Principles of Coextrusion

Stork Townsend QX systems

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Sausage Classifications

- Fresh
- Fresh-Smoked
- Cooked
- Cooked-Smoked
- Semi-Dry
- Dry
- Specialty Meats
Edible Collagen Appears

• In 1960 while working to develop a stronger surgical suture material than animal gut, the Johnson & Johnson company discovered a way to make edible collagen casings. This collagen was harvested from the middle layer of beef skins.

• This harvested collagen casing was stronger, more uniform and much more sanitary than the traditional natural gut casings.
With the approaching new century came the most radical development yet.

A new way of making sausages appeared on the market.

A way that is cheaper, highly automated and more sanitary than ever before is.....

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The Co-extrusion Process
What is Co-Extrusion (QX)

• In modern times, casings started to be made out of:
  
  – Cellulose
  
  – Pre-fabricated collagen
  
  – Plastics
• The success of the pre-fabricated casings prompted the development of a new sausage production method, better known as:

Co-Extrusion
The Co-Extrusion Principle

• Casing Development:
  – Casing material:
    ▪ Beef and pork based collagen
    ▪ Hybrid (collagen/Alginate)
    ▪ Alginate gel
  – Brine:
    ▪ Sodium-Chloride (NaCl)
    ▪ Di-Potassium-Phosphate (K₂HPO₄)
    ▪ Calcium-Chloride (CaCl₂)
  – Casing development:
    ▪ Crosswise fiber orientation
    ▪ Collagen fibers collapse (precipitation)
    ▪ Brining time: 2 – 40 seconds
The Co-Extrusion Principle

Casing Development:

- Chemical cross-linking:
  - Bridge between fibres
  - Network of fibres
  - Aldehydes
  - Liquid smoke

- Result:
  - Permanent skin
  - Colour, taste and flavour
  - Bite
Co-Extrusion (QX) Principle

- Casing gel
- Meat dough
- Cooling water
- Brining
Co-Extrusion (QX) Principle
Sausage diameter

- Cooling water
- Casing Gel
- Meat-dough
- Brine
- Counter-Rotating head

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Co-Extrusion (QX) Principle

Sausage length
History of Co-Extrusion

- **1960** – Invented in England
- **1972** – First Co-extrusion system installed in England
- **1978** – Transferred to The Netherlands
- **1980** – First production systems in operation in The Netherlands
- **1982** – First successful production system sold to Spain
- **1985** – Japan purchased first Co-extrusion system
History of Co-Extrusion

• **1990** – In the 90’s Co-extrusion became worldwide known.

• **1998** – Townsend Engineering Company introduces the Kontura Co-extrusion system.

• **2001** – Townsend Engineering Company acquires the Protecon Langen Company, and the Protecon Co-Extrusion technology, from Stork.

• **2002** – The introduction of QX-systems.
History of Co-Extrusion (QX)

- **2005** – QX systems sold to Hungary, South-Africa, U.S.A.
- **2006** – QX systems sold to Romania, U.S.A., U.K.
- **2007** – QX systems sold to U.S.A., U.K.
History of Co-Extrusion

Co-Extrusion systems sold world wide

Austria, Belgium, China, Denmark, Great Britain, France, Hungary, Italy, Japan, Portugal, Romania, South-Africa, Spain, Sweden, Switzerland, Taiwan, The Netherlands, USA.
What is Townsend QX?

• The QX Technology is based on this (Co-extrusion) technology.

• A QX system is a fully automated system that simultaneously extrudes a continuous flow of meat-batter and a thin layer of casing material.

• In stead of filling a casing, the QX process is actually creating the casing as the sausage is produced.
Benefits of Co-Extrusion (QX)

• **Commercial motivations!**

• **Savings motivations!**

• **Food safety motivations!**

• **Automation motivations!**

• **Versatility**
Benefits of Co-Extrusion (QX)  
Commercial motivations

• Appearance and sausage shape:  
  – QX processing results in perfectly shaped sausages.

• Casing:  
  – Bite can be influenced.  
  – QX casings are an edible part of the final product.

• Q = LV:  
  – Constant weight, length, caliber.  
  – Constant process conditions guarantee an uniform product.
Benefits of Co-Extrusion (QX)

Commercial motivations

• Reduced Processing Times:
  – Compared to conventional processes, QX typically reduces 30% to 60% of the process time.

• Maximum uptime:
  – The QX systems are designed for continuous operation.
  – They have a very little downtime.

• Cooking characteristics:
  – Cooking, grilling, deep fat frying, microwave.

• Uniformity:
  – All QX sausages are identical and perfect for automatic packaging.
Benefits of Co-Extrusion (QX)
Savings motivations

• Casing Savings:
  – Less expensive gel costs than collagen or natural casing.
  – No twist losses.
  – No start-stop losses.
  – No breaks.

• Labor savings:
  – QX systems are fully automated and need one operator / supervisor only.
  – Up to 80% labor reduction.
Benefits of Co-Extrusion (QX)

Savings motivations

• Reduced rework, waste / give away:
  – *No* pre-fabricated casings.
  – *No* beginnings.
  – *No* ends.
  – *No* breaks.
  – *Improved* weight control.
  – *Continuous* operation.
  – *Constant* process conditions.
Benefits of Co-Extrusion (QX)

Food safety motivations

• Two Levels of Enhanced Safety!

Level 1.

Elimination of peeling operations:
* Reduce risk of microbial contamination.

Level 2.

Cook in the pack:
* Eliminate microbial contamination.
* Increased shelf life.
* Non post lethality exposed sausage production.
  (Less HACCP costs).
Benefits of Co-Extrusion (QX)  
Food safety motivations

- **Cook in the pack, principle:**
  - Vacuum-packaged products are first immersed in hot water for cook-in-pack and afterwards in cold water for chilling.
  - Vibrating conveyor for de-stacking the packages.
  - The packages are dried by air-knifes above and underneath the packages.

- **Specification:**
  - Typical hot water temperature 176-185°F.
  - Typical cold water temperature 35-39°F.
  - Process time: depending on product diameter and number of layer.
Benefits of Co-Extrusion (QX)

Food safety motivations

• Cooking Principle:
  Heating of the vacuum packaged products to core temperatures between 149ºF - 167ºF.

• Chilling:
  Chilling of the vacuum packaged products to core temperatures between 39ºF - 50ºF.

• Finishing:
  After blowing off the residual water drops from the package, the product is safe and ready to be boxed, stored or transported.
Cook - In – Package
Food safety

1. In-feed conveyor
2. Water-cook section
3. Water-chill section
4. Water blow-off section

A. Hot water spray system
B. Insulated cover
C. Endless mesh belt
D. Cold water spray system
E. Air blow-off
Co-Extrusion (QX) Systems

- Fresh sausage systems
- Cooked-smoked systems
- Dry sausage systems
Fresh sausage systems

• **QX Fresh-frozen/cooked sausage systems** (Collagen, Hybrid, Alginate)
  - Short or extended brining

• **Coexskin Nijal Fresh sausage systems** (Alginate)
  - Short bringing
Fresh sausage systems
QX Fresh-frozen/-cooked sausage systems
Fresh sausage systems
QX Fresh-frozen/-cooked sausage systems

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Fresh sausage systems

Coexskin system - Extruder

Meat in center

Extruder

Alginate gel around meat rope

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Fresh sausage systems
CoexSkin system

Brine Bath
QX Cooked-smoked systems

• Link system
• Ring System
• Spiral
QX Cooked-smoked link basket systems
**QX** Cooked-smoked link basket systems

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QX Cooked-smoked ring basket systems

QX – Ring System
• Ring
• Link

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QX Cooked-smoked ring basket systems
QX Cooked-smoked ring basket systems
QX Cooked-smoked ring basket systems

• Production Savings for QX Ring-Sausage

• Casing Savings = 30%
• Labor Savings = 50%
• Microbial Savings = 09%
• Other Savings = %

- Rework 3.5%
- Waste 1.5%
- Weight control 2.0%
- Smoke ...
- Indirect cost reduction ...

Total = 0.19 – 0.38 $/Lb

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QX Cooked-smoked link spiral systems
QX Sausages and producers

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QX Sausages and producers International

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QUESTIONS?