COATING AND FLAVOURING OF EXTRUDED SNACKS AND CEREALS
OBJECTIVES OF COATING

Coating is essential
It has an impact on the product’s appearance, texture, structure, taste and smell.
It is the first thing a customer sees when opening the box.

- Consistency
- Uniformity
  - Throughout the process
  - Piece by piece

Even the best quality extruded products require some sort of coating
SAVORY COATING ON EXTRUDED SNACKS
SAVORY COATING ON EXTRUDED SNACKS

Snacks generally contain 25-45% of slurry (dry basis)
- Slurry contains 25-40% seasoning powder and 60-75% oil

- **Oil Type**: in general, liquid oil, which does not need to be heated
- **Seasoning powder**: different types, generally powders with dairy, cheddar or parmesan cheese, or nacho flavours, or can also have herb flavours.

It is important to properly control mixing/recirculation/temperature parameters in order to have a homogeneous slurry.
# TYPICAL COATING RECIPE SNACKS

<table>
<thead>
<tr>
<th>Curl/ Puff</th>
<th>Croutons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OIL</strong></td>
<td><strong>OIL</strong></td>
</tr>
<tr>
<td>70%</td>
<td>75%</td>
</tr>
<tr>
<td><strong>SEASONING</strong></td>
<td><strong>SEASONING</strong></td>
</tr>
<tr>
<td>28.5%</td>
<td>23.5%</td>
</tr>
<tr>
<td><strong>SALT</strong></td>
<td><strong>SALT</strong></td>
</tr>
<tr>
<td>1.5%</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

- Temperature below 35°C
- Applied in order to obtain 30-40% coating (dry basis)
- Temperature below 35°C
- Applied in order to obtain 20-30% coating (dry basis)
SAVORY COATING ON EXTRUDED SNACKS

- Coarse solids require good mixing (fine grinding is required).
- Slurry requires constant movement, so the matrix has continuous recirculation and constant flow of liquid through the coating skid.
- If poorly mixing ➔ Affects the final product and equipment wear (pumps, seals, nozzles)
- Needs more time for absorption prior to packaging.
SLURRY TANKS
Main function ➔ ensure preparation and dosing

- Preparation tank with variable speed mixing.
- Buffer tank, variable speed mixing.
- Dosing line with a metering pump.
- Hygienic design
- Centrifugal recirculation pumps with variable speed
- Compact system with stainless steel frame.
- Automation control with touchscreen.
- Optional: CIP
KEY POINTS FOR SAVORY COATING

Extrusion
Drying

Conveyors

Drum with spraying nozzles

Sifter

Feeding pump

Salt Feeder

Recirculation pumps

Slurry tanks

- Residence time in the drum ≈ 2 min
- Drum rotation speed
- Inclination
- Number and type of nozzles

Coating rate
SUGAR COATING
OBJECTIVES OF SUGAR COATING

- Provides sweetness and flavour
- Improves the consistency, uniformity and appearance of the product
- Provides a crunchy product and forms a barrier that provides protection from milk
- The coating may also contain vitamins and minerals
CRUNCHY?

Source: J.M. Bouvier

Consumer acceptance

→ Tests with consumer panels are essential
PRINCIPLES OF SWEET COATING

- Water-based with high concentration of sugar

Examples of Sugar matrix

<table>
<thead>
<tr>
<th>SUCROSE</th>
<th>INVERT SUGAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>= Sucrose</td>
<td>Dextrose ≈ Glucose (75%) ≈ Corn Syrup</td>
</tr>
<tr>
<td>Sweetening power: 100%</td>
<td>(glucose + fructose≈ H.F. Corn Syrup) (130%)</td>
</tr>
<tr>
<td></td>
<td>Maltose (40%)</td>
</tr>
<tr>
<td></td>
<td>Honey</td>
</tr>
</tbody>
</table>

- Brix Degree (°Bx)  % Dry content

- Mix with other ingredients to add functionality and flavour:
  - Fruit juice concentrate, vanilla flavour, fruit, etc.
  - Oil: to prevent the formation of lumps and improve the glossy appearance
  - Salt
  - Citric or Malic acid to improve flavour (with caution because it is sensitive to heat)
  - Cocoa powder: to provide the chocolate colour and flavour (with caution as it increases viscosity)
  - Lecithin to prevent powder dispersion
DISSOLUTION CURVE-SUGAR SATURATION

Sucrose Concentration in water

Temperature

unstable zone

supersolubility curve

spontaneous nucleation

growth

cooling

stable zone

solubility curve

metastable zone

Working area

80%

60%

40°C

90°C
TYPES OF COATING

Shiny coating

- Ingredients: Invert sugar, caster sugar, dextrose, oil...
- 60-75% dry content

The mix of invert sugars delays the crystallisation to occur

Typical formulation

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>30%</td>
</tr>
<tr>
<td>Sugars (caster, glucose, dextrose)</td>
<td>50%</td>
</tr>
<tr>
<td>Malt Extract</td>
<td>10%</td>
</tr>
<tr>
<td>Powdered cocoa</td>
<td>4%</td>
</tr>
<tr>
<td>Lecithin</td>
<td>0.4%</td>
</tr>
<tr>
<td>Vegetable oil</td>
<td>4.5%</td>
</tr>
<tr>
<td>Chocolate flavour</td>
<td>0.06%</td>
</tr>
</tbody>
</table>

Frosty coating

- Ingredients: sucrose
- 75-82% dry content

Looking for the crystalisation of sugar to occur

Typical formulation

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>20%</td>
</tr>
<tr>
<td>Sugar</td>
<td>80%</td>
</tr>
<tr>
<td>Flavours</td>
<td>&lt; 0.1%</td>
</tr>
</tbody>
</table>
TYPES OF COATING

Shiny coating

Brightness scale: Matte → Shiny
HOW TO CALCULATE THE COATING RATE?

Clextral Standard: Calculation based on Dry basis (D.B.)

Coating rate = \frac{\text{Syrup output (D.B.)}}{\text{Total capacity of the finished product (D.B.)}}

Example: 30% coating 68 Brix.

Feeder
- 1034 kg/h @ 12% moisture

Extrusion
- 1000 kg/h @ 9% moisture
  = 910 kg/h D.B.

Syrup
- 573 kg/h @ 32% moisture
  = 390 kg/h D.B.

Coating

Drying/Cooling
- 1340 kg/h @ 3% moisture
  = 1300 kg/h D.B.

\[
\text{Coating rate} = \frac{390}{1300} = 30\%
\]
SUGARY COATING - TECHNOLOGY

A – Belt weigher

B – Syrup Tanks

C – 2* Rotation Drums
TECHNOLOGY DETAILS – Drums and spraying nozzles

Main function
→ To ensure continuous and homogeneous coating

- Specific spraying nozzles with compressed air
- Flexible drum (Inclinaison/rotating speed)
- Hygienic design, stainless steel.
- 2 drums for continuous production (manual switch).
TECHNOLOGY DETAILS – Drums and spraying nozzles
TECHNOLOGY DETAILS
KEY POINTS OF SUGAR COATING

- Syrup tanks:
  - P: Preparation
  - U: Use

- Extrusion

- Mass flow meter + modulating valve
  - 60-100°C 60-80% Dry basis

- Weigh belt

- Drum
  - Up to 110°C
  - T°C: 120 - 150°C

- Drying
- Cooling
  - Room T° + 10°C

- Residence time
- Drum rotation speed and inclinaison
- Number and type of nozzles
- Coating rate
- Coating recipe
TECHNOLOGY DETAILS
CIP (CLEANING IN PLACE)

CIP =
Hot water recirculation in all pipes and tanks. Automatic procedure.
Manual cleaning of drum
(easy access to all parts; no retention area; stainless steel)
Main function
→ to ensure preparation and dosing

- Syrup preparation tank with helix mixer (homogenise, high speed, high shear).
- Buffer tank with helix mixer (homogenise, high speed, high shear).
- Dosing unit with modulating valve + mass flow meter.
- CIPable, hygienic design
- Automatic water dispensing + manual solid dispensing.
- Compact system with stainless steel frame.
TECHNOLOGY DETAILS – Control Screen + PLC

MAIN FUNCTION

→ Total control of the coating

- Automation system for the entire system.
- User enters coating parameters and the system auto-regulates.
- Smart system: very little operator intervention,
- Recipe management and their preparation.
- 10” touchscreen with parameters, alarms, etc.
- Management of number of open nozzles.
DECISIVE POINTS

✓ Compressed air input allows obtaining finer drops, allowing more uniform coating.

✓ Increasing the coating rate allows more uniform coating, but excess syrup leads to the formation of lumps that are hard to separate after drying.
Recommendation: 30% for products with simple shapes, 35-40% for cups shapes.

✓ Drying/cooling is very important to preserve the shiny or frosty appearance of the products and to separate them. Dryer cleaning is an important point (CIP).
AVAILABLE EQUIPMENT

- **Semi-industrial platform**: Continuous system with coated product capacity of 100 to 250kg/h.

See demo for breakfast cereals and snacks products

TESTING

CLEXTRAL offers semi-industrial testing to improve recipes or develop new products for its clients

- Sweet coating: Frosty & Shiny
- Expanded cereals or flakes
- Total capacity: between 100kg/h and 250kg/h
- Batch dryer: 5kg/batch
- Test on semi-batch or complete line
- CIP System
- Up to 80% Dry basis
COATING

Is the last process in your production line, but the **FIRST THING** your customers see when they open the packaging.
Thank you for your attention

www.clextral.com