Fermenting Foods at Retail…
Science and Safety

Alan M. Tart
FDA/Office of Regulatory Affairs/Office of Partnerships
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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.

*Smoking as a method of food preservation rather than flavor enhancement

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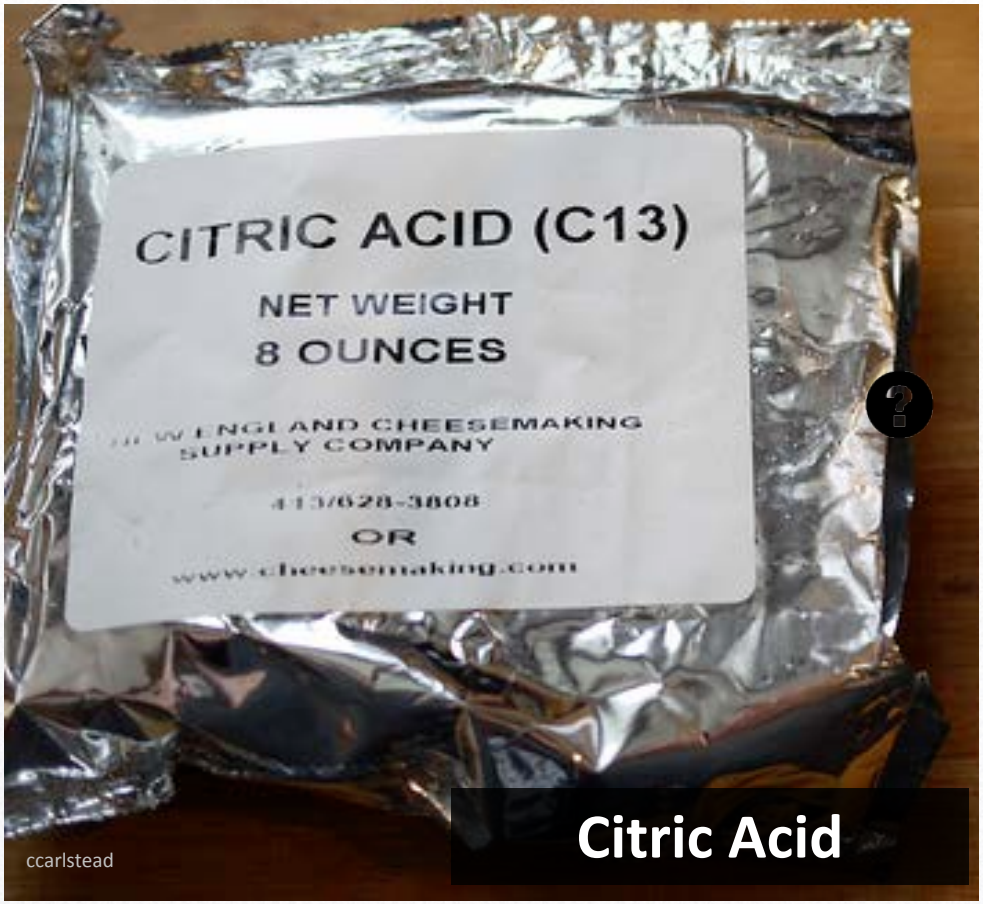
Special Processes Requiring a Variance

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

Special Processes Requiring a HACCP Plan

Special Process at Retail	HACCP Plan	Exceptions
Reduced Oxygen Packaging	**Yes**	ROP'ed TCS food labeled and kept less than 48 hours
Sprouting	**Yes**	
Custom Processing of Meat for Personal Use	**Yes**	
Operating Live Molluscan Shellfish Storage Display Tanks	**Yes**	
Curing, Drying and Smoking of Fish	**Yes**	Smoking for flavor enhancement, color, or part of the cooking process
Curing, Smoking of Meat and Poultry	**Yes**	Smoking for flavor enhancement, color, or part of the cooking process
Drying of Meat and Poultry	**Yes**	
Fermentation of Sausages	**Yes**	
Adding Components to Extend Shelf-life or Render non-TCS	**Yes**	
Juice Processing and Packaging	**Yes**	A warning label can be applied in lieu of HACCP Plan

What are some examples of added components (not for flavor) or food additives?



Citric Acid

- Sugar and salt
- Preservatives
- Citric, acetic, malic acids
- Starter cultures
- Curing accelerators

Why is fermentation considered a special process?

Fermentation involves adding components such as starter cultures, sugar, and salt

Fermenting Soybeans

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

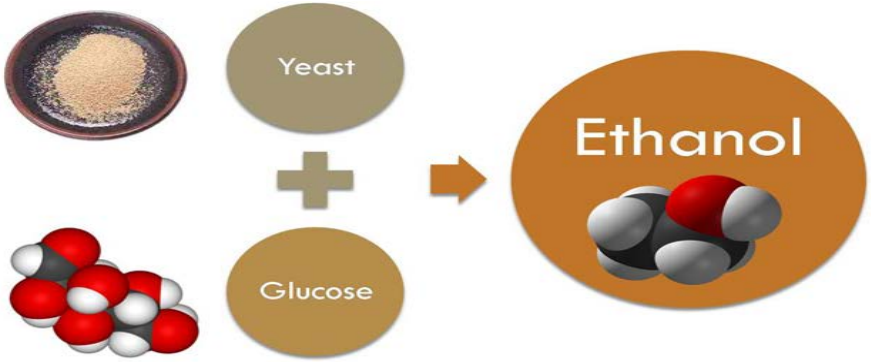
The Science of Fermentation

- **Lactose Fermentation**

$$C_6H_{12}O_6 \xrightarrow[\text{bacteria}]{\text{lactic acid}} 2CH_3CH(OH)COOH$$

glucose → lactic acid

- **Alcohol Fermentation**



$$C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$$






Example – Kimchi (or Kimchee)






Most Popular Kimchi

FDA









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 (~160^0 - 180^{0}F)
- Cooling to ~110^{0}F
- Addition of Starter Cultures
- Fermentation (~104^0 - 110^{0}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
  - 41^0F 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

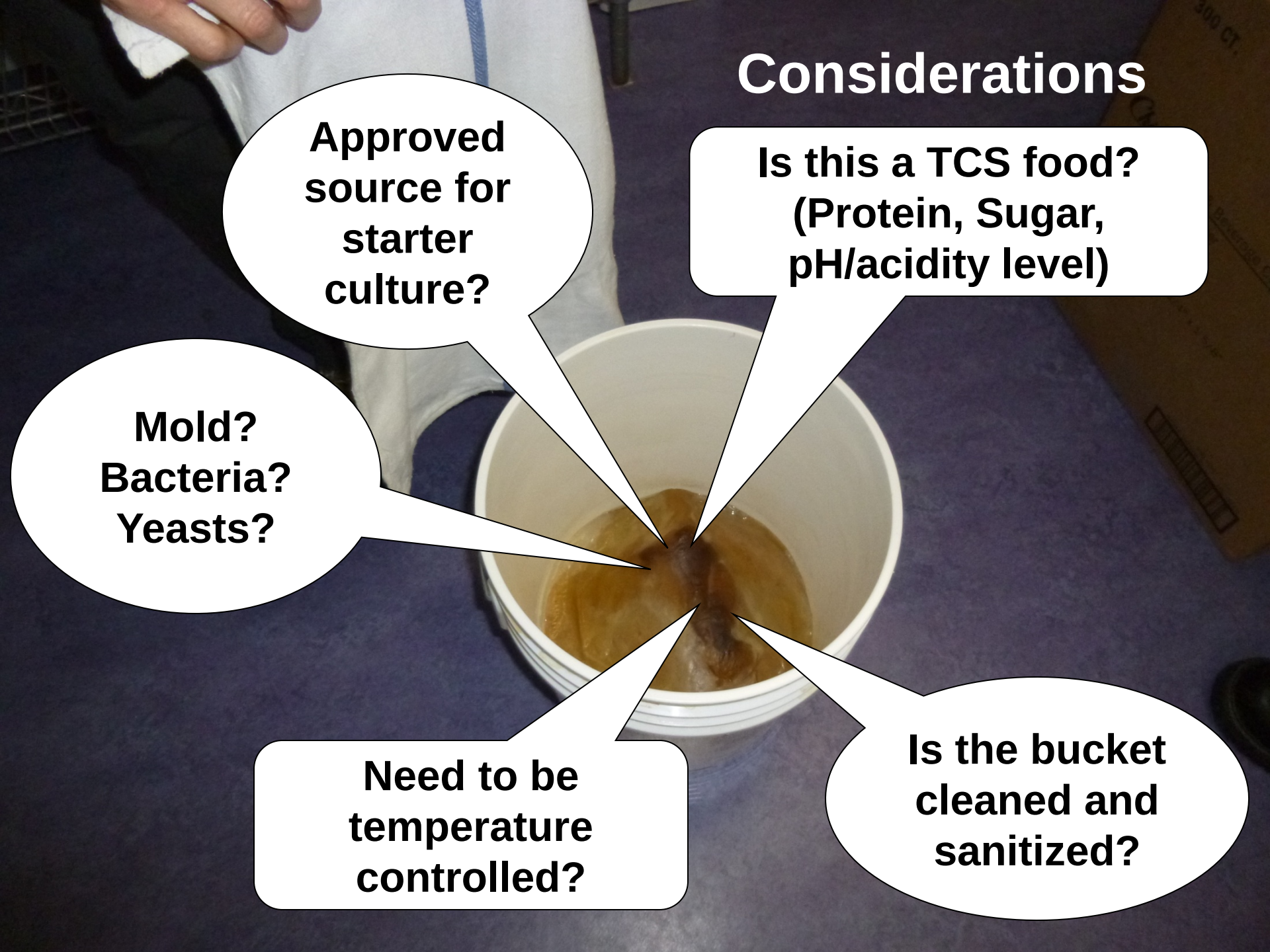
Kombucha

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

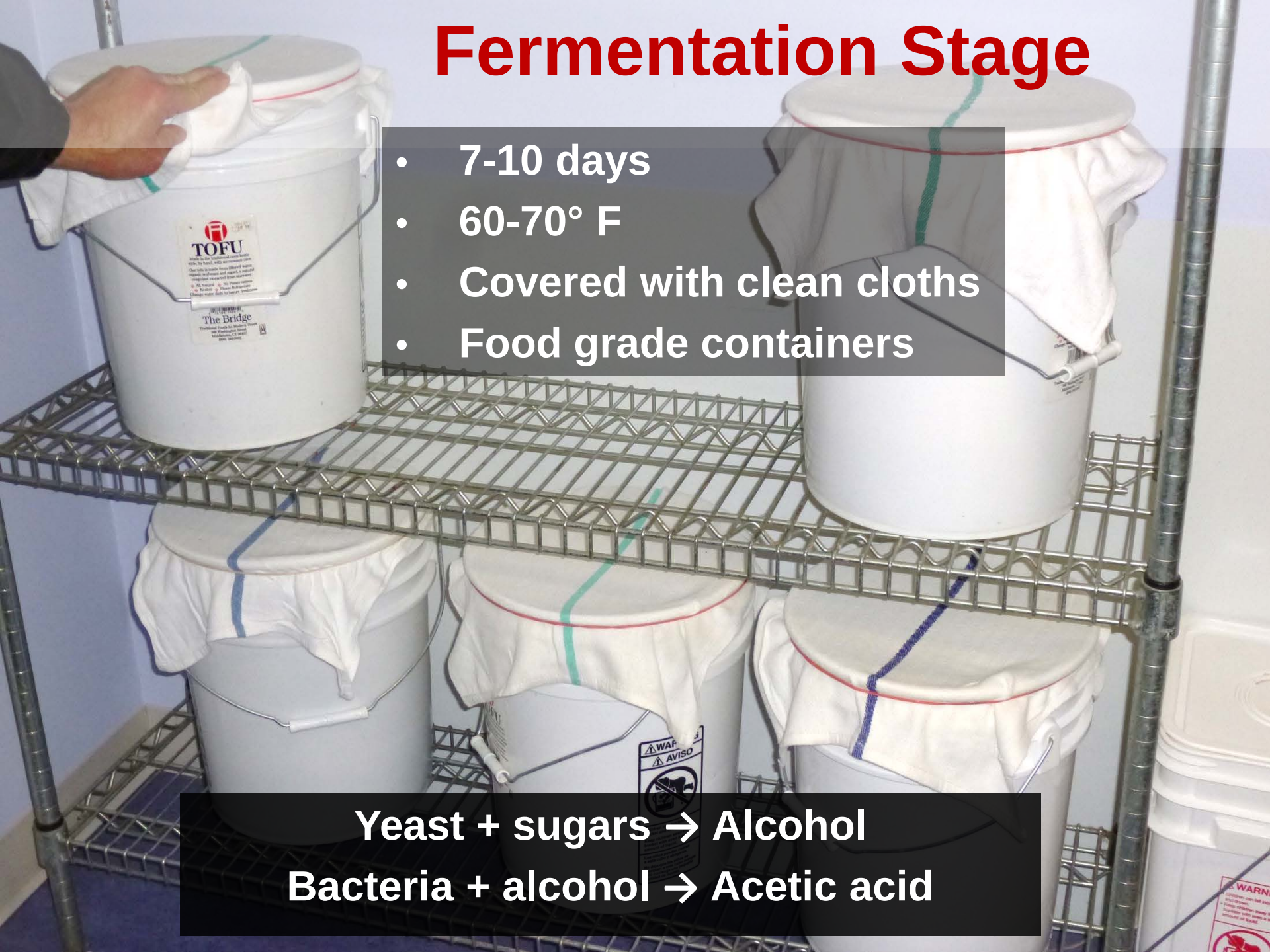
Cool mixture

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 → Alcohol

Bacteria + alcohol → Acetic acid

Monitoring

Acidity

pH meter

Critical limit ≤ 4.2 pH

Specific gravity (alcohol)

Hydrometer

Critical limit .5 – 2%

- Transfer tea to containers
- Tightly covered, food grade
- Store at 41^{0}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

Options

Pasteurization at 180^{0}F

Store in sanitized containers, shelf-stable

Shelf-life: 2 years (quality)

OR

Unpasteurized

Store at 41^{0}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

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

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