Biodegradable Flexible Packaging

What it is and how it can be used

Presented by:
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“It took almost 5 billion years to create the earth as we know it – with all its natural beauty.

But is has taken only 200 years to bring the earth to the brink of destruction.

It’s time to act now.”
"The future depends on what we do in the present."

-- Mahatma Gandhi
Biodegradable &/or Sustainable Packaging

Key Drivers
Drivers for Biodegradable & Sustainable Packaging

- Increasing governmental and industry awareness of the need to develop the use of sustainable resources. We need to preserve our resources & environment today, ... for future generations.

- One of the most pressing problems today is what to do with various waste products. Certain wastes can no longer be deposited in landfills, and landfill fees are on the rise.

- Very high proportion of flexible packaging is sourced from oil based derivatives.

- General public perception that ‘biodegradable is good’.

- Retailers and marketers are aware of and want to take advantage of these issues thereby creating a significant market opportunity.
Some Interesting Facts About Oil and Packaging

- 8% of Oil is Converted into Plastics
- Over 50% of Packaging is Plastic
- Oil has increased in price 500% since 1990’s
- Only Discovering 1 Barrel of Oil for every 4 used

2005...
Middle East uncertainty, Oil supply, Gas prices, Katrina, Rita
Some Interesting Facts About Oil and Packaging

Average $ per Barrel

Biodegradability & Compostability

What is the difference?

- **BIODEGRADABILITY** - Capacity of a substance to be broken down by micro-organisms. [No set time scale]

- **COMPOSTABILITY** - A managed biodegradation process, through production of a useful compost in a maximum period of 180 days. This requires conformity to an agreed norm.

- **COMPOSTABILITY NORMS** – EN, ASTM, DIN, GreenPla Europe has adopted EN 13432 & U.S. has adopted ASTM D 6400.

Composting Norm for ‘BIODEGRADABLE PLASTICS’

A BRIEF GUIDE TO ASTM 6400

- In simple terms, the biodegradability of the material is compared to a control (pure cellulose) and must biodegrade to a minimum of 90% of the control level.

- Constituents of the packaging material >1% by weight must be measured individually, and also biodegrade to a minimum of 90% of the control level.

- Constituents <1% by weight are exempted, but the sum of such constituents must not compromise biodegradation.

- Pilot composting & plant-growing tests are also carried out on the material.

- Heavy metal content tests are also required.
Methods of Composting

**Industrial composting:**
Suitable for all certified compostable materials

**Windrow Composting**
(not suitable for Oxo-degradables)

**Home composting:**
Only suitable for unmodified plant-based materials & materials tested specifically

Not suitable for materials that require higher temps to achieve biodegradation

**In-vessel Composting**
Product Certification

Packaging films having been fully tested & certified to the European composting norm EN13432 as well as the American standard ASTM 6400. They can therefore carry the following logos:

- Compostable Kompostierbar 7P0085
  Dincertco, Germany
  Also UK, Netherlands & Poland

- BPI logo, USA

- OK Compost, Belgium

They are also certified as fully ‘home’ compostable...
What does the Term Sustainable Mean?

- A sustainable film is one that is sourced with high levels of renewable raw materials.
- All sustainable films currently available are sourced from Bio-Based materials.
- This results in renewable cycles of less than 10 years.
- The degree of sustainability is determined by the Carbon\(^{14}\) ratio.
Main Biopolymers

- Most biopolymers exhibit either ‘Cling Film’ or ‘LDPE type’ properties. (Tear resistant, stretchy, weld seals, low melting points). They also tend to lack transparency and gloss.

- Only Cellulose or PLA based films exhibit ‘orientated’ type properties (stiffness, dimensional stability, transparency and gloss)

- Most biopolymers (with the exception of Cellulose and PLA films) are based on synthetic rather than renewable resources, but all are truly biodegradable these days...
Current Issues with Biodegradable Films

- Achievement of Moisture Barrier
- Cost
- Infra-structure to cope with composting of biodegradable used or waste films
Current Issues with Biodegradable Films

Currently best moisture barrier achieved with Cellulose based films

- Transparent Films 2g/100in\(^2\)/day
- Metallised Films 0.32g/100in\(^2\)/day
- Transparent BOPP < 0.4g/100in\(^2\)/day
- Metallised BOPP < 0.04g/100in\(^2\)/day
- Ceramis coated PLA which is transparent is achieving < 0.70g/100in\(^2\)/day
Cellulose Films and Making them truly Biodegradable

- Heat-sealable Cellophane Films have always been in excess of 90% biodegradable.
- Coatings to make them heat-sealable such as PVdC did not allow them meet the composting norms.
- Biodegradable heat-sealable coatings now being used that allow the films to meet the norms.
- The “Holy Grails” of moisture and oxygen barrier are still being pursued.
The Cellulose Film Cycle
Elements Required for Biodegradation of Cellulose Films

- High Enough Water Activity
- Aerobic Environment
- Nutrient
- Elevated Temperature will increase rate of degradation but not essential
Biodegradation of Cellulose Films

Evolution of the Disintegration of Cellulose Film

Full film sheet present

Total visible disintegration confirmed

Days

% degradation (CO2)

Control (pure cellulose)
Uncoated
Coated
Cellulose Films Used Extensively for Fresh Produce

Extends shelf life by controlling moisture environment (prevents mold growth)

Perforation controls gas environment (controls ripening)

Maintains produce aroma

Reduces Waste Produce and all packaging is compostable
Preserving the quality of the fruit from vine to consumer is essential to successful marketing.

Consumers buy tomatoes based on:
- Color
- Appearance
- Flavor
- Aroma
## The Results - Extension of Produce Shelf Life

### Vine Tomatoes

<table>
<thead>
<tr>
<th>Film</th>
<th>Weight loss</th>
<th>Mold</th>
<th>Ripening / Softening</th>
<th>Aroma</th>
<th>Skin Appearance</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulose mid barrier</td>
<td>Low</td>
<td>OK @ 36 days</td>
<td>Moderate</td>
<td>Good</td>
<td>No Change</td>
<td>No Change</td>
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<td>Cellulose low barrier</td>
<td>High</td>
<td>OK @ 36 days</td>
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<tr>
<td>BOPP Perforated</td>
<td>Medium</td>
<td>25 days</td>
<td>Moderate</td>
<td>Lost tomato aroma</td>
<td>Mold</td>
<td>No change</td>
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<tr>
<td>BOPP Breathable</td>
<td>Lowest</td>
<td>25 days</td>
<td>Moderate</td>
<td>Lost tomato aroma</td>
<td>Mold</td>
<td>No change</td>
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</tr>
<tr>
<td>PLA</td>
<td>Highest</td>
<td>OK @ 36 days</td>
<td>Moderate</td>
<td>Lost tomato aroma</td>
<td>Wrinkled @ 26 days</td>
<td>No change</td>
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<tr>
<td>Control unwrapped</td>
<td>Medium</td>
<td>OK @ 36 days</td>
<td>Overripe and soft @ 26 days</td>
<td>Lost tomato aroma</td>
<td>Wrinkled @ 26 days</td>
<td>No change</td>
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Future structures from Bio-based Films

Typical structure using Oil-based Films

- Polypropylene Film provides durability and good surface for print graphics
- Polyethylene Film provides enhanced sealability
Future structures from Bio-based Films

Proposed structure using Bio-based Films

- Adhesive
- Reverse Printed Cellulose Film
- Bio-based Sealant Film

- Cellulose film provides durability and good surface for print graphics
- Bio-based Sealant Film provides enhanced sealability
Persistence Pays
Thank You

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Please remember to turn in your evaluation sheet...