

UNIT III - THE BIOCHEMISTRY OF FOODS

Lesson 2: Problems with Food Deterioration

Objective

The student will be able to describe problems resulting from food deterioration.

I. Study Questions

- A. What physical changes result from food deterioration?
- B. What chemical changes result from food deterioration?
- C. What environmental conditions favor bacterial growth in foods?
- D. What organisms contribute to food deterioration?
- E. What are some of the organisms found in food that can cause human diseases?

II. Reference

Martin, Phillip R. *Food Science and Technology* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1994. Unit III.

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Lesson 2: Problems with Food Deterioration

TEACHING PROCEDURES

A. Review

Review the factors that contribute to food deterioration. They are: microorganisms, natural enzymes, insects, parasites, rodents, temperature, moisture, air, light, and time.

B. Motivation

Imagine you are in the military overseas and it is your birthday. You have anticipated receiving food packages from family back home. You can taste the chocolate chip cookies, caramel popcorn, homemade apple cider and dinner rolls.

Unfortunately, your platoon is involved in field exercises and it will be two weeks before you get back to base. You can only hope the birthday box will still be there when you get back. You are looking forward to the goodies more than ever. Hopefully, the box will be refrigerated until you get back.

The last day of field exercise has passed as you tiredly return to the base. Your hunger pains can only be satisfied with the contents of your birthday box.

To your surprise, the box is resting on your bunk. Unopened, but also unrefrigerated. You can only hope the food has not molded nor grown stale. You quickly cut the strings and dig into the box where you find four packages, individually wrapped in tin foil. In just a few seconds you will satisfy your taste buds. In fact, your mouth is watering.

The first package is chocolate chip cookies, but they are all green with mold. You decide the next package will surely be all right, but the rolls have circular molds on them, and are as hard as hockey pucks. Your disappointment grows deeper as you taste the apple cider's bitter flavor and the caramel corn's staleness. What caused all of this?

C. Assignment

D. Supervised study

E. Discussion

1. Discuss the physical changes from food deterioration.

What physical changes result from food deterioration?

- a. Dehydration - excessive heat, cold, or exposure to air
 - b. Cracked skin - fruit frozen then thawed
 - c. Broken emulsion - liquid foods frozen then thawed
 - d. Texture degradation - frozen milk will curdle
 - e. Off-color (surface)
 1. Fruits and vegetables stored at too low a temperature
 2. Light causes surface discoloration of meat pigments
 3. Insufficient oxygen to cut meat surfaces reduces oxymyoglobin to metmyoglobin (brownish-red color)
 4. Mold growth causes a variety of color development
 - f. Internal browning - apples stored at too low a temperature
 - g. Lumping/caking/crystallization - excessive moisture
 - h. Surface pitting - fruit stored at too low a temperature
2. Discuss the chemical changes that result from food deterioration.

What chemical changes result from food deterioration?

- a. Sugars ferment
 - b. Starches hydrolyze
 - c. Fats hydrolyze (lipolysis) - causes rancidity
 - d. Proteins are denatured or digested - ammonia-like odors
 - e. Toxin production
 - f. Enzymatic reactions
 - g. Pigment conversion
3. Discuss what environmental conditions favor bacterial growth.

What environmental conditions favor bacterial growth in foods?

- a. Warm temperature; although some bacteria grow at very high or at very low temperatures
 1. Psychrophilic - grow in temperatures as low as 32°F
 2. Mesophilic - 60°-100°F, most bacteria are this type
 3. Thermophilic - grow in temperatures as high as 180°F
 - b. Moist conditions
4. Discuss what organisms contribute to food deterioration.

What organisms contribute to food deterioration?

- a. Bacteria
 - b. Fungi - yeasts and molds
5. Discuss what human diseases may be caused by unsafe food.

What are some of the organisms found in food that can cause human diseases?

- a. Campylobacteri
- b. Clostridium botulism
- c. Escherichia coli (E. coli)
- d. Hepatitis A Virus
- e. Listeria
- f. Salmonella
- g. Staphylococcus
- h. Toxoplasma
- i. Trichinella
- j. Vibrio parahaemolyticus
- k. Yersinia

F. Other activities

1. Make kimchee to study lactic acid fermentation. A detailed procedure can be obtained from Bottle Biology Program, University of Wisconsin-Madison, (608) 263-5645.
2. Invite a health department official to present a program on food-borne diseases.

G. Conclusion

Food deterioration is a continual problem for the food industry. Physical and chemical deterioration result from microbial and environmental influences. Unsafe food can thus cause a multitude of human diseases.

H. Competency

Describe problems resulting from food deterioration.

Related Missouri Core Competencies and Key Skills: None

I. Answers to Evaluation

1. a
2. b

3. a
4. a
5. b
6. a
7. a
8. b
9. b
10. b
11. Warm temperatures, moisture
12. b
13. a
14. a
15. b
16. b
17. a
18. b
19. d
20. a
21. c
22. e

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Name _____

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Date _____

EVALUATION

Is the type of deterioration on the left a physical change or chemical change? Write the correct letter in the blank.

- | | |
|---|--------------------|
| 1.____Dehydration | a. Physical change |
| 2.____Starches hydrolyze | b. Chemical change |
| 3.____Off-color | |
| 4.____Internal browning | |
| 5.____Acid production | |
| 6.____Surface pitting | |
| 7.____Lumping, caking | |
| 8.____Pigment conversion | |
| 9.____Lipolysis | |
| 10.____Toxin production | |
| 11. List the 2 environmental conditions needed for most microbes to grow. | |

Match the microbial characteristic on the left with the appropriate type of microbe on the right.

- | | |
|--|--------------------------|
| 12.____Used to ripen certain types of cheese | a. Bacteria |
| 13.____Unicellular | b. Fungi (molds, yeasts) |

Food Science and Technology-Unit III

- 14.____Procaryote
- 15.____Grow by mycelia
- 16.____Require oxygen
- 17.____Classified based on shape

Match the disease on the right with the description on the left.

- | | |
|---|------------------------|
| 18.____Transmitted by improperly
processed or unrefrigerated low
acid foods | a. Salmonellosis |
| | b. Botulism |
| 19.____Leading cause of gastroenteritis in humans | c. Trichinosis |
| 20.____Caused by salmonella bacteria | d. Camphylobacteriosis |
| 21.____Raw pork from hogs fed uncooked garbage | e. Toxoplasmosis |
| 22.____Meat animals can be infected by cats, which
are a common host of this disease | |