

Kraft Foods'/Oscar Mayer's Barrier Property Requirements and Associated Flexible Packaging Challenges

Presented by:

Dan Feldmeier

Sr. Assoc. Principal Engineer

Kraft Foods



Outline

- Kraft's Flexible Packaging
- Processed Meats Packaging
 - The chemistry of cured meats
 - The primary causes of spoilage
- Packaging and Product Shelf Life
 - Meat packaging
 - Cheese packaging
 - Bread packaging
 - Cookie/Cracker packaging
- Challenges
 - Challenge 1 - Removing headspace oxygen
 - Challenge 2 - Leaker detection
 - Challenge 3 - Sustainability – Front end
 - Challenge 4 - Sustainability – Back end

Kraft and Flexible Packaging

- Kraft Foods is one of the largest flexible package users in North America.
- Capri Sun – stand up pouches



Kraft and Flexible Packaging

- Kraft cheese – horizontal and vertical pouches
- Nabisco – Flow wrap and bag in box



Kraft and Flexible Packaging

- Oscar Mayer – thermoform-fill-seal and stand-up pouches
- I will focus on processed meat packaging and touch on component packaging.





Processed Meats

- Produced from pork, beef, or poultry raw materials
- Categories include ham, turkey, salami, bologna, hot dogs, and bacon
- Usually fully cooked (exception is bacon)
- Often smoked
- Normally cured using sodium nitrite (responsible for characteristic pink color)



Processed Meats - Curing

- Curing is the chemical reaction whereby nitric oxide (NO) binds to the iron atom in myoglobin. Upon heating, a fairly stable pigment is formed.
- Beneficial effects of curing
 - Pink color (nitrosylhemochrome pigment)
 - Flavor and texture improvement
 - Antioxidant (slows lipid oxidation)
 - Microbial inhibitor



The Role of Packaging

- Packaging plays an important role in controlling the predominant causes of spoilage.
- It accomplishes this by limiting exposure of the product to oxygen and/or light.



Mechanisms of Processed Meat Spoilage

- Spoilage is a negative change in product quality attributes (appearance, texture, flavor) over time. There are 3 main mechanisms of spoilage in processed meats.
 - Rancidity
 - Microbiological Outgrowth
 - Light Catalyzed Oxidative Fading



Rancidity

- Development of off-flavors due to lipid oxidation
- Occurs when oxygen reacts with unsaturated portions of fat molecules forming volatile organic compounds
- Rancidity in processed meats is normally controlled through the use of barrier packaging materials to limit the product's exposure to oxygen.



Microorganisms

- Lactobacillus is the family of organisms of primary concern for spoilage in processed meats.
- If allowed to grow in sufficient numbers, they may form slime or cause souring, gas, milkiness, or discoloration.
- Spoilage due to microorganisms is controlled by:
 - Cook cycle
 - Good manufacturing practices
 - Good sanitation practices
 - Storage temperature
 - Formulation / ingredients
 - Limiting oxygen via packaging



Fading

- Fading is a visually noticeable color change from the normal pink color of cured meat to undesirable shades of brown, grey, or green.
- Photocatalyzed oxidation of nitrosylhemochrome (pink) to oxidized porphyrins (green, yellow, colorless) is responsible for fading.
- Fading may be controlled either by blocking light or by limiting oxygen exposure to the product.
- In practice, consumers favor clear packaging vs. opaque, so the preferred strategy to control fading is to limit oxygen exposure.



Providing Shelf Life – Meat Packaging

- Moisture barrier is not as critical as oxygen barrier for meat packaging.
- The shelf life of meat is protected by reducing exposure to oxygen.
 - Limit initial load – Vacuum or MAP packaging
 - Reduce oxygen transfer into package



Providing Shelf Life – Meat Packaging

- Packaging of processed meats is typically designed to prevent fading, because visually detectable color changes typically occur well before unacceptable rancidity or aerobic microbiological outgrowth.
 - MAP, Oxygen <0.5%
 - Vacuum, <3-5 cc residual air
 - EVOH barrier <0.2 cc/100in² @0%Rh
 - PVDC barrier <0.5 cc/100in² @ 0%Rh
 - Always exceptions, bacon can use less barrier



Providing Shelf Life – Meat Packaging

- When shelf life is driven by microbiological outgrowth, shelf life is not extended by increasing oxygen barrier because the microorganisms typically responsible for spoilage grow equally well with or without oxygen.

Providing Shelf Life – Cheese Packaging

- Cheese is similar to meat in requiring low oxygen levels; however, since it does not have the fading issues the oxygen requirements are not as low.



- Cheese requires slightly more moisture barrier than meat but for most flexible film packages this is not an issue.

Providing Shelf Life – Bread Packaging

- Bread does not require the low oxygen levels of meat or cheese because mold growth is largest oxygen issue.
 - Important because retained air in product difficult to achieve under 1% oxygen in package.
- Moisture barrier more important than with cheese but not difficult to achieve.
- Moisture management within the bread itself is most critical.





Providing Shelf Life – Cookie/Cracker Packaging

- Cookies and Crackers require the least oxygen barrier packaging and often are not MAP.
- Moisture barrier is key to the product shelf life. Increasing moisture barrier does increase the product shelf life.



Challenges

- Challenge categories:
 - Removing headspace oxygen
 - Leaker detection
 - Sustainability

Challenge 1 –

Removing Headspace Oxygen

- Some meat items are more sensitive than others to fading and require headspace oxygen levels below the capabilities of commercial MAP packaging equipment.
- Today we have 3 options
 - Vacuum package
 - Black / opaque package
 - Oxygen scavenger sachet

Challenge 1 – Removing Headspace Oxygen

- There are draw backs with each of the current options.
 - Vacuum often smashes the meat and wrinkles the package
 - Black packaging hides the product
 - Sachets can get pulled out with meat or opened and eaten



Challenge 1 –

Removing Headspace Oxygen

- The desire is to have an oxygen scavenger that can be incorporated into the film.
 - Fast acting
 - Clear
 - No expensive initiation equipment
 - Cost comparable to sachet (1-2 ¢/pkg)



Challenge 2 – Leaker Detection

- Everything we discussed assumed good hermetic seals and no other film leaks.
- Reality is leakers do occur in production so you need a method to detect and remove them.



Challenge 2 – Leaker Detection

- There are many detection methods available
 - Visual
 - Pressure decay systems such as the one patented for Lunchables
 - Vision systems that inspect the package seal
 - Thermal systems that inspect the package seal after sealing



Challenge 2 – Leaker Detection

- The desire is to have a leak detection system that can be incorporated into any production line.
 - Inspects 100% of packages at line speeds
 - Catches all leaking packages and passes over 99.9% of the good packages
 - Can be in wash down environment
 - Low capital cost

Challenges 3 & 4 – Sustainability



- 3 Aspects of Sustainability – Environmental, Economical, and Social
- I will concentrate on environmental and economical.
- Economical is divided into 2 types
 - Bottom-line gains – reduced material cost or improved transportation efficiency
 - Top-line gains – increase in sales or retail price

Challenges 3 & 4 – Sustainability



- Sustainability improvements - 5 R's – Reduce, Remove, Renew, Reuse, and Recycle
- The first 3 R's are Front-end (before use) and the last 2 R's are Back-end
- Front end sustainability is where flexible packages excel – low material use compared to amount of product protected



Challenge 3 – Sustainability – Front End

- Reduce - opportunity to change from rigid options to flexible.
 - Great for reduction.
 - Typically a bottom-line economic increase.
 - If you have dominant share, top-line economic advantage is minimal.
 - If you do not have dominant share and competition does not follow, you can have top-line economic advantage.



Challenge 3 – Sustainability – Front End

- Reduce – opportunity to reduce layers if already using flexible material
 - Material advances allow flexible layers to be made thinner.
 - Entirely bottom-line economic advantage.



Challenge 3 – Sustainability – Front End

- Remove – stand-up pouches can replace bag in box options
 - Similar to the change from rigid to flexible
 - Mostly is a bottom-line economic decision with minimal top line opportunity.



Challenge 3 – Sustainability – Front End

- Renew – using bio-based materials or recycled content
 - Great opportunity to do more
 - This third challenge is 2 fold
 - For producers of packaging material, it is to make these materials more economically.
 - For the consumer goods companies, it is to figure out how to talk about these improvements so they have top-line economic advantage.



Challenge 4 – Sustainability – Back End

- Reuse
 - Hard to clean
 - Designed to only last through one use
 - Mistake to focus here and lose the advantage of minimal material use
 - If we extend reuse to waste-to-energy there is opportunity here; however, outside our scope.



Challenge 4 – Sustainability – Back End

- Recycle
 - Multi-layered makes minimal use of materials with each layer providing a specific benefit.
 - Recycling difficult because the different layers do not mix well in reprocessing.
 - Lightweight packages works against the economics of material collection.



Challenge 4 – Sustainability – Back End

- Recycle
 - Being able to recycle flexible barrier packaging would give top-line economic opportunity - low material use & recyclability resonate with consumers
 - The final challenge –
find recycling methods for flexible barrier packaging
 - De-polymerizing flexible packaging may be an opportunity



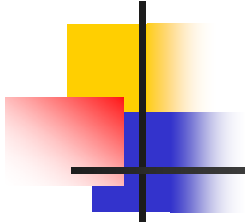
Challenges Summary

- Improve in-film oxygen scavengers
- Develop versatile low cost leak detection
- Improve economics of bio-based and recycle-content films and determine how to sell to consumers
- Find recycling methods for flexible barrier packaging



References

- Bailey, M. E., R.W. Frame, and H.D. Naumann. Cured Meat Pigments: Studies of Photooxidation of Nitrosomyoglobin. *Journal of Agriculture and Food Chemistry*. 12:89-93. 1964.
- Walsh, K.A., and D. Rose. "Meat Pigments: Factors Affecting the Oxidation of Nitric Oxide Myoglobin." *Journal of Agriculture and Food Chemistry*. 4:352-355. 1956.
- Casey, Linda, assoc. ed. "Second Life: Recycling and Waste-To-Energy technologies promise eco-friendly 'second lives' for flexible packaging." *Packaging Digest* January 2009.
- Mally, Timothy G. and Johnson, Carl W. Package Lead Detection U.S. Patent 5,226,316 granted July 13, 1993.
- Zerfas, Paul Z. Challenges of Processed Meat Packaging, Conference Proceedings, SPE FlexPackCon 2009, February 2008.



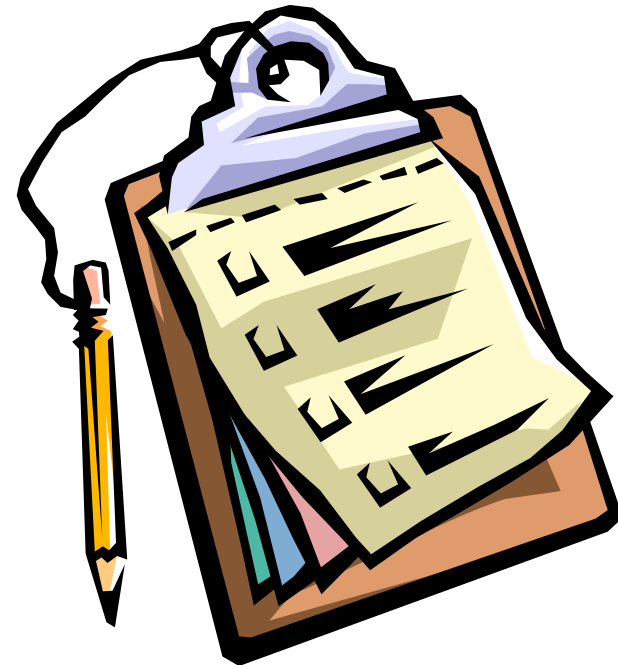
Thank You

PRESENTED BY

Dan Feldmeier

Sr. Assoc. Principal Engineer

Kraft Foods



*Please remember to turn
in your evaluation sheet...*