Food Safety and Fermentation

Ellen Shumaker, PhD

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Microorganism Growth

Factors that influence microorganism growth:

- Acidity
- Time
- Temperature
- Oxygen
- Moisture

- If done properly, manipulating these factors can create an environment unsuitable for microorganisms that cause spoilage and foodborne illness

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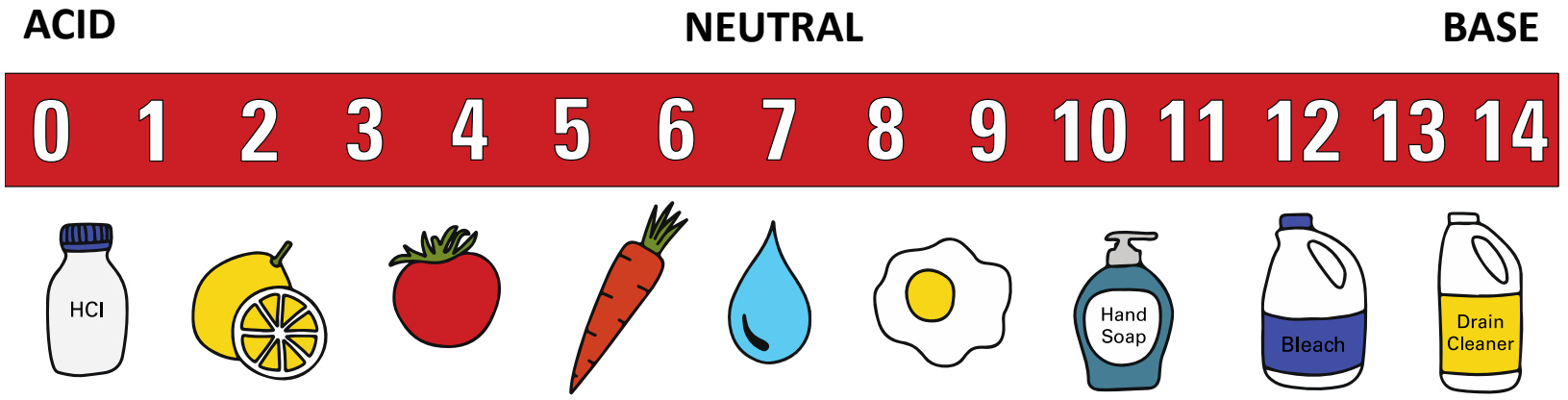
Acidity

- The addition of acid can destroy microorganisms, or at least prevent their growth
- Acidity is measured by pH



- Pathogenic bacteria need a pH between 4.6 and 7.5 to grow

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Fermentation

- During the fermentation process, native or added microorganisms convert sugars in the food to acid, alcohol and/or gas
- The acid or alcohol produced inhibits other microorganisms from surviving and growing
- Examples:
  - Yogurt
  - Vegetables (sauerkraut, kimchi, etc.)
  - Meat

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Common Retail Fermentations

- Dairy – yogurt, crème fresh
- Plant foods – sauerkraut, kimchi, miso, stinky tofu, vinegars
- Meat – sausages, salami, etc.
- Beverages – kombucha

Fermentation Starter Cultures

- Some foods naturally contain fermenting microorganisms, but in many cases, a starter culture must be added to the food to drive the fermentation.
- If a starter culture is added, it should be from an approved supplier or otherwise tested.
- Do not use previously fermented batches of food as starter culture for fermentation. This is called backslopping and carries risk of acid tolerant *E.coli*.

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Yogurt Fermentation HACCP

- Hazard analysis includes *Staphylococcus aureus*
- CCP is the fermentation process at a specific time and temperature
- CL is the pH reaching below 4.2
- Corrective actions can include continuing fermentation of within the time allowed

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Basics of Fermentation

- Controlled growth of a microorganism that produces a desired byproduct that changes the food
- At retail, most fermentation is from lactic acid bacteria
- The creation of these products usually results in acidification via fermentation

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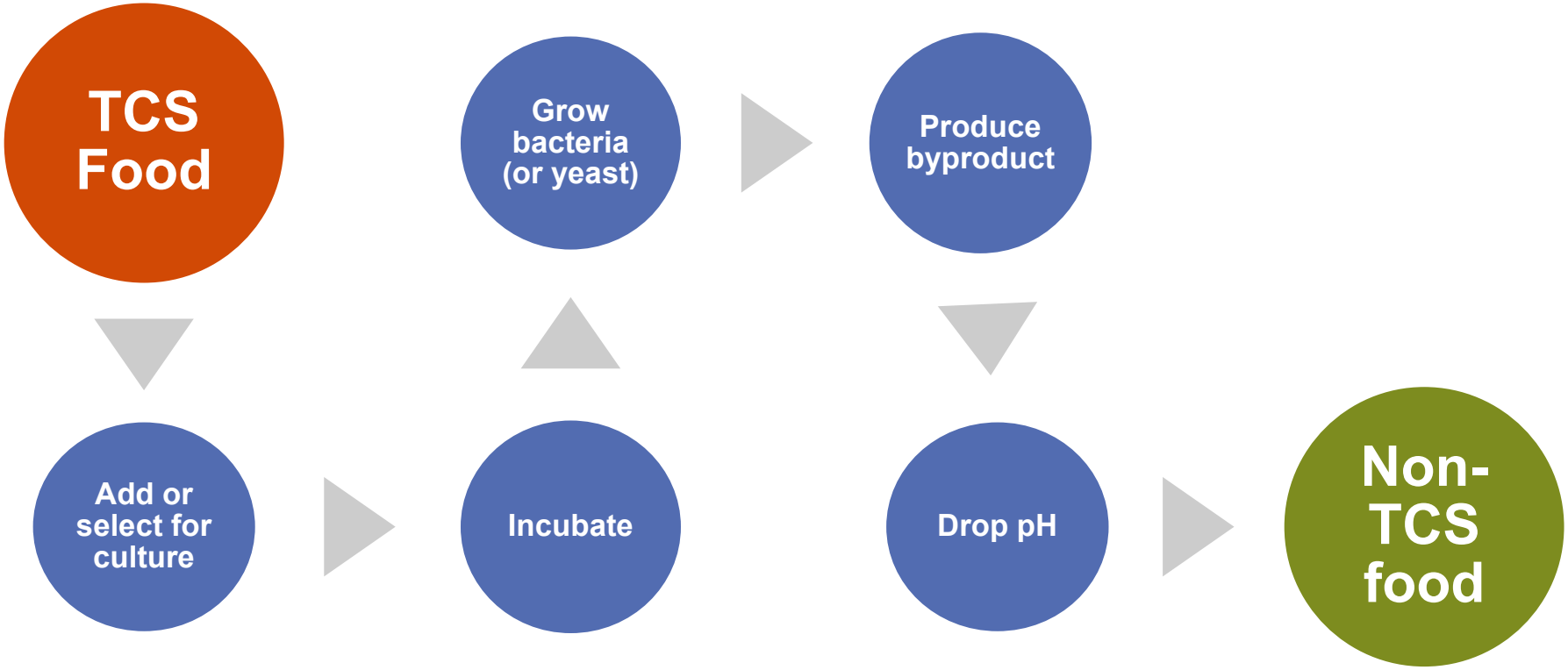
Basic Fermentation Process



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Case Study

1. Purchase cabbage
2. Trim, wash, chop and grind cabbage
3. Use a 2 gallon crock and fil ¾ full and pack
4. Put approximately 1 cup salt
5. Fill crock to the top
6. Fill crock/cabbage with full strength white vinegar to top
7. Cover with plastic wrap and let sit at room temp to kraut
8. Takes 6 days in winter and 4-5 in summer

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Hazards of Concern

Product	Pathogen of concern	Selection / Starter	Incubation Time/ Temp	Target pH
Yogurt	*Staph A*	Pasteurized milk / approved culture	Less than 10 hours	Less than 4.2, less than 5.3 within 10 hours
Sauerkraut	*Staph A*	Salting of cabbage / native ferment	21 days	Less than 4.2
Kimchi	*Staph A, L. mono, B. cereus*	Salting of vegetables / native ferment	~ 4 days	Less than 4.2
Sausages	Shiga toxin producing *E. coli, Staph A*	Approved culture	1200 degree hours	Less than 5.3 with aw less than 0.92

Current Trends

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Flow Charts

- Step by step path traveled by food during processing
- Shows CCPs
- Shows where to take corrective action
- Can use to monitor CCPs
- Helps verify effectiveness

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Key Terms

- **Validation** - That element of verification focused on collecting and evaluating scientific and technical information to determine if the HACCP plan, when properly implemented, will effectively control the hazards.

- **Verification** - Those activities other than monitoring, that determine the validity of the HACCP plan and that the system is operating according to the plan.

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ellen_Shumaker@ncsu.edu