Global overview of Post Consumer PET Recycling Technologies and Regulations for Food Contact

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Presentation Overview

- Sustainability
- Collection
- Bottle to bottle/ food contact technologies
- Advances in sortation
- Global regulatory status
Hallmarks of Sustainability

- Reduce
- Recover
- Reuse
- Inspire
**REDUCE**

**GOAL:** Improve package use efficiency 7% by 2015 (baseline 2008)

**PROGRESS:** Since their introduction, we have reduced the weight of our glass bottle by more than 50%, our aluminum can by more than 30% and our PET bottle by 25%

**OPPORTUNITY:** Innovate new packaging solutions (primary, secondary and tertiary) that reduce weight and use more eco-friendly materials

*Envision a carbon neutral package*
RECOVER

**GOAL:** Significantly increase recovery of the equivalent bottles and cans sold

**PROGRESS:** We recovered approximately 40% of the equivalent bottles and cans sold by the System worldwide last year.

**OPPORTUNITY:** *Implement recovery programs at operations and support efforts to expand effective comprehensive community programs:*

- Industry Recovery Organizations
- Micro-Enterprise Programs
- Recycling Enterprises
- Consumer Incentives
REUSE

GOAL: Significantly increase our source of PET from recycled material

PROGRESS:

- 3-5% Average recycled content PET sourced globally
- 40-60% Average recycled content in metal cans
- 20% Average volume in refillable glass & PET bottles

OPPORTUNITY: Innovate new materials and processes to sustainably increase “closed loop” opportunities.
INSPIRE

GOAL: Shape the future & inspire others through leadership initiatives

PROGRESS:

• Kicked off multi-million dollar “Give it Back” marketing campaign on season premier of American Idol

• Sponsored the Ocean Conservancy’s International Coastal Cleanup – the world’s largest volunteer event on behalf of clean water ways (104 countries / 42 US States)

• Provided seed funding to create Center for Packaging Innovation and Sustainability at Michigan State University

OPPORTUNITY: Consider Partnerships
Completing the Cycle

- Recycled PET
- Post Consumer PET
- Preform

CyclePET

Food Applications
Bottle to Bottle General Success Requirements

- Post consumer PET feed stock
- Regulatory frame work
- Authorized bottle to bottle recycling technologies
WORLD
PET Packaging Demand 1992-2017

Citizen demand
USA METRIC TONNES PET COLLECTED

YEAR

METRIC TONNES


0  100  200  300  400  500  600  700

000  45  635
Post Consumer PET Bottle Recycling in Europe 2007

Post consumer PET Bottle Collection Actual Volumes through 2007

Source: PCI/PETCORE
USA RECYCLED PET USE
APPLICATIONS 2007

- Food & Beverage: 15.1%
- Non Food: 6.7%
- Fiber: 42.6%
- Engineer Resins: 1.2%
- Other: 4.2%
- Sheet & Film: 14.2%
- Strapping: 16.0%
Post Consumer PET Bottle Recycling in Europe 2004

Source: PETCORE
Bottle to Bottle Recycling Technologies
Typical PET bottle washing line –

PET BALES

Debaling

PET FLAKES

Hot pre wash

Steam rinsing

Automatic or manual bottles sorting

Wet grinding

Non PET bottles

Labels

Detergents

Caps, PE, PP labels

Dust, fines

Washing section

Floating section

Rinsing tank

Drying and air separation

Mixing silo

Storage silo

PET FLAKES
PET RECYCLING OPTIONS

1. DEPOLYMERIZATION

DEPOLYMERIZE
(BREAK DOWN INTO ORIGINAL COMPONENTS)

REPOLYMERIZE
(MAKE PET)

GRIND → WASH → PET FLAKE

2. MULTILAYER

Virgin Layer

Recycled Layer

Virgin Layer

GRIND → WASH → PET FLAKE

3. MONOLAYER

GRIND → WASH → PET FLAKE

SUPER CLEANING
PET Rebirth (AIES) Tokyo, Japan
Food Grade Post ConSUMER PET Recycling Plant
Frauenfeld, Switzerland
Food Grade Post Consumer PET Recycling Plant
Sidney, Australia
Food Grade Post Consumer PET Recycling Plant
Obertiefenbach, Germany

The Coca-Cola Company
Food Grade Post Consumer PET Recycling Plant
Toluca, Mexico
Food Grade Post Consumer PET Recycling Plant
Beijing, China
Food Grade Post Consumer PET Recycling Plant Mullendorf, Austria
Food Grade Post Consumer PET Recycling Plant
Spartanburg, South Carolina, USA
Technological Advances
Sorting Technology
Ultra-High-Speed Laser Spectroscopy
Measurement Principle

Separation of flakes/pellets in chutes
Measurement Principle

Excitation of flakes/pellets with high energetic light
Measurement Principle

Collecting light/scattering emitted by flakes/pellets
Measurement Principle

Spectral Analysis of the flake/pellet
Measurement Principle

Sorting out foreign material
UNISENSOR POWERSORT 200
Selectivity of „Fingerprint“ detection using Ultra-High-Speed Laser Spectroscopy

Example: Spectra of different clear Plastics
Measurement Range and Speed

Wide-band Measurement with Ultra-High-Speed Laser Spectroscopy

Speed:
- VIS UV NIR: up to 1.000.000 measurements / sec
- VIS: up to 100.000 measurements / sec
- NIR: up to 100.000 measurements / sec

Visual methods

NIR methods

Ultra-High-Speed Laser Spectroscopy (POWERSORT)
POWERSORT 200 Video
The Global Regulatory Status
RECYCLED PLASTICS

REGULATORY CRITERIA
Alternate Sources of PET Starting Materials
PACKAGING REGULATIONS

- Packaging regulations began to be developed some 35+ years ago.
- Regulations were well in place in most countries before the concept or need for recycled plastics in food contact applications emerged.

Therefore,

- Most regulations neither allow nor preclude the use of recycled plastics in food contact applications.
Basic Tenets of Worldwide Packaging Regulations

- Packaging shall not endanger the consumer through product adulteration by migration from packaging.
- The package will not detract from the organoleptic properties (taste/smell) of the food.
POINTS TO CONSIDER FOR THE USE OF RECYCLED PLASTICS IN FOOD PACKAGING:
CHEMISTRY CONSIDERATIONS

FDA published revised guidelines August 2006
http://www.cfsan.fda.gov/~dms/opa-cg3b.html
Regulatory Criteria

1. Each recycling technology is different and must individually meet the recommendations

2. Only food grade plastics are allowed - sorting efficiency of 99% required
   - chemical depolymerization exception

3. Challenge test must be performed to demonstrate capability of technology to decontaminate
Regulatory Criteria

4. Challenge surrogates: would be defined to cover the basic physical and chemical properties of compounds.

5. Surrogate concentrations & exposure times would be defined:
   - 100% contamination of feedstock.

6. Any changes to the process would require repeat of surrogate challenge test:
   - key parameters would be stipulated in the initial authorization.
7. Establish potential for contamination of food product
- assume 100% migration to the food
- determine level in plastic and use recognized models to predict migration to food
- do migration tests with actual food under actual conditions of use
- do migration tests in accordance with regulatory guidelines
8. Migration must be non-detectable at detection limit of analytical methodology or based on a suitable criteria such as the Threshold of regulation

9. Finished material should comply with virgin resin regulations
Europe

- Europe established formal regulations for the use of Plastics in food contact applications March 2008
Guidelines on submission of a dossier for safety evaluation by the EFSA of a recycling process to produce recycled plastics intended to be used for manufacture of materials and articles in contact with food - Opinion of the Scientific Panel on food additives, flavourings, processing aids and materials in contact with food (AFC)

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Regulatory Criteria

Guidance and Criteria for Safe Recycling of Post Consumer Polyethylene Terephthalate (PET) into New Food Packaging Applications

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MERCOSUR/GMC/RES. N° 30/07
REGLAMENTO TÉCNICO MERCOSUR
SOBRE ENVASES DE
POLIETILENTEREFTALATO (PET)
POSTCONSUMO RECICLADO GRADO
ALIMENTARIO (PET-PCR GRADO
ALIMENTARIO) DESTINADOS A ESTAR
EN CONTACTO CON ALIMENTOS
Where We are Scientifically

- Numerous scientific investigations have been conducted and created an excellent database to establish the safety of PCRPET in food use applications:
  - Barrier layer inhibition of contaminant migration
  - Effects of contaminant removal via washing
  - Effects of contaminant removal via extrusion
  - Effects of contaminant removal via “super cleaning”
  - Composition of the PCRPET feed stream
  - Absorbed Compounds in the PCRPET feed stream
  - Statistical evaluation of the European PET feed stream establishing the basic absorbed compounds, their levels and the relative degree of incidental contamination.
Global Regulatory Recycling Technology “Approval” Status
Mechanical Recycling

◆ Monolayer (40**)  
   - Australia  Mexico
   - Austria*  Netherlands*
   - Belgium*  New Zealand
   - Canada  Norway
   - China**12/08  Slovakia*
   - Czech Republic*  Sweden*
   - Finland*  Switzerland
   - France*  United States
   - Germany*  Mercosur 17/12/08
   - Hungary*  EU 27/03/08
   - Philippines
INTERNATIONAL RECYCLING PACKAGING STATUS

◆ METHANOLYSIS  USA / EU / Japan / Canada
◆ GLYCOLYSIS  USA / EU/Japan/Australia / Canada
◆ MULTILAYER  USA / Australia / Austria / Sweden
              UK / Argentina / Switzerland / Brazil
              Belgium / NZ / Japan / Chile / Canada /
              France / Finland / Norway
◆ MONOLAYER  USA / Belgium / Netherlands /
              Canada/ France / Australia / Finland
              Sweden / N Z / Switzerland /
              Germany / Norway / Mexico / Mercosur
              Austria/Hungary/Slovakia/Czech Republic
              Philippines / EU (March 27, 2008) / China