

NatureFlex™ Flexible Packaging

Biodegradable & Compostable Packaging Films
From a Sustainable Resource

Malcolm Cohn - Market Manager, Americas





"The future depends on what we do in the present."

-- Mahatma Gandhi

Introduction

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- Company Overview
- Why the hoopla about biodegradability & sustainability?
Key Market Drivers.
- Biodegradable Test & Certification Procedures
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Company Overview

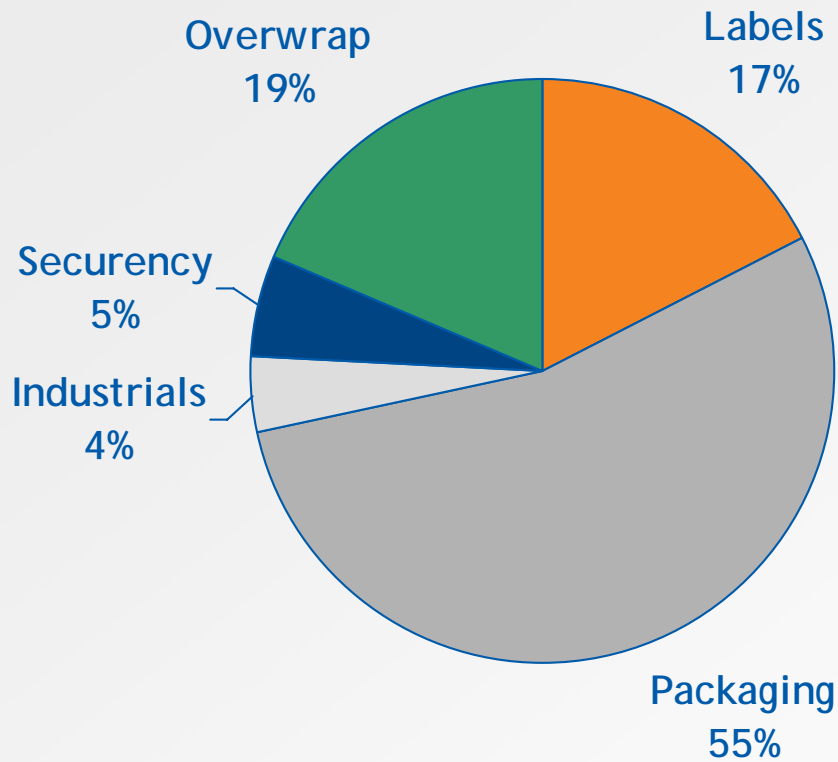


Innovia Films

- Innovia Films is a global producer of specialty Cellophane and Polypropylene packaging films.
- Turnover \$440 million from four industrial sites (including a major Cellophane manufacturing facility in Kansas).
- Produce 260 million pounds of flexible film annually from sites in the US, England, Belgium, and Australia.
- Over 1,400 employees support our operations.
- State of the art R&D center in Wigton, UK
- The Americas head office is based in Atlanta, GA.



Films Sales by Business



Film Capacities

BOPP: 192 million lb.

Cellulose: 68 million lb.

Sales: \$440 million





Biodegradable &/or Sustainable Packaging

Key Drivers

Dependence on Oil-Based Flexible Films

Average \$ per Barrel



**"17 Million new Chinese consumers of plastic
will be born this year. Are you ready?"**

-- gotoemerson.com

Key Market Drivers

- Significant volatility in polymer supply chain.
- Finite availability of oil.
- Long term aspect of Land Fills not very appealing to citizens or regulators (Europe much further along).
- Major increase in focus on 'Sustainability' (and the USA is a major driver in this...)
- Corporate Social Responsibility
Opportunity to align packaging policies within CSR programs.
- Retailers want to be able to send 'back of store' waste straight to compost facility, without need for separation.
- Consumers want 'biodegradable' packaging
Gives Supermarkets opportunity to respond to this demand.
e.g. Wal-Mart, Whole Foods, Wild Oats, Carrefour (Brazil)

Key Market Drivers

- Increase in use of composting as a waste management stream.
- Home (Back-yard) Composting popular in certain countries & US regions.
- EU legislation to progressively remove the biodegradable element from landfill and direct it to composting facilities.
(Biodegradable Municipal Waste to reduce to 35% of 1995 level by 2016)



Biodegradable Test & Certification Procedures

Biodegradability v 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** - ASTM, EN, DIN, GreenPla
U.S. has adopted ASTM 6400 and Europe EN13432.

All NatureFlex films are certified to ASTM 6400

Bioplastics: Definitions

- **Plastics from renewable resources**

Plastics made from raw materials that are renewable. These can be annually renewable (such as corn starch) or materials like cellulose from wood. Manufacturers can use the standard ASTM D6866 to identify the percentage of material made from renewable sources.

- **Biodegradable/compostable plastics**

Plastics that will fully, and safely, disintegrate and biodegrade when composted. Not all plastics made from 100% annually renewable raw materials may be biodegradable/compostable. It depends on the molecular structure of the material itself. Manufacturers can use standards, including ASTM D6400, to determine if a material is compostable.

■ Federal Biobased Product Preferred Procurement Program (FB4P)

- Independent analysis confirms “NatureFlex contains >90% biobased content based on ASTM D6866.”
- NatureFlex™ selected by the Federal Biobased Product Preferred Procurement Program (FB4P) for submission for the very exacting ‘cradle-to-grave’ BEES analysis (Building for Environmental and Economic Sustainability).
- NatureFlex™ will be eligible to use the ‘USDA Certified Biobased Product’ logo.



Composting Norm for BIODEGRADABLE PLASTICS

A BRIEF GUIDE TO ASTM 6400

- 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 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



Home Composting & Ambient Aqueous Biodegradation

- Miti Test (ISO 14851) carried out by 'Organic Waste Systems' [OWS] in Belgium.
- Material used 165 gauge NE2 ('Worst case scenario').
- Full biodegradation confirmed within 24 days.
- Test confirms:
 - (a) Material is suitable for Home-Composting.
 - (b) Material will biodegrade in waste-water, sewage or marine environments.
- Not suitable for Oxo-degradables & certain compostables (e.g. PLA) that require higher temps.



Home composting in your own garden

Product Certification

All NatureFlex™ packaging films have been fully tested & certified to the American standard ASTM 6400 as well as the European composting norm EN13432. They can therefore carry the following logos:



Compostable
Kompostierbar
7P0085

Dincertco, Germany
Also UK, Netherlands & Poland



BPI logo, USA

They are also certified as fully 'home' compostable...

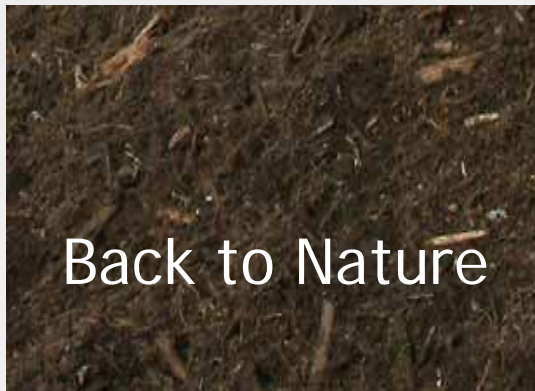


OK Compost, Belgium

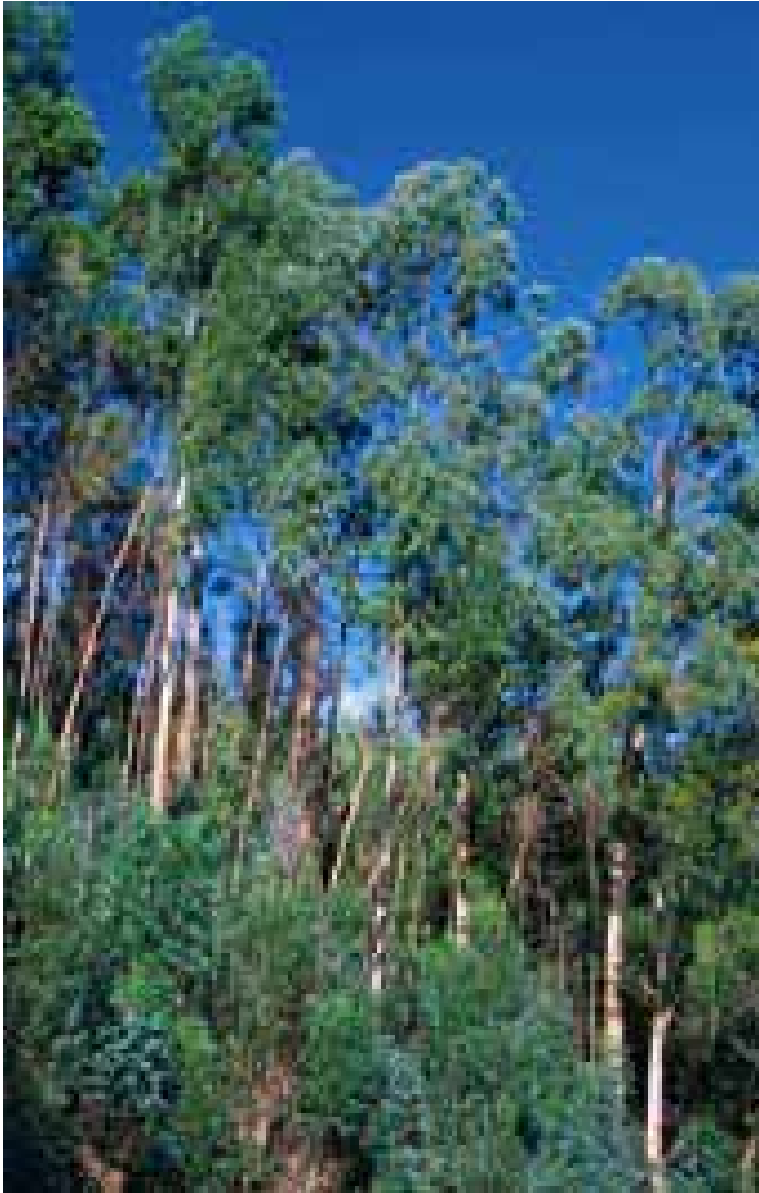
Innovia's Product Offering



NatureFlex™ Sustainable Product Stream



NATUREFLEX™ COMES FROM TREES...



- Our raw material is renewable wood-pulp sourced from managed plantations from suppliers operating sustainable forestry programmes such as FSC or similar.
- We take it through a complex process to dissolve it and then regenerate it as a kind of 'transparent paper'.
- We can then coat it, slit it and produce NatureFlex™ reels, with different characteristics for a range of packaging end-uses.
- After use it can be composted, completing the 'circle of life'...

... AND RECYCLES BACK TO NATURE AS COMPOST



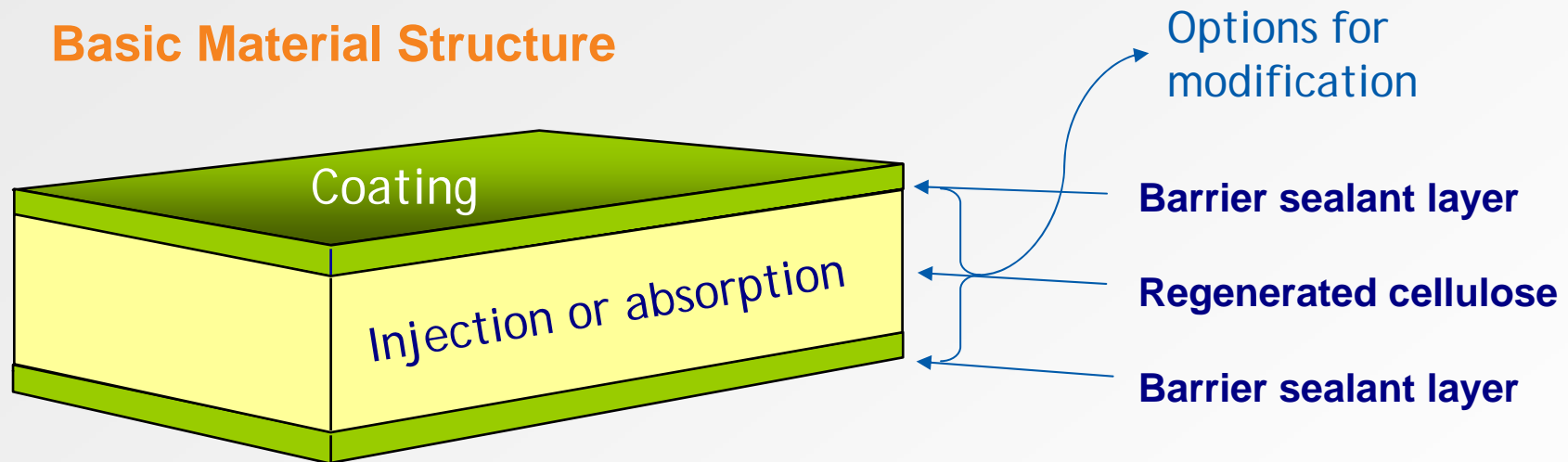
NatureFlex™ - Key Material Characteristics

- Typically >95% renewable resources
- Certified compostable in all key biodegradation situations (Industrial, Home, Marine & Waste-water)
- Based on GM-Free wood-pulp from managed plantations
- Machine friendly (anti-static, wide heatseal range, easy opening, excellent deadfold)
- High gas barrier & range of moisture barrier possibilities
- Excellent grease/oil resistance
- Compatible heatseal to other bioplastic materials
- Certain grades are microwavable
- Fully Commercial...



NatureFlex™ Barrier Films

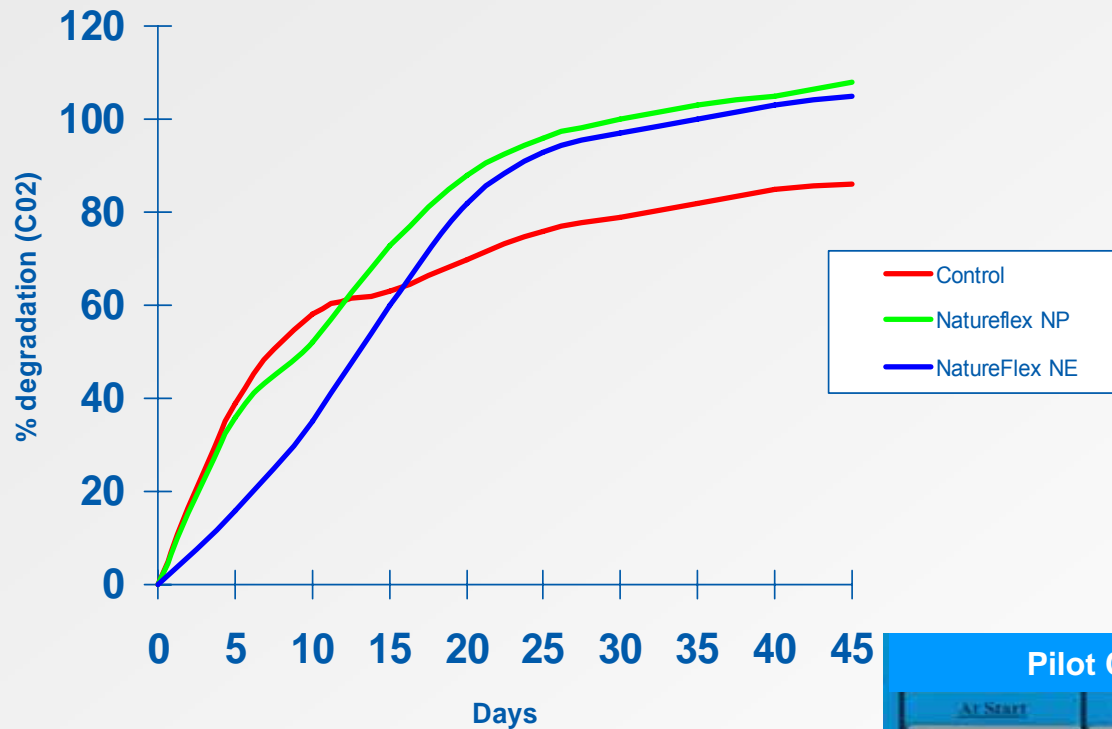
Basic Material Structure



- Fully biodegradable coating provides ultra wide heatseal range
- Fully biodegradable under industrial, ambient & aqueous conditions
- Tropical MVTR of 2g or 24g/100 in².24 hours
- Standard availability in 75, 90, 120, 165 gauge

- Micro-injection: Pigments etc, prior to extrusion
- Absorption: Dyes, softeners etc, post extrusion
- Coating: Slip, adhesion, heatseal, barrier

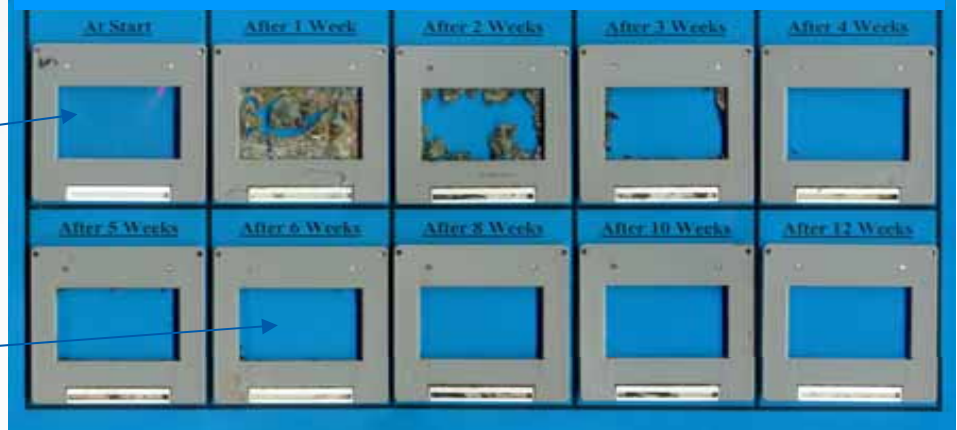
NatureFlex™ Biodegradation & Compostability



Full film sheet present

Total visible disintegration confirmed

Pilot Compostability of NatureFlex™ NE film





Key Market Applications

Key Market Applications

- Hygiene applications
 - ~ Diapers, Feminine hygiene, etc.
- Carton-box overwrap
- Confectionery
- Permeable applications
 - ~ Bakery
 - ~ Meat & Cheese smoking
- Fresh produce
 - ~ Moisture perm can increase shelf life
 - ~ 'Back of store' waste to composting
- Cereals (pouch & bag-in-box)
- Saran-free packaging
- Bio utensil bags
- Event catering
 - ~ Practical waste disposal
 - ~ Litter issue
- Convenience Foods
 - ~ Fast-food chains
 - ~ In store packaging (trays etc.)
- Paper bag liners
- Natural/Organic products
- Nutritional/Energy bar
 - Metallized laminate structures
- Cigarette Paper

Applications

Innovation Timeline 2003 - 2006



2003 NatureFlex Non heat sealable tape
NPU : base film

Applications

Innovation Timeline 2003 - 2006



2006 NatureFlex NVS: New generation coated NatureFlex

NatureFlex™ Films - The transparent paper...

Wal-Mart March 2006



Key Points:

- Palm fiber tray supplied by EarthCycle, Canada, and overwrapped with NatureFlex 120 gauge NVS, ~ 95% renewable resources.
- Both tray and overwrap film certified to the compostable standard ASTM 6400.
- GMO-free, tray and film suitable for home composting.
- NatureFlex is static-free & heat-sealable, designed to run on standard packaging equipment without modification.

WAL★MART®
ALWAYS LOW PRICES. *Always.*

Success at Wild Oats ...



December 2006
nationwide in-store
promotion.

Palm fiber tray supplied by EarthCycle, Canada, and
overwrapped with NatureFlex 120 gauge NVS



New NatureFlex™ NVS for

J Sainsbury plc



Sainsbury's switches to new biopackaging grade

- Extension of concept to over 500 product lines starting September 2006.
- Almost half of organic Fresh Produce lines are in compostable packaging. Target to hit 80% by January 2007.
- Where possible materials employed are to be home compostable.
- Move to save 3,550 tonnes of conventional plastics from Sainsbury's use annually.



Compostable packaging - Press Release October 3rd 2006

Followed by

By the end of 2006 both Morrison's and Tesco had followed Sainsbury's lead to biodegradable packaging.

See reverse of label for packaging composting information



“every little helps”



Compostable, non GM packaging
from a sustainable source





TOMATO PACKAGING

Survey of packaging tomatoes undertaken in Australia

Tomato Packaging

- Preserving the quality of the fruit from vine to consumer is essential to successful marketing.
- Consumers buy tomatoes based on:
 - Appearance
 - Flavor
 - Quality

Tomato Packaging

Packaging Requirements

- Protect product through-out shelf life.
- Shelf life extension.
- Reduce moisture loss.
- Provide oxygen permeability - via perforation or enhanced breathability.
- Attain an equilibrium of oxygen and carbon dioxide transmission through the package and the product's respiration rate.

Innovia Testing

Objective

- Understand the effect of packaging films on tomato shelf life.

Films Tested

- 3 NatureFlex films (NVS, 535E956 & NE600).
- 2 BOPP films (one perforated, one breathable NOT perforated).
- Bio plastic (PLA).

Method

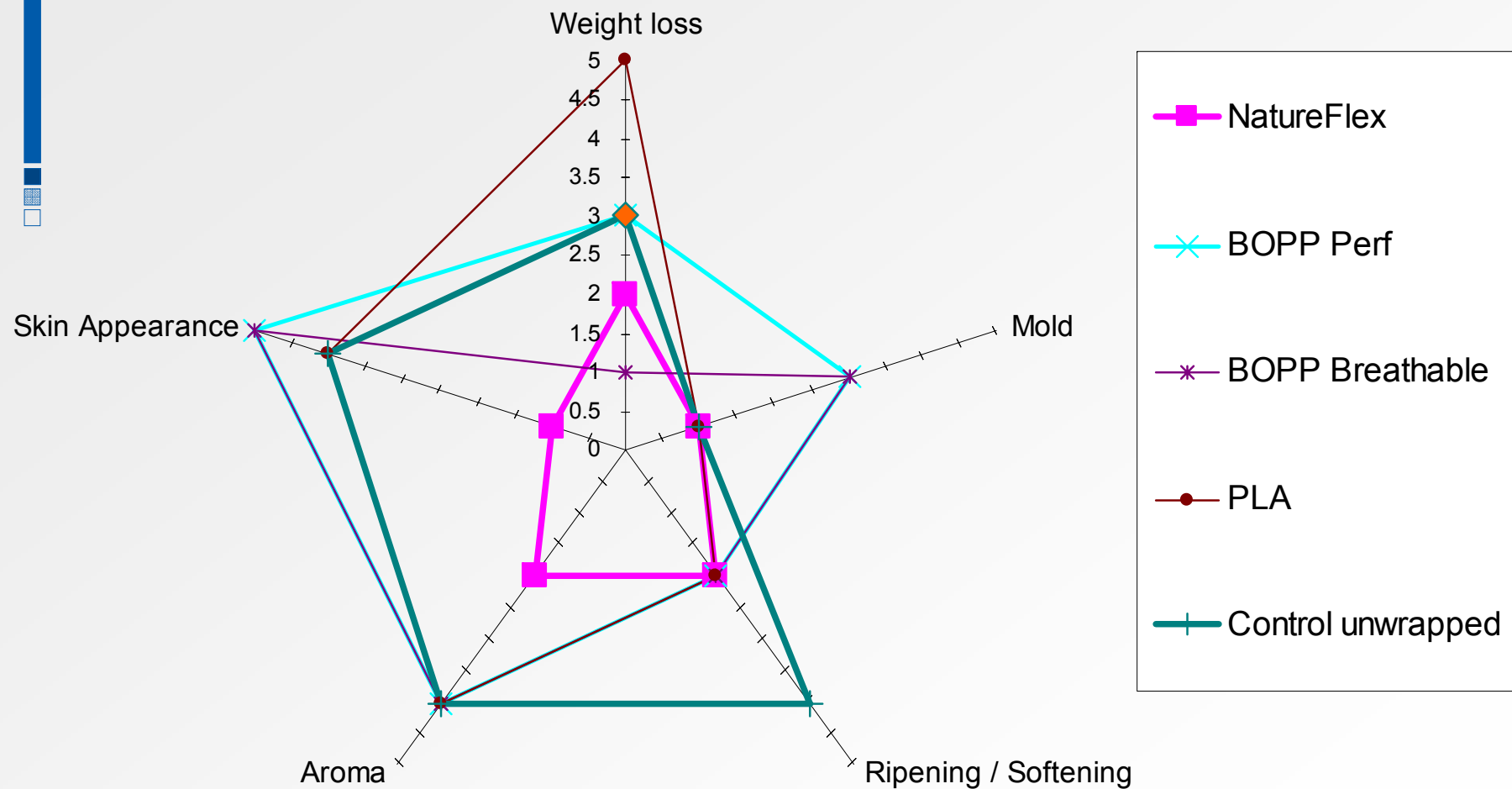
- Control was unwrapped.
- All films were perforated to a P8 pattern (exception above).
- Packed in flow-wrapped PET trays.
- 6-8 vine tomatoes were used in each tray.
- Stored at 55^oF over 26 days, then extended to 36 days.
- Tomatoes were evaluated for changes in color, firmness and weight.



Innovia Testing Results

Film	Weight loss	Mold	Ripening / Softening	Aroma	Skin Appearance	Color
23E946	Low	OK @ 36 days	Moderate	Good	No change	No Change
535E956	Low	OK @ 36 days	Moderate	Good	No Change	No Change
NE600	High	OK @ 36 days	Moderate	Good	No Change	No change
BOPP Perforated	Medium	25 days	Moderate	Lost tomato odor	Mold	No change
BOPP Breathable	Lowest	25 days	Moderate	Lost tomato odor	Mold	No change
PLA	Highest	OK @ 36 days	Moderate	Lost tomato odor	Wrinkled @ 26 days	No change
Control - Unwrapped	Medium	OK @ 36 days	Overripe and soft @ 26 days	Lost tomato odor	Wrinkled @ 26 days	No change

Innovia Testing Results



Closer to centre is better

Tomato Packaging Conclusions

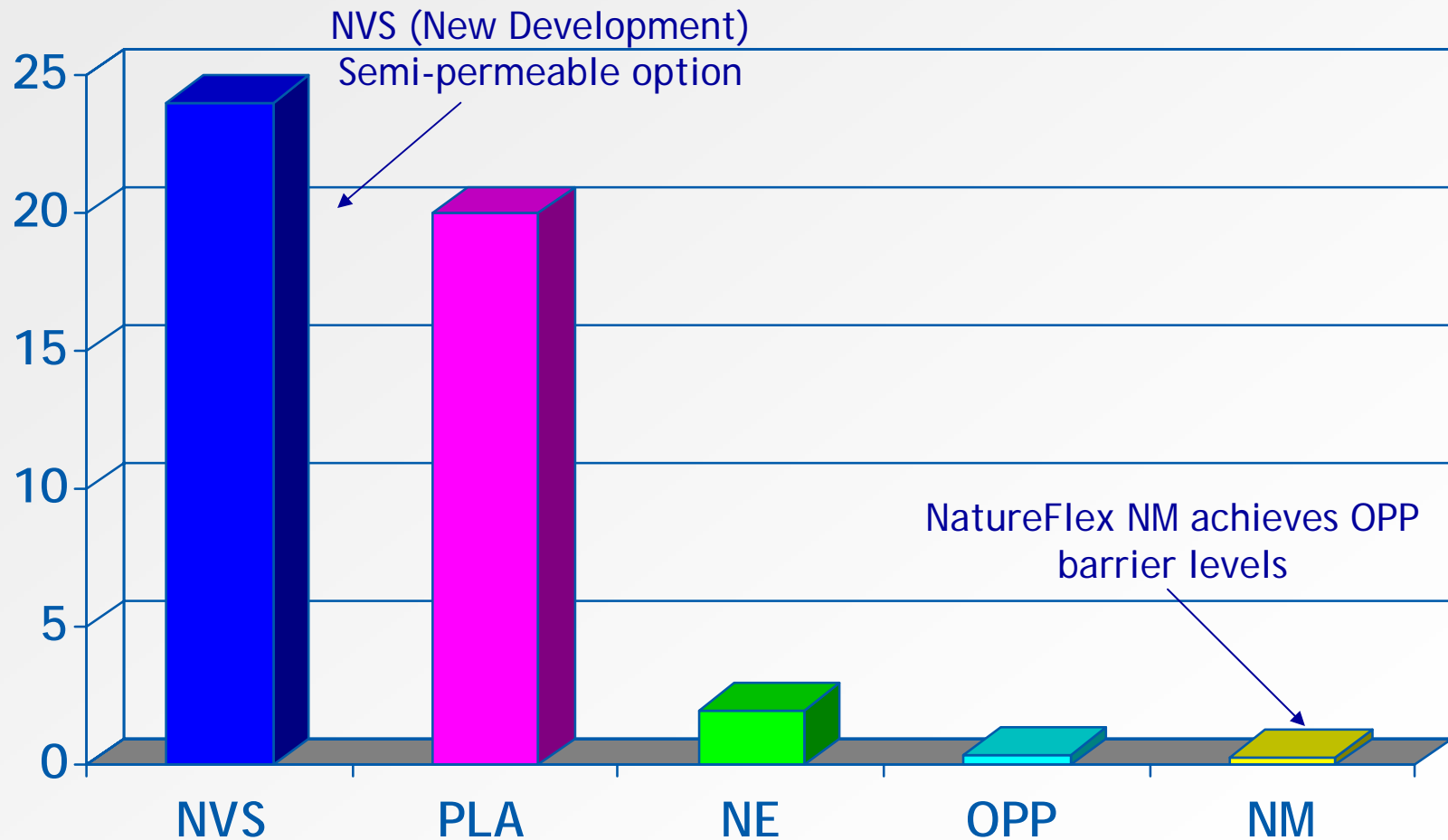
- Packaged tomatoes last longer than unwrapped.
- Best performer = Perforated NatureFlex™ NVS.
- Anti-mist is not required on the NatureFlex™ films due to their moisture permeability.
- BOPP, perforated or breathable, is possible, albeit with shelf life limitations.



Challenges for Bio-based Films

Moisture Barrier of 'Biofilms'

120 gauge films [100°F, 90%RH]



Challenges for Bio-based Films

Cost!

- Currently bio-based films are substantially higher in cost compared to oil-based films.
- Unlike renewable energy, bio-based films do not receive financial support during their development and market-entry stage.
- However, the gap is narrowing as the price of finite fossil-fuel based materials increases.
- Surveys also indicate that Consumers will pay a little more for environmentally friendly & sustainable films.
- Bottled water costs 10,000 times more than tap water, and is often more expensive, per gallon, than gasoline.
(Earth Policy Institute Report)

Challenges for Bio-based Films

Other concerns!

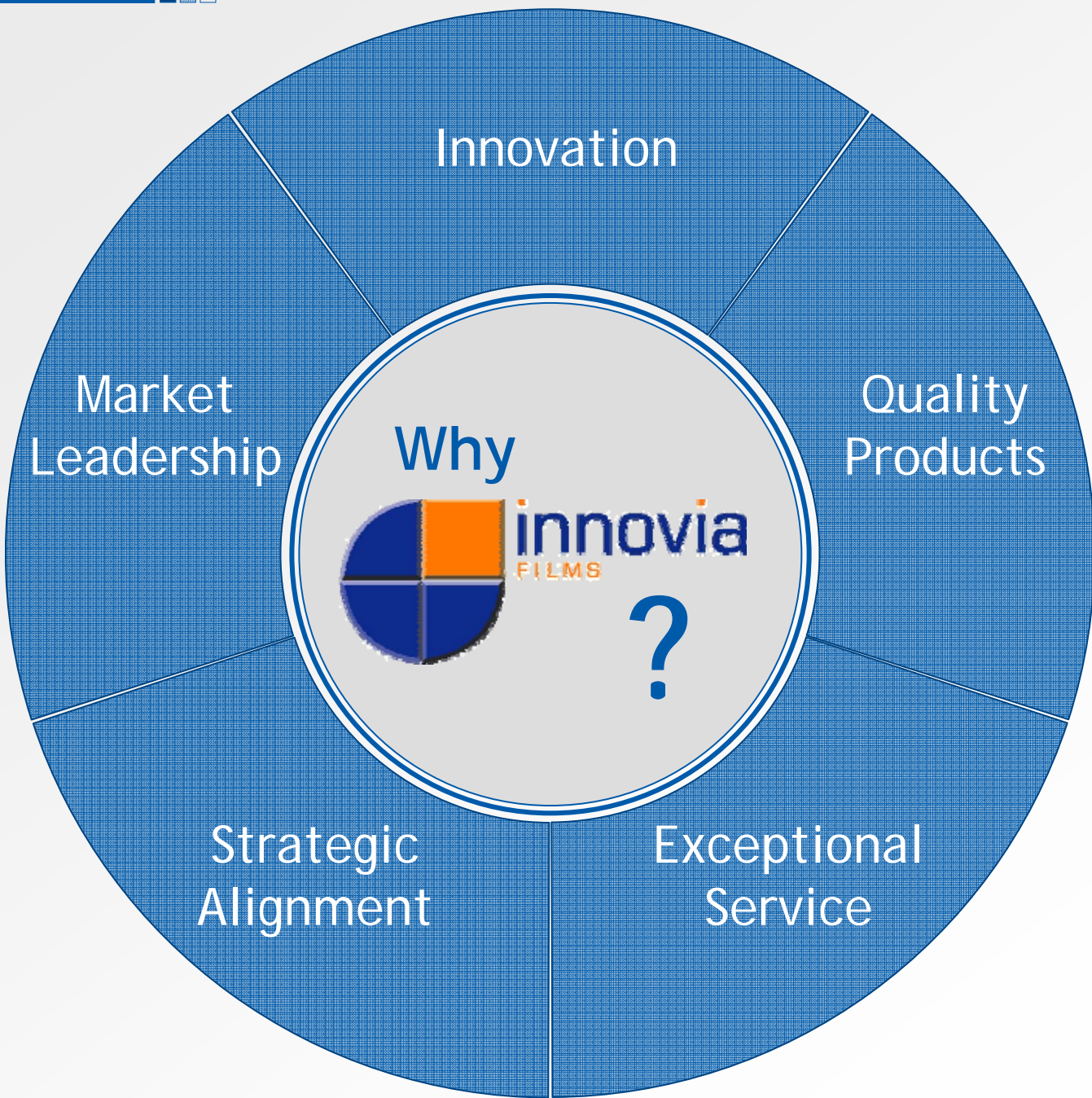
- One of the industry's biggest hurdles for the adoption of compostable materials is the lack of curbside collection and municipal composting facilities. Municipal composting would 'complete the circle' for bio-based materials.
- Consumer awareness programs must be introduced to educate the consumer of the need to compost, ...

Otherwise, it will all be for naught!



PACKAGING FROM NATURE, PACKAGING FOR NATURE

It's only ... ***NATURAL!***



Innovation

Quality Products

Exceptional Service

Strategic Alignment

Market Leadership

