Food Security and Nutrition - The Tetra Pak Case

Dr. Bozena Malmgren
Company Specialist
Dr. Bozena Malmgren
For every dairy production solutions

Company Specialist Dairy Aseptic

Educated in food technology
PhD subject difference between steam injection and steam infusion

Working in the company with aseptic processing for 36 years

Supporting all world markets with knowledge in general dairy field as well as aseptic technology
Food Security and Nutrition - The Tetra Pak Case

Dr. Bozena Malmgren
Company Specialist
Our carton family portfolio
The widest range of shapes and volumes to choose from
A multi-product company

Processing systems

Carton packaging systems
Our Business 2016
65 years working alongside food producers

24,100
Employees

>175
Countries

>3% of turnover
Investment in R&D

<table>
<thead>
<tr>
<th></th>
<th>Packaging</th>
<th>Processing</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units delivered 2016</td>
<td>336</td>
<td>2,230</td>
<td>938</td>
</tr>
<tr>
<td>Units in operation</td>
<td>8,860</td>
<td>76,000</td>
<td>20,000</td>
</tr>
</tbody>
</table>
OUR PROMISE
Protecting Food, Protecting People, Protecting Futures
The pillars of our brand and the chapters of our sustainability story

- **FOOD**
  - Safety, Quality & Availability
  - Protecting products with our processing & packaging solutions

- **PEOPLE**
  - Employees, communities & society at large
  - Safeguarding, supporting and developing those whose lives we touch

- **FUTURES**
  - Innovative technologies & smart solutions
  - Understanding and supporting our customers’ business growth ambitions

- **FUTURES**
  - Materials, water, CO₂ & more
  - Pursuing environmental excellence along the entire supply chain
Drive a sustainable business
Low environmental impact
Minimizing cost and saving nature

- Minimizing water consumption
- Minimized product loss
- Low water consumption
- Low detergent consumption
- Minimized effluents
Sustainable products
Our long-term goal: all packages from 100% renewable materials

- Tetra Rex® Bio-based
  - The world’s first fully renewable package Tetra Rex®
- Tetra Brik® Aseptic 1000 Edge
  - Bio-based LightCap™
  - The first Tetra Brik® package made from over 80% renewable materials

Products are designed with recycling in mind

- Plastic’s derived from sugarcane used for caps and coatings
- Paper board that’s FSC™ certified
OUR VISION

We commit to making food safe and available, everywhere
Aseptic technology – versatile technology for hot climate countries

- Cold chain is unpredictable or missing at all
- Remain fresh and safe without refrigeration
- Allow transportation ambient on long distance
Aseptic food

- No preservatives
- Long self life
- Ambient distribution and storage
Commercial sterility means the absence of microorganisms capable of growing in the food at normal non-refrigerated conditions at which the food is likely to be held during manufacture, distribution and storage (Codex Alimentarius*).

Aseptic processing

Product

Sterilisation

Aseptic environment

Container

Sterilisation

Filling & sealing

Aseptically packed product

Aseptically packed product
Important Growth Factors

- Temp
- Time
- Acidity
- Nutrients
- Oxygen
- Water
Effect of pH on growth of micro-organisms

- pH 2.0: Apple
- pH 2.5: Grape
- pH 3.0: Orange (sweet)
- pH 3.5: Grapefruit
- pH 4.0: Pineapple
- pH 4.5: Tomato juice
- pH 5.0: Vegetable juice
- pH 5.5: High-acid food

Low-acid food

Pathogenic bacteria

Lactic acid bacteria

Mould

Yeast

Sporoformic bacteria
### Principles of UHT processing

Influence of heat treatment on sterility and chemical changes

<table>
<thead>
<tr>
<th>Temperature °C</th>
<th>F₀ min</th>
<th>Time sec (z = 10°C)</th>
<th>C min (z = 30°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>121</td>
<td>6,0</td>
<td>360</td>
<td>30,0</td>
</tr>
<tr>
<td>135</td>
<td>6,0</td>
<td>14</td>
<td>3,5</td>
</tr>
<tr>
<td>140</td>
<td>6,0</td>
<td>5</td>
<td>1,7</td>
</tr>
<tr>
<td>150</td>
<td>6,0</td>
<td>0,47</td>
<td>0,37</td>
</tr>
<tr>
<td>160</td>
<td>6,0</td>
<td>0,04</td>
<td>0,07</td>
</tr>
</tbody>
</table>
Available UHT systems on the market

Indirect systems
► Tubular heat exchangers
► Plate heat exchangers

Direct systems
► Steam injection
► Steam infusion
Indirect heating
Available UHT systems on the market

**Indirect systems**
- Tubular heat exchangers
- Plate heat exchangers

**Direct systems**
- Steam injection
- Steam infusion
Direct UHT systems
Tetra Therm® Aseptic VTIS

Flash cooling

*(all-in-one design)*
UHT - Ultra High Temperature processes

![Graph showing temperature vs. time for Direct and Indirect UHT processes.](image-url)
Example: UHT milk – nutritional value
Milk – important part of diet

**Energy** – fat 3.8-4.2%

**Protein** 3.2-3.4%

**Calcium** 1200-1300mg/l

**Vitamins** (A,D,B complex, folic acids)

**Trace elements**
Only healthy animal can produce high quality raw milk
Micro-organisms... can be found everywhere
The influence of temperature
Bacterial development in raw milk
Good quality raw material
The influence of temperature

Bacterial development in raw milk

CFU/ml

0  4  8  12  16  20  24

0,3  1  2  3  4  5  10  15  20  30  500  900

4°C  15°C  20°C  25°C  30°C

Hours

20°C

15°C

4°C

25°C
Unprocessed milk – can be dangerous

- Brucellosis
- Tuberculosis
- Q fever

BM/2013 12 01 / 33
Unprocessed milk – can be dangerous

- Shigella
- E.coli
- Salmonella
Tetra Therm Lacta
Goal for pasteurisation

To destroy pathogenic bacteria in foodstuffs
Pasteurisation

- Phosphatase
- Peroxidase
- Lethal effect for bacteria
- Destruction of enzymes

- Coli bacteria
- Tubercle bacteria
- Typhus bacteria
- Heat resistant micrococci

Temperatures and times for various effects:
- 60°C: 2.5h
- 65°C: 2.0h
- 70°C: 1.0h
- 72°C: 30 min
- 75°C: 20 min
- 80°C: 10 min
- 85°C: 5 min
- 90°C: 2 min
- 90°C: 1 min
- 90°C: 15 s
- 90°C: 10 s
- 90°C: 1 s
Milk fat
Milk – valuable protein source

<table>
<thead>
<tr>
<th>Protein</th>
<th>Biological value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hen’s egg</td>
<td>100</td>
</tr>
<tr>
<td>Cow’s milk</td>
<td>92</td>
</tr>
<tr>
<td>Casein</td>
<td>73</td>
</tr>
<tr>
<td>Lactoalbumin</td>
<td>104</td>
</tr>
<tr>
<td>Cattle beef</td>
<td>78</td>
</tr>
<tr>
<td>Potato</td>
<td>69</td>
</tr>
<tr>
<td>Peanut</td>
<td>60</td>
</tr>
<tr>
<td>Wheat flour</td>
<td>45</td>
</tr>
</tbody>
</table>
Influence of heat
# Milk proteins – excellent source of essential amino acids

<table>
<thead>
<tr>
<th>Essential Amino Acid</th>
<th>Minimal Daily Intake (in mg)</th>
<th>Content in 1 Litre of Milk (in mg)</th>
<th>Litre of Milk Needed (Adult)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tryptophan</td>
<td>0.25</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Phenylalanin</td>
<td>1.1</td>
<td>1.8</td>
<td>0.6</td>
</tr>
<tr>
<td>Leucin</td>
<td>1.1</td>
<td>3.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Isoleucin</td>
<td>0.7</td>
<td>2.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Threonin</td>
<td>0.5</td>
<td>1.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Methionin</td>
<td>1.1</td>
<td>0.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Lysine</td>
<td>0.8</td>
<td>2.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Valin</td>
<td>0.8</td>
<td>2.3</td>
<td>0.4</td>
</tr>
</tbody>
</table>

- **Reduction by up to 5%**
- **Not of significant influence**
Milk proteins – nutritional value
Infant formulas

After storage at elevated temperatures bioavailability of essential amino acids for infants can be reduced.
Calcium

Milk

Cream

Ca
Calcium bioavailability

No negative effects of heat treatment and storage

Absorption almost as good as in raw milk
Vitamins in milk

\[ \text{Folic Acid} \]

\[ B_2 \]

\[ B_6 \]

\[ B_{12} \]
# Heat induced losses of vitamins

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Short boiling</th>
<th>UHT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B1 [%]</strong></td>
<td>10 – 20</td>
<td>5 - 15</td>
</tr>
<tr>
<td><strong>B2 [%]</strong></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>B6 [%]</strong></td>
<td>5 – 8</td>
<td>10</td>
</tr>
<tr>
<td><strong>B12 [%]</strong></td>
<td>20</td>
<td>0 – 30</td>
</tr>
<tr>
<td><strong>C [%]</strong></td>
<td>15 – 20</td>
<td>10 – 20</td>
</tr>
<tr>
<td><strong>Folic acid [%]</strong></td>
<td>15</td>
<td>10 – 20</td>
</tr>
</tbody>
</table>
## Loss of vitamins in UHT milk

<table>
<thead>
<tr>
<th>Vitamine</th>
<th>Losses by (%) UHT treatment</th>
<th>Sensitivity to Light</th>
<th>Sensitivity to Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascorbic Acid</td>
<td>0–80</td>
<td>–</td>
<td>+++</td>
</tr>
<tr>
<td>Folic acid</td>
<td>10–20</td>
<td>–</td>
<td>++</td>
</tr>
<tr>
<td>B₁₂</td>
<td>0–30</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>B₆</td>
<td>0–20</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>B₂ (riboflavine)</td>
<td>&lt;10</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>Thiamin</td>
<td>&lt;10</td>
<td>+++</td>
<td>–</td>
</tr>
<tr>
<td>A</td>
<td>Very low</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>D</td>
<td>Very low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Very low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Aseptic packaging material

1. Inside plastic layer
2. Internal coating
3. Al-foil
4. Lamination
5. Paperboard and printing
6. Outside plastic layer / Decor layer
Safe and Nutritional UHT milk
Commercially sterile products
Absolutely safe for consumption
Commercially sterile products
Allow us to distribute
and store at ambient conditions
Unique combination of processing and packaging technology

Without entrance of bacteria
Maintenance and quality assurance

- Quality Control of raw materials
- HACCP
- Quality Control of final product
World market of aseptic packed products

Growth by 5% a year

Growth by 22% a year

Source: Zenith Intl.
TOGETHER WE CREATE A BETTER FUTURE

WE LIVE OUR PROMISE: