Packaging Reduces Food Waste: Combing the Power of Food Science & Material Science for optimized packaging

Sydney Hansen, Food Packaging Product Development
Dow Packaging and Specialty Plastics
Flex Pack Con October 2016

Dow.com
Key Facts About Dow

2015 Sales - $49B

Corporate Stats:
• ~49,500 employees
• More than 6,000 products
• Sales in ~180 countries

Dow Sites Around the World
Dow’s 2025 Sustainability Goals

Redefining the Role of Business In Society

Dow’s Aspiration
• Dow advances the well-being of humanity by helping lead the transition to a sustainable planet and society.
• Dow maximizes economic, environmental, and societal value.

Delivering Solutions to Global Challenges

Dow’s Pillars
Unlocking the Potential of People and Science
Valuing Nature
Courageous Collaboration

2025 Sustainability Goals
Leading the Blueprint
Advancing a Circular Economy
Valuing Nature
Increasing Confidence in Chemical Technology
Engaging Employees for Impact
World-Leading Operations Performance

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By 2030, the world’s population will reach 8.3 billion.

Source: United Nations sustainability report
The world will need...

50% more food

Source: United Nations sustainability report
The Food Supply Math

<table>
<thead>
<tr>
<th>Total Food Available</th>
<th>Portion Consumed</th>
<th>People Adequately Fed</th>
</tr>
</thead>
<tbody>
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<td>0.6</td>
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S = Supply of food available at harvest

*Theoretical calculation assuming that current food consumption would provide sufficient nutrition for 6 billion people if that food were redistributed

Fraction of food wasted = 1 – portion consumed
### The Food Supply Math

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S = Supply of food available at harvest

* Theoretical calculation assuming that current food consumption would provide sufficient nutrition for 6 billion people if that food were redistributed

Fraction of food wasted = 1 – portion consumed

Changing the portion consumed from 0.6 to 0.7 requires reducing waste from 40% to 30% and results in enough additional food to feed 1 billion people
EPA and USDA have announced (Sept. 2015) the United States' first-ever national food waste reduction goal, calling for a 50-percent reduction by 2030.
Packaging plays an integral role in preserving energy

Packaging only accounts for 10% of the average energy consumption in providing food for a person, but plays a critical role in the other 90% wasted.

Source: RMIT, “role of packaging in minimizing food waste in the supply chain of the future”
Optimized Flexible Plastic Packaging provides Value

Demonstrate to key stakeholders and consumers the positive value of flexible packaging

Provide solutions combining MATERIAL SCIENCE and FOOD SCIENCE to overcome today's challenges in food packaging
Innovation Model: Engagement Across the Value Chain

Collaborate
- Food Science
- Process Research
- Catalyst Research
- Material Science

Innovate
- Application Development
- Pack Studios

Accelerate
- Converter
- Supplier / Equipment Manufacturer
- Food Processor
- Brand Owner
- Retailer

Research - Development - Commercialization

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1. DECREASE MATERIAL USE AND PRODUCT WASTE
Superior Packaging Abuse Resistance

Collaborate
- Reduced Weight & Thickness

Innovate
- Superior Stiffness & Toughness

Accelerate
- Higher Performance

Up to 25% Down-gauging

Dart Impact

- DOWLEX™: 1X
- ELITE™: 2X
- INNATE™: 4X

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Providing Downgauging with Dart Advantage

INNATE™ shows improved toughness vs comparatives at 5-10% downgauging.

Study completed with multilayer films.

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Increasing performance and reducing material use

**Applications:** Multiple F&SP applications requiring abuse in scope, sold by linear foot / bag count

- **Film Strength**
  - Incumbent Film
  - 20% downgauging with INNATE™

- **Increase in Surface Area**
  - Incumbent Film
  - 20% downgauging with INNATE™

20% down gauging results in about 25% increase in surface area per given weight
Recycling Many Plastics is Challenging

**Consumer behavior:** Plastics has lower recycling rate than paper or metal

**Technical:** The use of multiple plastics in very thin layers makes flexible plastic packaging more difficult to recycle than most other types of packaging

**Infrastructure:** The lifecycle benefit of being lightweight makes flexible packaging more difficult and less valuable to collect, and less important to weight-based metrics used by cities, states, and MRFs when setting goals
Superior Packaging Abuse Resistance

Collaborate
- Sustainability Partnerships

Innovate
- Improved compatabilization

Accelerate
- Enabling post consumer recycling

Rethinking the traditional recycling model

Polar component
Compatibilizer
Non-polar matrix
ultra-low viscosity enabling fast mixing

for store drop-off recycling by

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Value Chain Collaboration – Enabling Post Industrial Plastic Recycling

- Based on a **reactive ultra-low viscosity**
- Allow pelletized barrier films, containing materials like EVOH or PA: more **evenly dispersed** into a polyolefin matrix
- Helps make **clearer packages, maintain mechanical properties** and significantly **reduce gels** in films produced from barrier film recycle streams

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**Dow**

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2. PRODUCT SPECIFIC BARRIER
One Dow solution

WORKING TOGETHER TO BRING YOU MORE

AGRICULTURAL SCIENCES
- Seeds
- Crop Protection
- Omega 3 Oils

FOOD & PHARMA
- Ingredients
- Food enhancement
- Pharmaceuticals

INFRASTRUCTURE SOLUTIONS
- Dow Coating Materials
- Energy & Water Solutions

PERFORMANCE PLASTICS
- Dow Elastomers
- Dow Packaging and Specialty Plastics
- Energy
- Hydrocarbons
Impact of the Value Chain

When one changes, it will affect the others

- Packaging
  - Barrier
  - Abuse
- Ingredients
  - Macro nutrients
  - Additives
  - Emulsifiers
  - Water content
- Processing
  - Pasteurization
  - Sterilization
- Distribution/Storage
  - Time
  - Temperature
  - Humidity
  - Contamination
The Ingredients and Process matter

How do ingredients degrade?

- Carbohydrates
  - provide fuel for microbial growth
  - participate in reactions with other proteins and enzymes

- Protein
  - Protein degradation (ex: Maillard browning)
  - enzymatic reactions
  - Microbial degradation

- Lipids
  - Hydrolysis
  - Oxidation
  - Microbial rancidification

- Water
  - medium for chemical reactions
  - facilitate the entrance of micro-organisms into food.

How is it processed?

- Pasteurization
- Sterilization

Generally the lower the water content, the more stable a product will be
What kind of Barrier do you need?

**Light Barrier** preventing UV radical activated reactions
- Unsaturated fat undergoing lipid oxidation
- Photodegradation causing changes in appearance

**Gas Barrier**
Regulating the permeation of gases such as oxygen, CO₂ and nitrogen to create the right environment for the food
- Ethanol regulation of Fresh produce
- Decrease oxygen content for reactions such as oxidation or microbial growth
- Loss of highly volatile compounds such as those found in Coffee
- Sustaining modified atmosphere

**Moisture Barrier** preventing texture changes, microbial growth, hydrolysis of oils
- Cereals/crackers staling
- Clumping of Powders
- Mold growth in Semi-solid and liquid foods
- Shrinkage in fresh produce
- Maillard browning in proteins

To what Degree?

- **Low barrier**
- **High Barrier**
Isolating the performance gap

Linking the mode of degradation back to the ingredients to determine how to optimize the package based on specific needs.

Measuring extent of reactions such as oxidation over time through formation of primary and secondary products.

Determining how the change in nutrition is affected by reactions in the food matrix.

“off”

“good”

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3. PACKAGING OPTIMIZED PER APPLICATION
Improving Product Quality

Increasing shelf life by understanding the product

Optimizing the packaging for better performance with Moisture Barrier Control using HDPE ELITE™ Enhanced Polyethylene

Translating WVTR into flavor and texture changes

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Product characteristics play a major role in food safety

Both intrinsic and extrinsic characteristics play a major role in shelf stability of the food.

Reducing the survival of *L. monocytogenes* in pre-packaged cooked ham INCREASES OVERALL SHELF LIFE

*Source: FSFI*
Flexible Plastic Packaging Extending shelf life

Protection, Preservation and Promotion of Packaged Content

In-store waste reduced from 3% to < 1%

Flexible packaging prolongs shelf life:

Shelf life extended from 3 to 14+ days in-store

Identical bunches stored for 7 days

Flexible plastic packaging reduces food spoilage & waste

Source: INCPEN
Thank You

Helping accelerate solutions for better packaging
Sydney Hansen

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