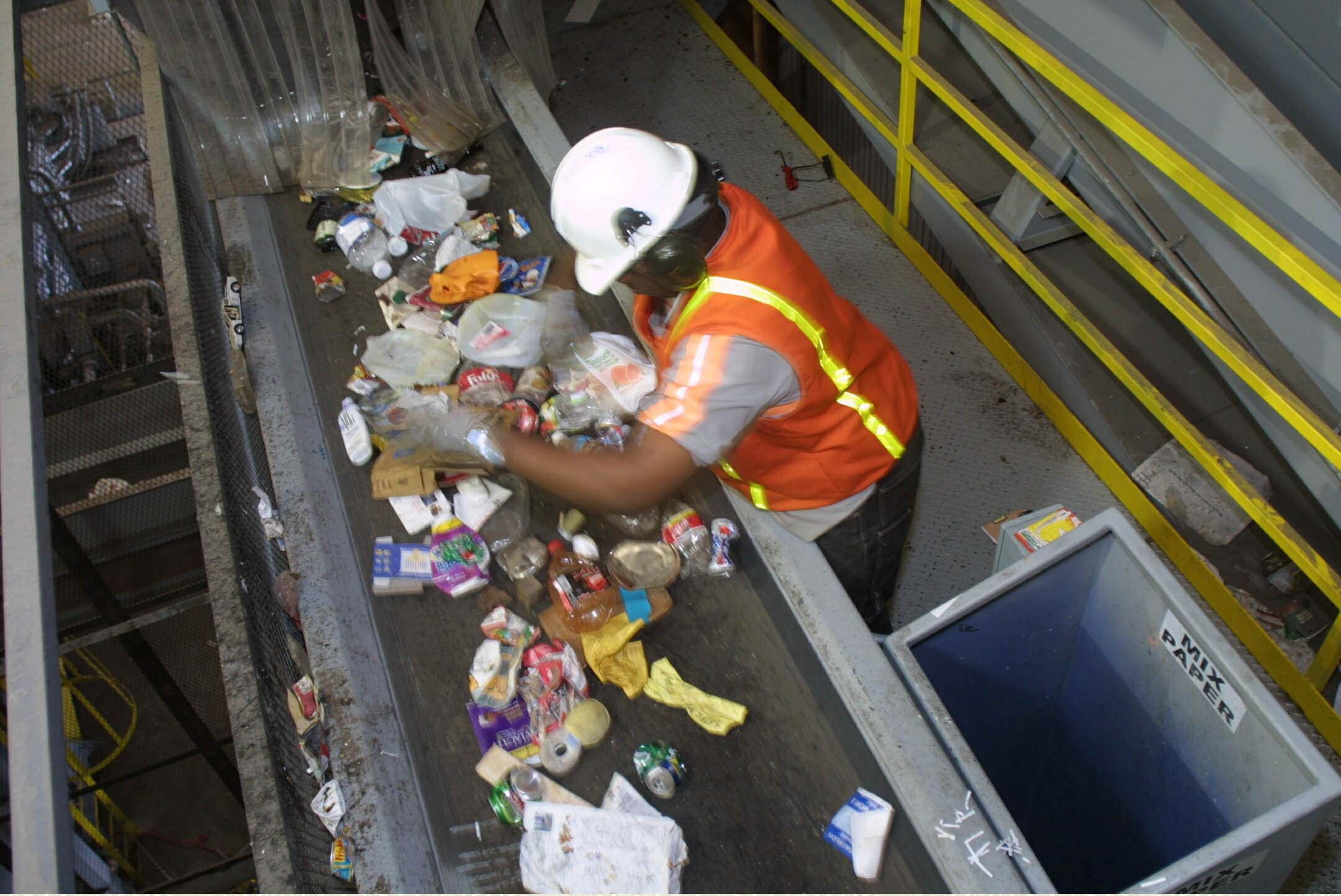
SPI Resin Identification Code

- “Make the code inconspicuous at the point of purchase so it does not influence the consumer’s buying decision.”
- Do not make recyclability or other environmental claims in close proximity to the code.

Source: The Society of the Plastics Industry, www.plasticsindustry.org

Color-coded compostable design for 400k at SF Festival

Courtesy of City of San Francisco


MIX PAPER

Where's Waldo?

Identifying and Sorting Bio-Bottles

Courtesy of Eureka Recycling, Minneapolis, MN (www.eurekarecycling.org)

Tricky?

At 120 feet per minute on a 30” wide conveyor line – It sure is!

Courtesy of Eureka Recycling, Minneapolis, MN (www.eurekarecycling.org)

Where's Waldo?

Identifying and Sorting Bio-Bottles

Courtesy of Eureka Recycling, Minneapolis, MN (www.eurekarecycling.org)

Not just PET

Courtesy of Eureka Recycling, Minneapolis, MN (www.eurekarecycling.org)

Noble Juice Bottle

The Framework for Sustainable Biomaterials

- Sustainably grown feedstocks
- No hazardous inputs and impacts during production
- Healthy and safe during use
- Recyclable or compostable and actually recycled and composted

Recommendations

- Don’t forget reuse and source reduction
- Encourage non-bottle applications
- Focus on substituting for PS, PVC, and PC
- Focus on substituting for non-recyclable packaging/products
- Composting serve as a transition solution
- Labeling focused on compost capture
- Support composting of compostable bioplastics with food scraps and yard trimmings
- Build the organics collection and composting infrastructure