Xylophane – A Sustainable Barrier for Packaging

Presented by:
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Agenda

• Xylan based barrier material
• Xylan – the raw material
• Material properties
• Further conversion
• Results from customer projects
• Status
• Conclusion
Xylan-based barrier against oxygen, grease and aroma
Based on natural carbohydrate - xylan

- Xylan – natural polysaccharide
- Occurring in wood and agricultural residues
- Available in large amounts
Xylan content in barley husks

- Xylan: 40-50%
- Cellulose: 15-25%
- Starch: 10-25%
- Other
Feed stock for xylan production

- Isolated from husks/hulls from agriculture residues
- Availability of husks/hulls
  - 70 000 – 100 000 tons/year in Sweden
  - > 5 000 000 tons/year in Europe
- Low value by-product – no competition with food
- Alternative end-use of feed stock:
  - animal feed - not ideal from nutrition point of view
  - incineration – inefficient due to high ash content
From agriculture by-products to xylan based barrier in multilayer packaging

Xylan – a natural carbohydrate – is present in large amounts in agriculture byproducts

Xylan is isolated from the byproducts through an extraction process

Xylan in powder form is mixed with additives

The xylan based barrier is incorporated into a multilayer packaging material
Comparison oxygen barrier properties

<table>
<thead>
<tr>
<th>Material</th>
<th>OTR (cc/m²/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum foil</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Xylan-based barrier</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>EVOH</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>PVdC</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>PA MXD6</td>
<td>50</td>
</tr>
<tr>
<td>OPET</td>
<td>250</td>
</tr>
<tr>
<td>LDPE</td>
<td>10 000</td>
</tr>
</tbody>
</table>

~5 µm, 23°C, 50% RH
Excellent grease barrier properties for advanced applications

- KIT-level 12 can be obtained onto suitable paper and board substrates
- Xylan-based barrier resists penetration of aggressive substances such as etheric oils
Example of applications
Method of application: dispersion coating

- Several coating techniques possible e.g. blade, air knife and roll coating
- Application onto paper, board and plastic coating
- Pilot coating trials have been performed
  - Good processability
  - No blocking
  - No blistering
  - Reduction of coat weight compared to laboratory coating
Viscosity at 30°C for slurry with (top curve) and without (bottom curve) filler.
Further conversion – extrusion coating of moisture barrier

- Extrusion coating of moisture barrier onto paper board with xylan-based coating
- Xylan-based barrier could withstand the extrusion coating process
- Adhesion measured with Y-peel
Adhesion

Y-peel

Good adhesion
Customer project: Xylan-based barrier as grease and aroma barrier in industrial sacks

• Development project in cooperation with sack manufacturer and spice producer

• Three problems to solve which were all related to penetration of etheric oils:
  – Grease stains on sack paper
  – Labels fell off
  – Loss of weight during storage (up to 5%)
Customer project: Xylan-based barrier as grease and aroma barrier in industrial sacks

- Dispersion coating of xylan-based barrier in industrial scale
- Sack production in industrial scale
- Filling with product (spices)
- Storage test and evaluation

Xylan-based barrier
LDPE
Paper
Multilayer structure
"You have certainly been successful with the barrier. It works very well for the packaging of etheric oils and grease containing spices. We have had problems with fat stains on the outside of the paper sacks and labels that were falling off due to etheric oils penetrating the bags. With a xylan-based barrier we could eliminate this problem."

*Peter Karlsson, Stores Manager, Bodén & Lindeberg*
Customer project: xylan-based coating as oxygen barrier in crisp bags

- Project performed with converter
- Driver: to find sustainable alternatives to metalized film
- First application: paper-based bags for potato crisps
Customer project: xylan-based coating as oxygen barrier in crisp bags

- Dispersion coating of xylan-based coating
- Extrusion coating of moisture barrier
- Conversion to crisp bags in conventional bag filling equipment

<table>
<thead>
<tr>
<th>Sample</th>
<th>WVTR (38°C, 90% RH) g/m²/day</th>
<th>WVTR (23°C, 50% RH) g/m²/day</th>
<th>OTR (23°C, 50% RH) cc/m²/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper/pre-coating/xylan-based coating/LDPE</td>
<td>13.6</td>
<td>1.4</td>
<td>3.8</td>
</tr>
</tbody>
</table>
Status: Development in co-operation with customers

- Development projects in lab, pilot and industrial scale with potential customers
- Strategic development projects with board and paper producers
- Market entry application projects with end users and converters
Status: Pilot production unit

- Pilot production unit for xylan production
- Optimisation of production process for further up-scaling
- Production of raw material for customer trials and commercial material for niche applications
Summary

- Xylan-based barrier - a renewable alternative to synthetic plastics and metal foils
- Development in cooperation with potential customers
- Preparation for commercial production and market entry
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Thank you

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