Advances in Airtight Paperboard Packaging

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Session + papernumber
Food Packaging Functions

..and everything in between
An Airtight Paperboard Packaging

- Offers Excellent Printing Surface
- Sustainable Packaging
- Fits On-the-Go
- Dry Food Packaging Knowledge
- Polymer Coated Barrier Material
- Enhanced Side Seam Protection
- No Aluminum → Suitable for Metal Detection
- Protects Against Contamination (*moisture, oxygen, light, mechanical damage*)
- New customers, new segments
- Offers Excellent Printing Surface
- Sustainable Packaging
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Dry food packaging knowledge

The critical factors for shelf life of dry food are:

- changes in moisture content
- oxidation of fats

Often it is more difficult to eliminate moisture changes in the product itself than to prevent changes due to environment.

It is important to understand basic requirements of a product before designing a new packaging concept:

- heat treatment and salt content affecting water absorption properties of the product
- the critical moisture content etc.
## Dry food packaging knowledge

**Case: Nuts**

<table>
<thead>
<tr>
<th>Possible changes in quality</th>
<th>Effects</th>
<th>Packaging requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oxidation of fats</strong></td>
<td>Off-odours and -flavours</td>
<td>Oxygen barrier (vacuum packaging) (modified atmosphere packaging)</td>
</tr>
<tr>
<td>Nuts have high oil contents.</td>
<td></td>
<td></td>
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<tr>
<td>➔ Lipid oxidation is the main type of deterioration.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Loss of aroma</strong></td>
<td>Staling</td>
<td>Oxygen barrier</td>
</tr>
<tr>
<td><strong>Water absorption</strong></td>
<td>Loss of crispiness Staling Increase in moisture content increases susceptibility of nuts to microbial growth.</td>
<td>Moisture barrier</td>
</tr>
<tr>
<td>Typically nuts have low moisture content 1 – 5 % and water activity ($a_w$) around 0.2 to 0.4.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- For example, shelf life of roasted peanuts is usually 2 – 4 months.

Sources: Ruperton, G.L. Food Packaging. 1993
Trezza, T.A. & Krocha, J.M. Protein-Based Films and Coatings. 2002
Airtight Paperboard Packaging

Why Airtight Paperboard Packaging?

Water vapour barrier protects food against

• Caking
• Off-odour and off-taste
• Change in colour
• Loss of crispiness
• Mould growth
Airtight Paperboard Packaging

Why Airtight Paperboard Packaging?

Oxygen barrier protects food against

• Off-odour and off-taste (e.g. rancidity)
• Loss of vitamins
• Change in colour
• Growth of microbes
Airtight Cup Case
Polymer Coated Paperboard Material

- Uncoated or clay coated SBS board
- Multilayer high barrier coatings
- Barrier against:
  - Oxygen
  - Humidity
  - Aromas
  - Grease
Airtight Cup Case
Air tightness

Barrier properties of Airtight Cup =

✓ barrier properties of a material
✓ raw edge protection
✓ tightness of the seams

➔ The better the gas barrier properties of a material, the more effect on tightness leakages have.
Airtight Cup Case
Raw edge protection

Effect of raw edges at tropical conditions (38 °C / 90 % RH):

- $O_2$TR 60 times bigger [cc/(m$^2$ day)]
- WVTR 3 times bigger [g/(m$^2$ day)]

than with raw edge protection.
An Airtight Cup Case
Raw edge protection

 ✓ With raw edge tape
 ✓ With skiving
Airtight Cup Case
Tightness of the seams

It is important to optimize the sealing parameters to avoid leakages through

✓ package seams
✓ lid seam

There is no benefit to use high barrier coatings if tightness of the seams is not verified.
Airtight Cup Case
Tightness Verification System
Airtight Cup Case- Stora Enso AT Master
Airtight Cup Tightness Verification

Locating the leaking point

In-line & semiautomatic setups

Approved by EU, FDA pending

Inexpensive
Safe, non-flammable
Odorless, tasteless

Patented Testing System

Non-destructive Testing Method

Detected leaks stored for Quality Control

Hydrogen (H2) as tracer gas
Airtight Cup Case
Tightness Verification method

• The package is placed in a test cell

• Hydrogen (mixed with $N_2$, $CO_2$ or air) is fed into the package and the system immediately detects possible leakages

• Operator can manually locate the point of leakage
Airtight Cup Case
Tightness Verification Variables

• Level of needed package tightness requirement
  – Right detection limits
  – Correlation to ppm-values

• Test gas accumulation time
  – detection time length

• Needed speed of for measuring
  – Filling Machine Cycle time approximation
Airtight Cup Case
Tightness Verification / repeatability

H₂ leakages in the beginning of the test run (50 cups)
The same cups tested after test run of 5 hours

➔ Repeatability with AT Master is good.
Saturation effect is not noticed.
Airtight Cup Case
H₂ leakages in a steel plate / WVTR

<table>
<thead>
<tr>
<th>Pinhole area µm²</th>
<th>H₂ leakage* ppm</th>
<th>WVTR* 23°C, 50% RH g/pkg/day</th>
<th>WVTR* 38°C, 85% RH g/pkg/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>~90</td>
<td>~110</td>
<td>~0,0007</td>
<td>~0,0008</td>
</tr>
<tr>
<td>~330</td>
<td>~300</td>
<td>~0,0008</td>
<td>~0,0009</td>
</tr>
<tr>
<td>~1880</td>
<td>~960</td>
<td>~0,008</td>
<td>~0,03</td>
</tr>
<tr>
<td>~7190</td>
<td>~2560</td>
<td>~0,06</td>
<td>~0,2</td>
</tr>
</tbody>
</table>

* measured with reference holes in a steel plate (~13 µm thick)
Airtight Cup Case
Tightness Verification Results

• Enables very sensitive leak detection
  – leakage through 1 µm (diameter) within a few seconds
  – repeatable results.

• Accurate leak point detection
  – Hydrogen is the lightest and the smallest of all gases

• Fast detecting method for filled package WVTR and O₂TR leakages
  – Earlier days, now minutes
  – Possible for online testing
Airtight Paperboard Packaging Summary

TOTAL PACKAGING CONCEPT
► customized applications

- market and application know-how
- packaging materials
- package forming, filling and closing machinery
- tightness verification systems
Thank You

PRESENTED BY
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