Food Preservation Methods

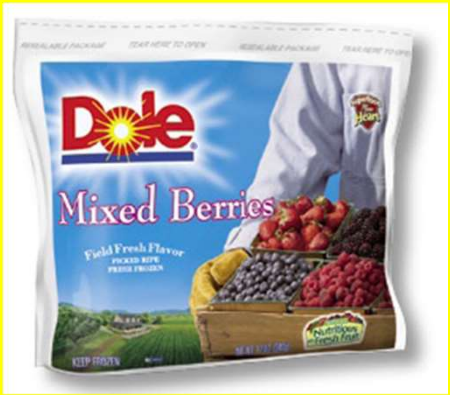
Core Course: Food and Industrial Microbiology
M.Sc., Microbiology
III Semester
Course Code: 24MICCC8

Dr.D.DHANASEKARAN
Professor
Department of Microbiology
Bharathidasan University, Tiruchirappalli- 620 024

Food Preservation

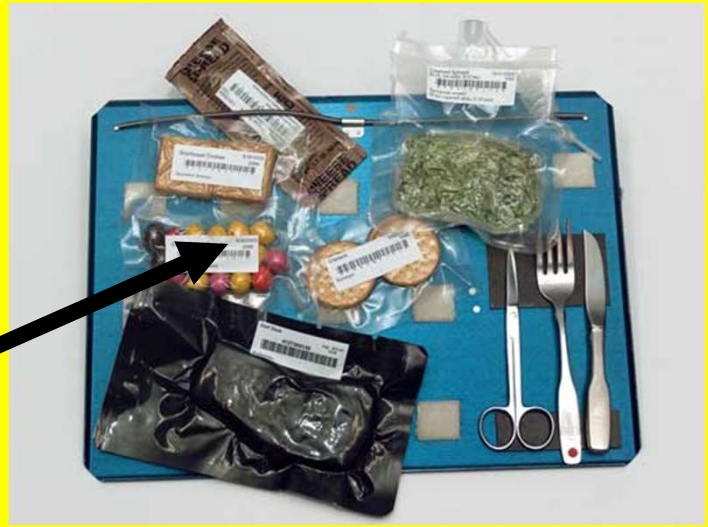
- How a food is processed can affect its appearance, odor, flavor, and texture.
- Over the years many food preservation methods have been improved to increase the shelf-life of foods while minimizing changes to the quality and nutritional content.

IQF or Individual Quick Freezing has improved the quality of frozen fruits and vegetables



Food Preservation

- Many food preservation methods have also been used to create foods for astronauts and for the armed forces. These foods must remain safe to eat over a long shelf-life.
- It is reported that M & M's were developed when Forrest Mars, Sr. saw soldiers eating candy coated chocolate. The chocolate pellets that the soldiers were eating were coated in sugar to increase their shelf-life in hot climates and prevent the chocolate from sticking to the soldier's fingers!



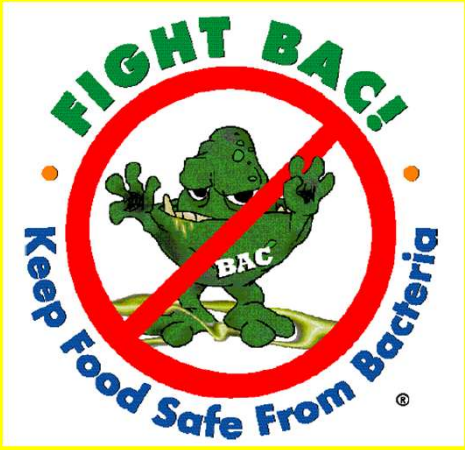
Bags of Space Station food and utensils on a tray.

Food Preservation

- So, how does food preservation work?
- All of the food preservation processes work by slowing down the activity and growth of disease causing bacteria, or by killing the bacteria all together. They also slow down or stop the action of enzymes which can degrade the quality of the food.
  - Temperature
  - Water Activity
  - pH

Food Preservation

- How a food is packaged also influences its shelf-life.
- It is also important that foods are handled properly by the consumer at home.
  - Check “Use By” or expiration dates.
  - Follow storage or preparation



Controlling Food Spoilage

Table 41.4 Basic Approaches to Food Preservation

Approach	Examples of Process
Removal of microorganisms	Avoidance of microbial contamination; physical filtration, centrifugation
Low temperature	Refrigeration, freezing
High temperature	Partial or complete heat inactivation of microorganisms (pasteurization and canning)
Reduced water availability	Water removal, as with lyophilization or freeze drying; use of spray dryers or heating drums; decreasing water availability by addition of solutes such as salt or sugar
Chemical-based preservation	Addition of specific inhibitory compounds (e.g., organic acids, nitrates, sulfur dioxide)
Radiation	Use of ionizing (gamma rays) and nonionizing (UV) radiation
Microbial product–based inhibition	The addition of substances such as bacteriocins to foods to control food-borne pathogens

Removal of Microorganisms

- usually achieved by filtration
- commonly used for water, beer, wine, juices, soft drinks, and other liquids

Low Temperature

- refrigeration at 5°C retards but does not stop microbial growth
  - psychrophiles and psychrotrophs can still cause spoilage
  - growth at temperatures below -10°C has been observed

High Temperature

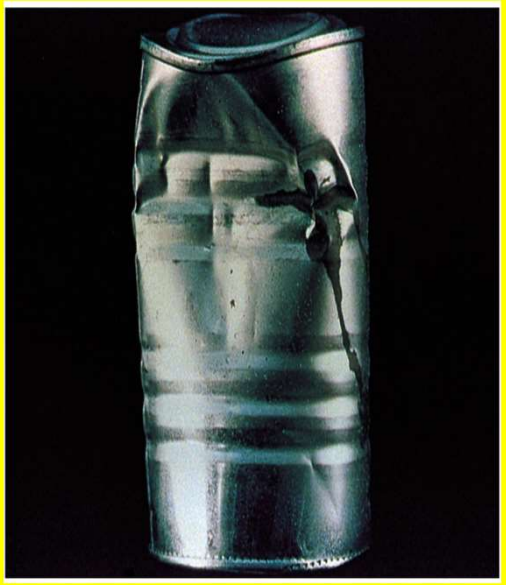
- canning
- pasteurization

Canning

- food heated in special containers (retorts) to 115 °C for 25 to 100 minutes
- kills spoilage microbes, but not necessarily all microbes in food

Spoilage of canned goods

- spoilage prior to canning
- underprocessing
- leakage of contaminated water into cans during cooling process



Pasteurization

- kills pathogens and substantially reduces number of spoilage organisms
- different pasteurization procedures heat for different lengths of time
  - shorter heating times result in improved flavor

Water Availability

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Chemical-Based Preservation

- GRAS
  - chemical agents “generally recognized as safe”
- pH of food impacts effectiveness of chemical preservative

Table 41.5 Major Groups of Chemicals Used in Food Preservation

Preservatives	Approximate Maximum Use Range	Organisms Affected	Foods
Propionic acid/propionates	0.32%	Molds	Bread, cakes, some cheeses, inhibitor of ropy bread dough
Sorbic acid/sorbates	0.2%	Molds	Hard cheeses, figs, syrups, salad dressings, jellies, cakes
Benzoic acid/benzoates	0.1%	Yeasts and molds	Margarine, pickle relishes, apple cider, soft drinks, tomato ketchup, salad dressings
Parabens[a]	0.1%	Yeasts and molds	Bakery products, soft drinks, pickles, salad dressings
SO_2/sulfites	200–300 ppm	Insects and microorganisms	Molasses, dried fruits, wine, lemon juice (not to be used in meats or other foods recognized as sources of thiamine)
Ethylene/propylene oxides	700 ppm	Yeasts, molds, vermin	Fumigant for spices, nuts
Sodium diacetate	0.32%	Molds	Bread
Dehydroacetic acid	65 ppm	Insects	Pesticide on strawberries, squash
Sodium nitrite	120 ppm	Clostridia	Meat-curing preparations
Caprylic acid	—	Molds	Cheese wraps
Ethyl formate	15–200 ppm	Yeasts and molds	Dried fruits, nuts

From James M. Jay. 2000. *Modern Food Microbiology,* 6th edition. Reprinted by permission of Aspen Publishing, Frederick, Md.

[a]Methyl-, propyl-, and heptyl-esters of *p*-hydroxybenzoic acid.

Radiation

- ultraviolet (UV) radiation
  - used for surfaces of food-handling equipment
  - does not penetrate foods
- Gamma radiation
  - use of ionizing radiation (gamma radiation) to extend shelf life or sterilize meat, seafoods, fruits, and vegetables