

## UNIT II - FOOD PROCESSING

### Lesson 1: Procedures Used in Processing Food

#### Objective

The student will be able to explain procedures used to process food safely.

#### I. Study Questions

- A. Why are foods processed?
- B. How can foods be processed?
- C. How is food safety assured?
- D. What methods should be used to clean and sanitize food processing equipment?

#### II. References

- A. Martin, Phillip R. *Food Science and Technology* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1994. Unit II.
- B. Activity Sheets
  - 1. AS 1.1: Dehydration and Rehydration
  - 2. AS 1.2: Food Processing--Magic Square



## UNIT II - FOOD PROCESSING

### Lesson 1: Procedures Used in Processing Food

#### TEACHING PROCEDURES

##### A. Introduction

The largest segment of employment in the food business is food processing. This unit will examine the various processing techniques and related issues.

##### B. Motivation

1. Give each student a piece of pizza. Before they eat it, have them dissect its ingredients and chart what processes took place before it became a pizza. A frozen pizza label can be used to identify all of its ingredients.
2. Show one or all of the following eight-minute careers videos from Hobar: Careers in Harvested Foods; Dairy Products and Processing; and Meat, Poultry, and Fish Processing.

##### C. Assignment

##### D. Supervised study

##### E. Discussion

1. Discuss with students why foods are processed. Food processing can be defined as any mechanical, chemical, or biological treatment to food. These processes may preserve the food or change the raw materials appearance or flavor.

#### **Why are foods processed?**

- a. Processed food can be stored for longer periods of time.
  - b. Processing techniques slow down deterioration.
  - c. Processing helps guard against microbial contamination.
  - d. Processing can make foods more convenient, add variety, enhance flavor, and increase value (tenderization, size, weight, shape control).
  - e. Processing controls composition (protein, fat, moisture content).
2. Discuss with students the various ways that foods can be processed. Have students complete AS 1.1 and AS 1.2.

#### **How can foods be processed?**

- a. Dehydration - the removal of water from foods: dried fruit, beef jerky
  - b. Fermentation - fermentation releases nutrients locked in plant cells; starch can be split into simple sugars
  - c. Milling - removal of chaff and all other foreign material; may be washed with water and separated by size
  - d. Fractionation - separate constituents (i.e., hulls, bran, germ, endosperm) from each other
  - e. Grinding - reducing the particle size, (e.g., ground beef, flour) - called comminution in the meat industry
  - f. Emulsifying - ingredients that normally would repel each other and separate are held together, or stabilized, by an emulsifying agent
  - g. Homogenizing - forcing milk or other liquids under high pressure through a valve which breaks large fat molecules into smaller ones
  - h. Hydrogenation - edible oil is converted to a semi-solid state (e.g., margarine and shortening), resulting in a product that is spreadable and resists rancidity
  - i. Combination - mixing of constituents back together
  - j. Texturization - wheat is transformed into pasta; restructured meats have been ground, flaked, or chopped and formed into steak or roast-like products
  - k. Chemical modification - addition of heat, enzymes, or microbes to produce a product (e.g., cider, pickles, popcorn, corn syrup)
  - l. Precipitating/centrifuging - separating the components based on their densities; a centrifuge speeds the process (e.g., milk casein precipitates forming the curd)
  - m. Extrusion - formulated dough or mash is forced through an extruder; high pressures cause the starch molecules to swell and then gel; this creates a puffing of the newly shaped product
3. Discuss with students how food safety is assured.

### **How is food safety assured?**

- a. Federal Meat Inspection Act of 1906 - provides mandatory inspection of animals, slaughtering conditions, and meat processing facilities; regulates interstate activities
- b. Wholesome Meat Act of 1967 - all city and state meat regulations must meet federal standards
- c. Federal Poultry Products Inspection Act of 1957 and Wholesome Poultry Products Act of 1968 - set federal standards on poultry.
- d. Federal Trade Commission Act of 1938 - protects the public from false advertising in the food industry

- e. Food, Drug, and Cosmetic Act of 1938 - set the basic principles of food safety and gave the FDA the power to enforce food safety measures
  - f. Infant Formula Act of 1980 - manufactured formulas must contain known essential nutrients at appropriate levels
  - g. Federal Grade Standards - uniform quality standards
  - h. State and Local Laws - various state and local laws usually administered by the Health Department
  - i. Food and Drug Administration (FDA) - assures consumers that the food they buy is safe, nutritious, and honestly represented; approves all additives before they can be used; lists over 600 ingredients that are safe and not considered additives; Generally Recognized As Safe (GRAS) e.g., sugar, table salt, cinnamon
  - j. USDA - monitors meat and poultry products; FDA monitors all other foods
  - k. USDA Grade A Pasteurized Milk Ordinance
4. Discuss the methods that should be used to clean and sanitize food processing equipment. Clean means to remove all visible filth. Sanitize refers to removing any microbial contamination.

**What methods should be used to clean and sanitize food processing equipment?**

- a. Cleaning - removing all visible filth
  - 1. Hot water plus alkaline cleanser
  - 2. Acidic cleanser used to remove mineral deposits
- b. Sanitize - Following cleaning, sanitize at 180°F with water or an approved chlorine or iodine rinse.
- c. Metal equipment needs to be sprayed with an edible mineral oil to prevent rusting.

F. Other activities

Conduct "Bacteriological Examination of Food Equipment and Eating Utensils" experiment from *Food Science, Safety and Nutrition* by the National Council for Agricultural Education.

G. Conclusion

Food is processed, or changed mechanically, chemically, or enzymatically for a variety of reasons. Due to these reasons, several processes have been developed to provide consumers with a safe food supply. The U.S. Government, through the USDA and the FDA, regulate food safety standards. Producers and processors alike, work to deliver wholesome food to the consumer. A part of this

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commitment to food safety is the proper cleaning and sanitization of processing equipment.

### H. Competency

Explain procedures used to process food safely.

Related Missouri Core Competencies and Key Skills:

10C-5: Identify the variables and controls in a laboratory experiment involving osmosis and reach a conclusion from the given data.

### I. Answers to Evaluation

1. Any three of the following: convenience, value adding, microbial contamination guard, slows down deterioration, variety, longer storage, composition control, flavor enhancement
2. j
3. d
4. h
5. f
6. d
7. k
8. i
9. g
10. b

### J. Answers to Assignment Sheets

#### AS 1.1

##### Part A

1. Longer storage, more convenient, slows microbial activity, adds value
2. More chewy, less juicy, darkened, etc.
3. Answers will vary depending on type of foods compared.
4. Certain foods would lose their palatability, water-soluble vitamins, diversity of use, etc.
5. Yes, answers will vary depending on type of foods compared.

##### Part B

1. Normally, no they cannot. Cells have collapsed and cell walls are broken.

#### AS 1.2

The magic number is 39.

A	2	B	7	C	18	D	12	Total
								<u>39</u>
E	8	F	5	G	11	H	15	
								<u>39</u>
I	13	J	17	K	6	L	3	
								<u>39</u>
M	16	N	10	O	4	P	9	
								<u>39</u>
Total	<u>39</u>		<u>39</u>		<u>39</u>		<u>39</u>	





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Name \_\_\_\_\_

Date \_\_\_\_\_

EVALUATION

1. Name three reasons for food processing.

**Match the definition in Column A with the correct term in Column B.**

Column A

Column B

- \_\_\_\_2. Removal of chaff, foreign material, soil
- \_\_\_\_3. Separate the hulls, germ, bran, and endosperm
- \_\_\_\_4. Converting vegetable oil into shortening
- \_\_\_\_5. Process that keeps oils and water from separating
- \_\_\_\_6. Microorganisms break starch into sugars
- \_\_\_\_7. Removal of moisture
- \_\_\_\_8. Enriching food with needed ingredients
- \_\_\_\_9. Separate a solid from a solution

- a. Extrusion
- b. Precipitating/  
centrifuging
- c. Textuization
- d. Emulsifyin
- e. Homogenizing
- f. Hydrogenation
- g. Combination
- h. Fractionation
- i. Grinding
- j. Milling
- k. Fermentation
- l. Dehydration



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AS 1.1

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Name\_\_\_\_\_

**Dehydration and Rehydration**

**Objective:** Observe the effects of dehydration of food. Students will be able to calculate the moisture content of fresh food.

**Activity Length:** Part A: 1.5 days  
Part B:1 day

**Materials and Equipment:**

sharp knife

scale

labels

fruit or vegetable (examples: apple, apricot, banana, bean, broccoli, cabbage, carrot, peach, pear, nectarine, orange, pumpkin, radish, and tomato)

dehydrator or standard oven

Fruit Fresh® or .1 percent solution sodium bisulfite

PART A: Dehydrate

**Procedure:**

1. Select food from those provided by your instructor.
2. Wash, peel, wash again, and remove the seeds from your fruit/vegetable.
3. Remove any surface moisture.
4. Cut into very thin slices.
5. Weigh cut produce. Divide produce into 2 equal portions. Record data in the table.
6. With ½ the fruit, apply Fruit Fresh® or sodium bisulfite. Follow label instructions.
7. Label produce with type of produce, your name, and with or without Fruit Fresh®. Dehydrate food.

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NOTE: Check with your instructor for proper use of the dehydrator or the standard oven, which is set on 200°F.

8. Remove produce from dehydrator.
9. Weigh and record your data in Table 1.1.
10. Calculate percentage of moisture in original sample.

$$\frac{\text{original weight} - \text{dried weight}}{\text{original weight}} \times 100 = \text{percent moisture}$$

Table 1.1

Type of Produce	Weight of Original Sample	Dried Weight	Volume H <sub>2</sub> O Lost	% H <sub>2</sub> O removed from Original	Color after dehydrating

### Key Questions:

1. What are the benefits of dehydrating food?
2. How was the food's texture, flavor, and general appearance affected by dehydrating?

3. How do the fruits with Fruit Fresh® compare to the fruits without Fruit Fresh®?
4. Describe reasons why all foods are not dehydrated.

Fill in information on Table 1.1 about three different foods that were dehydrated by classmates. Make sure you get some information on fruit dried with and without Fruit Fresh®. Compare the dehydrated foods to the original foods.

5. Is there any difference in the amount of water in the original foods? Why?

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PART B: Rehydrate

Name \_\_\_\_\_

### Procedure:

1. Place dehydrated food in a water bath overnight under refrigeration.
2. Weigh rehydrated food.
3. Calculate the volume of moisture that was regained. Rehydrated wt minus dried wt. equals volume regained.

Table 1.2

Weight of Original Sample	Dried Weight	Rehydrated Weight	Volume Gained

### Key Question:

1. Can rehydrated fruit/vegetables completely regain their original water content? Why or why not?

Adapted from: Frick, Marty. *Food Science, Safety and Nutrition*. The National Council for Agricultural Education, 1993 and Mehas, Kay; Sharon Rodgers. *Food Science and You*. 1st ed. Mission Hills, CA: Glencoe Publishing, 1989.

UNIT II - FOOD PROCESSING AS 1.2

Lesson 1: Procedures Used in Processing Food Name \_\_\_\_\_

**Food Processing-Magic Square**

**Directions:** Find the description on the following page which best fits each term. Write the number of the correct description in the space in each lettered square. If all your answers are correct, the total of the numbers, or the "Magic Number," will be the same in each row and column. Write the Magic Number in the space provided.

**Terms**

- |                          |                      |
|--------------------------|----------------------|
| A. Anaerobic             | I. Fortification     |
| B. Aerobic               | J. Frozen storage    |
| C. Aseptic canning       | K. Hypobaric storage |
| D. Blanching             | L. Irradiation       |
| E. Commercially sterile  | M. Pasteurization    |
| F. Controlled atmosphere | N. Pathogenic        |
| G. Cool storage          | O. Precipitate       |
| H. Food dehydration      | P. Shelf life        |

A	B	C	D	Total
E	F	G	H	_____
I	J	K	L	_____
M	N	O	P	_____

Total \_\_\_\_\_

### Descriptions:

1. This is the protein, carbohydrates, fat, minerals, and vitamins that are dissolved in milk.
2. Without oxygen
3. Processing with a limited number of kinds of radiant energy that together are referred to as ionizing radiations. This process is also called "cold sterilization" because it does not produce a significant amount of heat.
4. This means to cause a solid substance to separate from a solution.
5. Is used for apples and other fruits that respire, and then over ripen in cold storage. The system is based on reduced temperatures, depletion of oxygen and increased levels of carbon dioxide.
6. Refrigerated storage area maintained under reduced pressure and high humidity.
7. In the presence of oxygen
8. Means the degree of sterilization at which all pathogenic and toxin-forming organism have been destroyed, as well as all other types of organisms, which if present, could grow in the product and produce spoilage under normal handling and storage conditions.
9. The time a food product can safely be stored before deteriorating.
10. Disease carrying microorganisms
11. Refers to storage at temperatures above freezing, from 16°C down to -2°C. Commercial and household refrigerators are usually run at 4.5° to 7°C.
12. This is a kind of pasteurization process used to inactivate natural food enzymes in fruits and vegetables. It is typically used when these products are to be stored frozen (freezing will not completely stop enzyme activity).
13. Addition of a nutrient to foods such as adding vitamin D to milk
14. Addition of water to dehydrated foods



15. This refers to the nearly complete removal of water from foods under controlled conditions.
16. This involves a comparative low order of heat treatment (usually temperature is below the boiling point of water). Pasteurization is used to destroy pathogenic organisms associated with foods like milk. It is also used to extend product shelf life for products such as beer, wine, and fruit juices.
17. This requires temperatures of -18°C or below.
18. This refers to a method in which food is sterilized or commercially sterilized outside of the can and then aseptically placed in previously sterilized containers that are subsequently sealed in an aseptic environment.

Credit: Frick, Marty. *Food Science, Safety and Nutrition*. The National Council for Agricultural Education, 1993.

