total customer focus

“Basic principles of shelf life assessment”

Jochen P. Zoller
What does this presentation cover?

• Intertek and global market trends
• Safety & Quality aspects of self life
About Intertek…

Intertek provides **quality and safety services** to a wide range of global and local industries.

Partnership with Intertek brings **increased value** to customers’ products, processes and ultimately **supports their success** in the global marketplace.

….we support our customers in their global trade
Our Profile

- Countries: 110
- Laboratories: 355
- Offices: 577
- Employees: 21,000

Floated May 2002
FTSE 250, Support Services Sector
Market capitalization at July 2007 £1.5bn

AMERICA
35%
Turnover, People

EAME
33%
Turnover, People

ASIA
32%
Turnover, People
Crises in the food industry in the past

Salmonella

BSE

Avian flu

Dioxin

Bovine spongiform encephalopathy

Melamine

1,3,5-Triazine-2,4,6-triamine

H5N1
Global impact of foodborne diseases

- Rapid globalization of food production and trade has increased the potential likelihood of food contamination.
- In 2005 over 2 million people died from diarrhea diseases.
- Even in industrialized countries, up to 30% of the population of people have been reported to suffer from foodborne diseases every year.
- Foodborne illnesses can and did inflict serious and extensive harm on society.
- Food contamination creates an enormous social and economic strain on societies. (e.g. US $35-40 billion annually on medical costs and lost productivity due to major pathogens)
What does this presentation cover?

- Intertek and global market trends
- Safety & Quality aspects of shelf life
What shelf life means?

- **Shelf life** is the time period from manufacturing until reaching the “best before date”
- “**Best before date**” names the date until the product remains a defined quality (quality = set standards)
- **Food must be safe at the “best before date”**
- **Nutritional values, appearances, colour, odour** may have changed when reaching the best before date as any food undergoes permanent change during storage
What shelf life means?

• “Use by date” is often used with food that perishes very easily and has an especially high risk of becoming “unsafe” due to excessive storage.

• Food with the “use by date” must not be sold or put into circulation for consumption in anyway after reaching this date.
History and current situation

- Shift towards from fresh foods to perishable foods
- Shelf life can be extended
- Food is longer fit for consumption
- Food can be distributed worldwide without any quality or safety leakages
- Food can be consumed worldwide
Process hygiene vs. Food safety

Responsibility of food business operators

- Production process
- Before food has left the facility
- During the shelf-life

Additional studies...

PROCESS HYGIENE criteria

FOOD SAFETY criteria

Under the control of the company with the HACCP and GMP

Source: HDE, 2007
Who influences the shelf life?

Source: A Guide to Calculating the Shelf Life of Foods
Factors affecting the shelf life

- Microbiology, chemistry, enzymatic, moisture, ERH – Equilibrium relative humidity
- Products with high or low:
  - Water content
  - Water activity
  - Moisture content (free water-liquids and bound water-sugar)
  - Fat/oil content-rancidity
  - Alcohol content
  - Acid content
  - pH
Water activity vs. RRR vs. Moisture content

**Figure 1:** Stability map of foods as a function of water activity.

Labuza, 1970
Factors affecting the shelf life

- Influence through:
  - Use of preservatives or preservatives measurements (pasteurisation, sterilisation, UHT, …)
  - Tainting of the packaging-material
  - Amount and level of light exposure
  - Quality, consistence of products/ingredients
  - Combination of products/ingredients
  - Manufacturing and storage of all products
  - Atmosphere (MAP-Modified atmosphere packaging)
  - “Intelligent” and other “safe” packaging (e.g. absorbing materials, UV-filters, …)
Shelf life analysis

• Has to be conducted for each product type, no generic studies are acceptable

• 2 different methods:
  – **Indirect method**: An accelerated shelf life assessment by increasing the storage temperature (for long shelf life products)
  – **Direct method**: A predictive modelling exercise, which generally tends to concentrate on particular micro-organism (most commonly used method)

• **Purpose**: Determine how long a food product might expect to be fit for consumption (assuming under the correct storage conditions)
# Shelf life studies types

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Usage</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerated</td>
<td>Long life products, R&amp;D new products</td>
<td>Bacterial growth rates do not properly reflect shelf-life for storage or transport</td>
</tr>
<tr>
<td></td>
<td>Time sensitive introduction (Real time recommended as back-up)</td>
<td></td>
</tr>
<tr>
<td>Ideal Conditions</td>
<td>For best shelf-life</td>
<td>Bacterial growth rates do not properly reflect shelf-life for storage or transport</td>
</tr>
<tr>
<td></td>
<td>Storage set to ideal conditions</td>
<td></td>
</tr>
<tr>
<td>Real Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Customer Conditions</td>
<td>Conditions set to average levels</td>
<td>Does not take into account storage extremes (ie. Winter vs. Summer temperatures)</td>
</tr>
<tr>
<td></td>
<td>Bacteria species and levels reflect actual</td>
<td></td>
</tr>
<tr>
<td>Extreme Customer Conditions</td>
<td>Conditions set to average levels</td>
<td>Does not reflect typical customer, or ideal shelf-like conditions</td>
</tr>
</tbody>
</table>
The concept of Q10

• Q10 is the increase in the rate of the reaction when the temperature is increased by 10 degrees centigrade (18°F).

E.g. If a food has a stability of 20 weeks at 20°C and 10 weeks at 30°C, thus the Q10 will be 20/10
Steps for the study

- **STEP 1:** Identify what may cause the food to spoil or become unsafe (acc. HACCP)
- **STEP 2:** Which tests to use (sensory, microbiological, etc.)
- **STEP 3:** Plan the shelf life study
- **STEP 4:** Run the shelf life study
- **STEP 5:** Determine the shelf life
- **STEP 6:** Monitoring the shelf life

Source: A Guide to Calculating the Shelf Life of Foods
Evaluation in a shelf life analysis

• **Analysis of:**
  – Microbiological quality
  – Physical quality
  – Chemical quality
  – Organoleptic (sensory) quality

• **With an understanding of:**
  – Ingredients
  – Packaging material
  – Manufacturing
  – Storage and Distribution/Transport
Microbiological analysis

- Total aerobic count
- Coliform bacteria / E.coli
- Lactic acid bacteria
- L. monocytogenes
- Salmonella
- Staphylococcus aureus
- Yeast and mould
- and many more …
Physical analysis

- Water activity (AW-value)
- Viscosity
- Determination of atmosphere inside the packaging (oxygen, nitrogen, CO2-content)
- Decreasing or increasing pressure inside the packaging
- Turbidity
Chemical analysis
Organoleptic analysis/evaluation

• Appearance
• Colour (e.g. acc. to a comparison chart)
• Taste including “mouth feel” and texture
• Odour/smell
• Acoustics (e.g. cracking of biscuits)
Government role

• Requirements for Analysis, Labelling with fixed limits for the determination of the shelf life:
  – Regulations
  – Directives
  – Test-methods of analysis
• Link with government analysis
Legal requirements (examples)

- Worldwide: FAO/WHO, Codex Alimentarius-Guidelines and country specific requirements
- Europe: EU 852-854, Country specific requirements
- Germany: DIN 10969, §64 LFGB
- America: FDA-Guidelines
- China: Food Hygiene Law
Food producer role

• Responsible for the food and the food safety
• Responsible for the labelling (shelf life under 2 years have to be clearly date marked)
• Responsible for the product specification
• Responsible for the instruction for the preparing and also for the opening after storage (have to be stored <4°C after opening,…)
• Implementation of a HACCP and Management analysis
• Operational Benefits
  – Improve food safety aspects
  – Increase risk management and reduce recalls

• Marketing and Sales
  – Support quality promises
  – Avoid brand damage

• Commercial benefits
  – Enhance brand protection
  – Establish extent of liability
  – Avoid recall costs

• How can Intertek support you?
  – Global and local management capability
  – Extensive understanding of different market expectations
  – Strong laboratory support
  – Offices and laboratories everywhere to match your sourcing plan
  – Strong customer service support
Thank you for your attention!

Intertek Food Services

www.intertek.com
www.intertek.com/food

Dr. Jochen P. Zoller
Email: jochen.zoller@intertek.com