III International Conference on Fresh-cut Produce

Packaging Fresh–cut Products
15 September 2015

Presented by:
The JSB Group, LLC

What is Fresh-cut Packaging?

- What do you want out of your fresh-cut packaging?



Consider the Possibilities:

- A functional, technology, marketing, branding and sustainability platform
  - **Functional Protection**
    - Keeps what's in in and what's out out
  - **Technology Platform**
    - MAP
      - Shelf Life Extension
      - Quality Optimization
      - Food safety
  - **Marketing Tool**
    - Branding
  - **Sustainability Tool**



What must be considered when designing a fresh-cut package

- Consumer Requirements
- Produce Innovation
- Packaging Technologies
- Marketing
  - Branding
  - Recognition
- Truths



Consumer Requirements

- Safety
- Convenience
- Freshness
- Quality
- Sustainability
- Localvores
- Economics



The Future is Now…





Or is it.....

- Lets not get ahead of ourselves
- ...Only the foolish build their homes on sand.....
- Modified Atmosphere Packaging Fundamentals

Packaging Technologies

Produce Physiology Requirements

Polymer Engineering

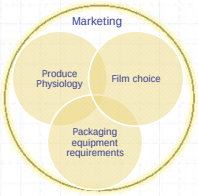
Converting/Filling Machine Requirements

Marketing Requirements

Branding

Story

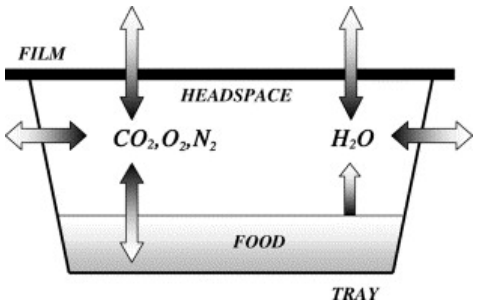
Sustainability



Jeff's Fundamental Truth

- Anytime you place fresh-cut produce into a sealed package you have created Modified Atmosphere Package.
- It may not be correct or desired and certainly not optimized; but make no mistake it is a Modified Atmosphere Package.
- This then begs the question; how do I optimize the package...

MAP



Packaging Calculations

$OTR = RR_{O2} \cdot t \cdot W/A \cdot (O_{2atm} - O_{2pkg})$

Where:

***OTR = Film O_2 Permeability (Oxygen Transmission Rate) per mil**
RR = Respiration Rate (O_2 Consumption)
t = Film Thickness (mils)
W = Product Weight (Kg)
A = Film Surface Area (cm^2)
O_{2pk} = Desired O_2 Concentration In the Package (O_2 Target Atmosphere)

The calculated OTR is the per mil transmission rate for the given thickness of film used in the calculation,
In other words if you plug in 2 mils the resulting OTR is the per mil transmission rate of that 2mil film

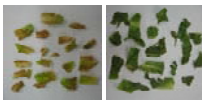
*To convert OTR ($CC/mil/cm^2/Hr$) to OTR ($cc/100\ in^2/day$) multiply by 15483.84

Produce Physiology

OTR = $RR_{O2} \cdot T \cdot W/A \cdot (O_2atm - \underline{O_2pk})$

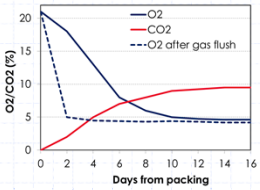
Desired atmosphere in the package (O_2 pk)

- Information available from CA/MA literature
- Need to consider oxygen and carbon dioxide tolerances
- Calculations are much more complicated with mixed products in the bag
- Atmospheres in the package should be measured during shelf life
- Avoid anaerobic respiration i.e. when O_2 becomes so low that fermentation occurs and ethanol and acetaldehyde form
  - Flavour
  - Shelf-life (damages membranes)
  - Appearance



Gas flushing

- Rapid drop in O_2 is critical for some products to prevent browning e.g. Iceberg lettuce
- Usually flush with nitrogen until 2-8% O_2 remains



Packaging Technologies

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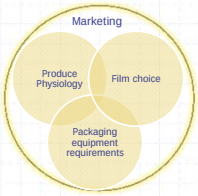

Polymers Outer Layers

- Each polymer has its own set of gas transmission properties
- Gas moves through each layer of a multilayer package one at a time
- Inks, adhesives, and even antifog coatings must be viewed as a discreet layer
- Typical outer layers of a multiply lamination
  - PET
    - APET
    - CPET
    - RPET
  - PP
  - OPS
  - PVC
  - PLA
  - K-Resin
  - BON

Structure	Characteristics
Monolayer Films	One resin one film (single layer).
Engineered Blended Mono Films	Different resins blended together to produce one mono-layer film. See Figure 1 for an example of a blended film.
Laminations	Different film types are joined together with some type of adhesive or molten polymer. See Figure 1 for an example of a laminated film.
Coextrusions	Multiple film layers are incorporated into a single structure during the manufacturing process to produce one film. See Figure 1 for an example of a coextruded film*.

•Recent advancements in Coextrusion technology have lead to a line of Coextruded films with OTR values up to 1500cc/100 sq. in. while at the same time providing excellent optics and increased stiffness.

LDPE-EVA Blend

LDPE-EVA Coextrusion

LDPE-EVA Lamination

Polymer Sealant Layers

- In addition to unique transmission properties each sealant layer has its own unique sealing properties
- Polyolefins
  - Low Density PE
  - Hi Density PE
  - Medium Density PE
- Metallocenes
  - Linears
  - Plastomers
- EVA
  - %

Antifog Requirements/ Properties

- Coated/Registered
- Impregnated
- OTR Performance
- Impacts Sealing Properties
- Microwaveable
  - Functional
  - Regulatory

Microwave Requirements/Properties

- Applicable CFR's

Although there is no specific code, which applies Microwave applications, the following CFR's may be applicable when dealing with Antifog's in Microwave Applications.

21CFR Chapter 1 177.1520
21CFR Chapter 1 177.1350
21CFR Chapter 1 177.1390
21CFR Chapter 1 177.1395

- Structure, Antifog. Additives
- Are the polymers and additives used to construct the package approved for the temps that the package will reach in the microwave

Packaging Technologies

Produce Physiology Requirements
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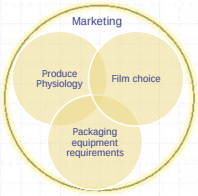
Sustainability



Converting Requirements

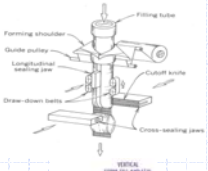
- Dimensions
- Construction Type
- Seal Type
- Graphics
- Stiffness
- Desired OTR
- COF
- Beta Value
- Antifog Requirements
- Re-seal Requirements
- Microwave Requirements
- Cook-In
- Regulatory

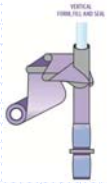
Filling Machine Requirements

- Seal Type
- Filling Speed
- Sealing Conditions
- Differential COF
- Heat Resistance Differential
- Re-seal Attachment
- Antifog

Vertical form fill & seal (VFFS)

- Film is mounted around a tube
- Seals at the back with a lap or fin seal usually
- Rapid
- Adaptable to a wide range of films
- Works well for foods that can fall e.g. chopped lettuce





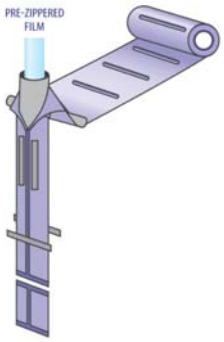
Seal type for pillow packs

- Fin Seal
  inside surfaces of the film meet and seal against themselves.
- Lap Seal
  inside surface of the film seals to the opposite or outer surface of the film.

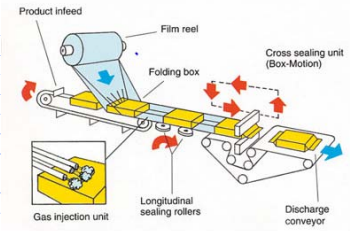
Attachments

Zipper can be placed on roll-stock, resulting in more flexibility during manufacturing,

or can be automatically applied at forming of the bag.

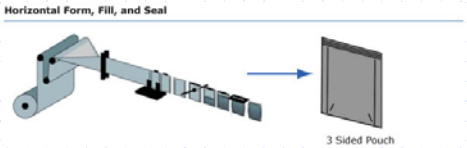


Horizontal form fill & seal (HFFS)



- Uses one film that is folded on itself
- Filled with product
- Sealed at back, front or both ends
- Fast and economical

Horizontal form fill & seal (HFFS)



- Uses one film that is folded on itself
- Filled with product from top
- Sealed at back, front

Horizontal form fill & seal (HFFS)

- Uses one film that is folded on itself
- Filled with product from top
- Sealed at back, front

Stand-Up Pouches

- Allows product to be displayed upright and free-standing
- Good use of shelf space
- Good protection from mechanical damage
- Use stiffer polymers which tend to have lower OTR
- Micro- & macroperforations

Rigid containers

- Clamshells
- Two piece containers
- Trays
- Rigid Containers

Atmospheres

- Natural Aspiration
- Peelable Lidding
- "Breathable Rigid Containers"
- Patch Technology

Perforated films

Macroperforated

- Holes visible to the naked eye
- Reduce water loss without modifying O_2 and CO_2
- Prevents produce from going anaerobic

Microperforated

- Holes of 40-200 um; not visible to the naked eye
- Usually made by laser
- Useful for products with a high respiration rate
- Tends to be a low to moderate O_2 with a moderate to high CO_2; i.e. cannot have low O_2 and low CO_2
- High RH

Jeff's Corollary Packaging Truths

- Temperature Control
- Cold Chain Management
- Incoming Product Quality
- Post-harvest Technology
- Leakers
- Gas Flushing
- Static Environment
- One Product Fits All
- Choosing the packaging the week before launch guarantees a non-optimized package

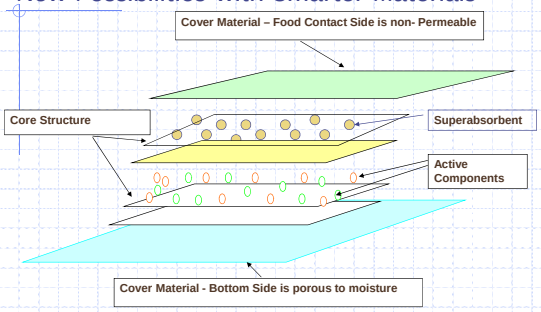
Now let's get back to the Future...

Food Safety

- The CDC in the US summarizes that each year, 1 in 6 Americans get sick from and 3,000 die of foodborne diseases. Reducing foodborne illness by 10% would keep 5 million Americans from getting sick each year. Preventing a single fatal case of E. coli O157 infection would save an estimated $7 million.

Active Packaging

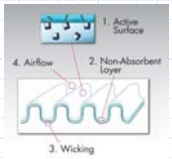
New Possibilities with Smarter Materials



Antimicrobial Packaging

Microbeguard

1. **Active Surface** – silver particles embedded in outer surface.
2. **Non-Absorbent Layer** – Polyethylene coat layer:
   a. Does not absorb essential food oils;
   b. Provides wet strength when soaked.
3. **Wicking** – white kraft paper layer, wicks away surface moisture from food.
4. **Airflow** – surface texture provides breathing.



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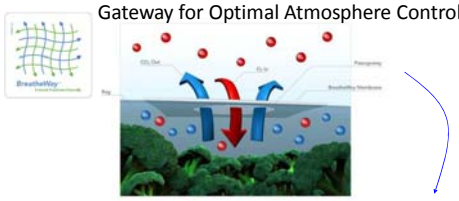
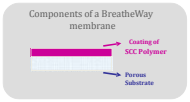
LANDEC

BreatheWay® Membrane

Gateway for Optimal Atmosphere Control





BreatheWay Provides

- Very High Permeability
- Adjustable CO2/O2 Ratio
- Moderate Temperature Compensation
- Improved Quality and Shelf Life

BreatheWay®

Increased Water Vapor Transmission Rate Films

High WVTR can reduce condensation and, therefore, decay

Peelable Resealable MAP Systems

What is sustainability

Sustainable Packaging Technology

Polymers

Plastics are:

- durable,
- lightweight,
- versatile

Therefore they can help reduce waste and consume less energy.

Lighter packaging
= lighter loads
= fewer trucks and railcars needed to ship the same amount of product.

This helps to:

- reduce transportation energy,
- decrease emissions
- and lower shipping costs.

For example, just 1 kg of plastic can deliver 30 liters of a beverage.

http://plastics.americanchemistry.com/Sustainability-Recycling

Sustainable Packaging… the '-abilities'

- Recyclable
- Renewable
- Compostable
  - Industrial
  - Consumer
- Degradable
  - Oxy
  - Bio
  - Land Fills

Sustainable Packaging Technology

"Green Polymers"

Nature & More first to market with new sugar cane packaging

- looks like fine cardboard
- easily compostable,
- 100% GMO free!
- made of waste material,
- tree-friendly
- plastic-free.

And the market is embracing this new development.

Sustainable MAP Films

- What sets this product apart from what is currently available is that it will be a fully compostable (both home and industrial composter) in combination with being able to engineer the gas transmission rate of the film structure.
- It will also be biodegradable
- This allows MAP to truly enter into the world of sustainable packaging

Packaging of Fresh-cut Produce

- Optimally designed packaging plays a critical role
- The fundamentals must be covered
- At the end of the day what are the customer requirements and what creative technologies can be brought to bear to address those requirements
- We supply a technical support service that happens to include packaging
- Packaging must be an integral part of the entire new product development process
- The technology and supply of packaging is a global effort in a global market

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