Fermenting Foods at Retail…
Science and Safety

Alan M. Tart
FDA/Office of Regulatory Affairs/Office of Partnerships
CER FDA Retail Food Protection Seminar
Lansing, MI
September 10, 2014
Disclaimer

The processes described in this presentation are for illustrative (training) purposes only. They should not be construed as “validated” processes. Operators should submit HACCP plans that have been developed by a process authority or provide other scientific data supporting that the specific process being employed by the establishment is, in fact, safe.
2013 FDA Food Code
Special Processes at Retail

- Reduced Oxygen Packaging
- Molluscan Shellfish Life Support Tanks
- Packaging Juices
- Custom Processing of Meat for Personal Use
- Curing, Smoking* and Drying of Fish
- Curing and Smoking* of Meat and Poultry
- Drying of Meat and Poultry
- Fermentation of Sausages
- Adding Components/Additives to Render Shelf Stable
- Sprouting

*Smoking as a method of food preservation rather than flavor enhancement
## Special Processes Requiring a Variance

<table>
<thead>
<tr>
<th>Special Process at Retail</th>
<th>Variance</th>
<th>Exceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced Oxygen Packaging</td>
<td>Yes</td>
<td>Methods specified under 3-502.12</td>
</tr>
<tr>
<td>Sprouting</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Custom Processing of Meat for Personal Use</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Operating Live Molluscan Shellfish Storage Display Tanks</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Curing, Drying and Smoking of Fish</td>
<td>Yes</td>
<td>Smoking for flavor enhancement, color, or part of the cooking process</td>
</tr>
<tr>
<td>Curing, Smoking of Meat and Poultry</td>
<td>Yes</td>
<td>Smoking for flavor enhancement, color, or part of the cooking process</td>
</tr>
<tr>
<td>Drying of Meat and Poultry</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Fermentation of Sausages</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Adding Components to Extend Shelf-life or Render non-TCS</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Juice Processing and Packaging</td>
<td>No</td>
<td>A performance standard is required instead of a variance</td>
</tr>
</tbody>
</table>
# Special Processes Requiring a HACCP Plan

<table>
<thead>
<tr>
<th>Special Process at Retail</th>
<th>HACCP Plan</th>
<th>Exceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced Oxygen Packaging</td>
<td>Yes</td>
<td>ROP’ed TCS food labeled and kept less than 48 hours</td>
</tr>
<tr>
<td>Sprouting</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Custom Processing of Meat for Personal Use</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Operating Live Molluscan Shellfish Storage Display Tanks</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Curing, Drying and Smoking of Fish</td>
<td>Yes</td>
<td>Smoking for flavor enhancement, color, or part of the cooking process</td>
</tr>
<tr>
<td>Curing, Smoking of Meat and Poultry</td>
<td>Yes</td>
<td>Smoking for flavor enhancement, color, or part of the cooking process</td>
</tr>
<tr>
<td>Drying of Meat and Poultry</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Fermentation of Sausages</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><strong>Adding Components to Extend Shelf-life or Render non-TCS</strong></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Juice Processing and Packaging</td>
<td>Yes</td>
<td>A warning label can be applied in lieu of HACCP Plan</td>
</tr>
</tbody>
</table>
What are some examples of added components (not for flavor) or food additives?

- Sugar and salt
- Preservatives
- Citric, acetic, malic acids
- Starter cultures
- Curing accelerators
Fermentation involves adding components such as starter cultures, sugar, and salt.
What are the major types of fermented foods?

1. Grain, fruit, and honey
2. Vegetable, dairy, and tea
3. Bean, fish, and meat
4. All of the above
The Science of Fermentation

- **Lactose Fermentation**

  \[ C_6H_{12}O_6 \xrightarrow{\text{lactic acid, bacteria}} 2\text{CH}_3\text{CH(OH)COOH} \]

  glucose

- **Alcohol Fermentation**

  \[ C_6H_{12}O_6 \rightarrow 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2 \]
Example – Kimchi (or Kimchee)
Most Popular Kimchi
Kimchi Preparation

• Trim and cut Chinese cabbage or other vegetables
• Sprinkle salt between the leaves
• Soak cabbage in brine mixture for up to 8 hours, then drain
• Add more salt
• Soak at room temperature until wilted (usually 5-7 hours)
• Add other seasonings and soak more
Kimchi Preparation

• Ferment
  - Place in brine in airtight container (important...LAB prefer anaerobic environments)
  - Store at room temperature
  - Several days to few months

• After fermentation is complete, refrigerate at 41°F

• Shelf-life = 4-6 weeks under refrigeration
Concerns - Biological Hazards (Bacteria)

- Bacteria
  - *Salmonella*, *Listeria monocytogenes*, *Shigella*, *E. coli*, other fecal-oral route pathogens
Kimchi - Controls

- Kimchi (with TCS ingredients) prepared under an approved variance and HACCP plan:
  - Validated process for safe preparation
  - Ensures product is rendered non-TCS based pH and/or Aw values

- Product is prepared and stored under sanitary conditions
Controls (cont’d)

- No bare hand contact with RTE food
- Proper handwashing
- Prevention of cross-contamination
- Implementation of employee health policy
- Use of food grade containers and utensils during preparation and storage
Yogurt
Starter Culture (thermophilic lactobacilli)

- Lactobacillus bulgaricus
- Streptococcus thermophilus
- Lactobacillus acidophilus
- Lactobacillus subsp. Casei
- Bifido-bacteria
Yogurt

• Type of milk used depends on the type of yogurt

• Standards of Identity
  – Designate certain % solids and % milk fat
  – 21 CFR 131.200 (Yogurt)
  – 21 CFR 131.203 (Lowfat yogurt)
  – 21 CFR 131.206 (Nonfat yogurt)
Yogurt Production at Retail

- Heating Grade A Milk (~160° - 180°F)
- Cooling to ~110°F
- Addition of Starter Cultures
- Fermentation (~104° - 110°F for 5 – 18 hours)
- Cooling
- Addition of Flavors & Fruit
- Refrigeration/Storage
- Service
Yogurt - Considerations

• Grade A milk used
• Starter culture
  – Approved source
  – Considerations with using previously prepared yogurt for starter culture
• Minimum pH achieved
  – 4.6 or less
  – Note that a pH of less than 4.2 is considered non-TCS
Yogurt - Considerations

- Time/temperature/pH recorded (all batches)
- Refrigeration
  - 41°F or less to slow fermentation
- Shelf-life
  - 7 days or less if TCS
- Intended use
  - Selling packaged yogurt will typically require additional permits and regulatory considerations
Kombucha

Fermented tea

Water + Sugar + Tea

Biofilm develops: SCOBY
Symbiotic Culture of Bacteria and Yeast
Considerations

- Approved source for starter culture?
- Is this a TCS food? (Protein, Sugar, pH/acidity level)
- Mold? Bacteria? Yeasts?
- Need to be temperature controlled?
- Is the bucket cleaned and sanitized?
Science of Kombucha

Fermented tea

Water + Sugar + Tea

Biofilm develops: SCOBY
Symbiotic Culture of Bacteria and Yeast
Science of Kombucha

Yeast reacts with sugar
to produce alcohol

Bacteria reacts with alcohol
to produce acetic acid

Result:
- Fermented tea beverage
- Tangy, slightly acidic
- Health claims
The Process

Boil distilled water

Add:
Organic sugar
Black tea

Cool mixture
Add SCOBY

Symbiotic Culture of Bacteria and Yeast
(Starter culture, “mother”, “mushroom”)
Fermentation Stage

- 7-10 days
- 60-70° F
- Covered with clean cloths
- Food grade containers

Yeast + sugars $\rightarrow$ Alcohol
Bacteria + alcohol $\rightarrow$ Acetic acid
Monitoring

**Acidity**

- **pH meter**
  - Critical limit $\leq 4.2 \text{ pH}$

**Specific gravity (alcohol)**

- **Hydrometer**
  - Critical limit $0.5 - 2\%$
- Transfer tea to containers
- Tightly covered, food grade
- Store at 41°F or below
Save SCOBY for next batch?
Continue to monitor pH and alcohol levels every 3-4 days

Add distilled water to adjust levels
Pasteurization at 180°F
Store in sanitized containers, shelf-stable
Shelf-life: 2 years (quality)

Options

OR

Unpasteurized
Store at 41°F or below
Monitor pH and Specific gravity levels
Sold by glass, in sanitized Growlers, vessels, other containers
Shelf-life: 3-6 months (quality)
Labeling

Health risks
Acidosis, alcohol toxicity

Consumer advisory
Immunocompromised warning
4 oz./ day recommended limit

Health claims not allowed
Questions?

Alan M. Tart
Retail Food Program Specialist
FDA| Office of Regulatory Affairs| Office of Partnerships | Standards Implementation Staff
Office: (404) 253-1267
Cell: (828) 409-0953
Email: Alan.Tart@fda.hhs.gov

Website: http://www.fda.gov/RetailFoodProtection

Special thanks to Cindy Rice (Eastern Food Safety) for the Kombucha pics!