UNIT II - FOOD PROCESSING

Lesson 12: Processing Fruits, Vegetables, and Nuts

Objective

The student will be able to explain how fruits, vegetables, and nuts are processed.

I. Study Questions

A. How are fruits, vegetables, and nuts processed?

B. How do processing techniques affect the nutritional value of fruits, vegetables, and nuts?

C. How are fresh fruits, vegetables, and nuts treated and packaged to enhance their appearance and shelf life?

D. How is the industry that processes fruits, vegetables, and nuts organized?

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

AS 12.1: Enzymatic Browning

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TEACHING PROCEDURES

A. Review

Review the major classes of fruits, vegetables, and nuts. Ask your students to name an example of each. Compare these raw products to what is found in the grocery store. Would any fruit, vegetable, or nut require processing?

B. Motivation

The "Love Apple".... what is it? It is a fruit, but gets treated like a vegetable. It is a perennial, but gets treated like an annual. It was probably domesticated in Mexico and arrived in Europe in the 1500's. Thomas Jefferson, a gardener ahead of his time, raised it. Robert Gibbon Johnson is slightly famous because he ate one on the courthouse steps in Salem, NJ, in 1820. It was believed to be poisonous due to the family from which it came, the nightshade family. It supplies vitamins A an C. It normally self pollinates. It provides the pizazz on pizza, sauce for spaghetti, base for soup, garnish on a salad, and main ingredient in catsup. What is it? Tomato
ref. Credit: Rick, Charles M. *Science of Food & Agriculture*, Jan. 1986.

C. Assignment

D. Supervised Study

E. Discussion

1. Discuss how fruits, vegetables, and nuts are processed.

How are fruits, vegetables, and nuts processed?

a. Fruits and vegetables
    1. Harvest
    2. Transported to plant
    3. Cleaned and sorted
    4. Some go to a ripening chamber
    5. Additional processing depends on end product
        a. Fresh - cooled, washed
        b. Frozen - washed, pitted, stemmed, cut or cored before freezing; some may be blanched

c. Canned - blanched, peeled and/or cored, filled in cans, air removal, sealed, retorted, cooled, and labeled.

b. Nuts
   1. Harvest with mechanical tree shaker
   2. Hulled by mechanical nut hullers
   3. Sorted by size and/or color
   4. Dried to 9.5 percent moisture
   5. Additional processing depends on end product
      a. Nut meats - remoistened, shelled, and packaged
      b. In-shell nuts - washed, polished, and waxed
      c. Roasted nuts - heated in oil, oil coated, salted, and oiled again (Dry roasted are heated without oil.)

2. Discuss how processing techniques affect the nutritional quality of fruits, vegetables, and nuts.

   How do processing techniques affect the nutritional value of fruits, vegetables, and nuts?

   a. Fresh fruits/vegetables are highest in overall nutrition.
   b. Frozen items are a close second.
   c. Canned items lose minerals and vitamins - canning extends the processing period but some minerals and vitamins are lost.
   d. Dried fruits are devoid of Vitamin C.
   e. The composition of nuts is not usually affected by processing.

3. Discuss how fruits, vegetables, and nuts are treated and packaged to enhance their appearance and shelf life.

   How are fresh fruits, vegetables, and nuts treated and packaged to enhance their appearance and shelf life?

   a. Ethylene gas - ripening agent
   b. Sodium bisulfite - retards browning
   c. Sulfur dioxide - retards browning
   d. Waxing - prevents dehydration in apples and nuts
   e. Irradiation - inhibits sprouting in potatoes
   f. Cool temperatures - slows enzymatic reactions
   g. Nuts in opaque containers - prevents rancid flavors
   h. Fruits and vegetables stored in containers with holes to allow for respiration
   i. Artificial coloring - enhances eye appeal

4. Discuss the organization of the fruit, vegetable, and nut industry.

How is the industry that processes fruits, vegetables, and nuts organized?

a. Contract production
b. Cooperatives
c. Very large parent companies
d. Immigrant, migrant labor
e. Organizations promote products

F. Other activities

Effect of roasting upon color, flavor, and texture of peanut butter.

G. Conclusion

Fruits, vegetables, and nuts are processed to maintain a steady supply in the off season. Following harvesting, fruits, vegetables, and nuts undergo different processing techniques depending on the end product. In general, the nutritional quality is highest in raw fruits and vegetables. Various techniques are used to enhance shelf-life and market value.

H. Competency

Explain how fruits, vegetables, and nuts are processed.

Related Missouri Core Competencies and Key Skills:

9D-5: Describe the relationship between technologies which improve our lives and the environmental problems that can result from them.
9D-6: Identify the control, dependent, and the independent variables in an experiment.

I. Answers to Evaluation

1. e
2. b
3. a
4. c

5. 3
   1
   2

6. Contract production - growers supply processors certain quantities of a specific crop

Cooperatives - several producers have joined together to collectively market their products
Migrant workers - laborers who travel from farm to farm during the growing and harvesting season

J. Answers to AS 12.1

1. Enzymatic browning occurs when plant tissue is exposed in a brown colored pigment, melanin, being produced as a result of a series of biochemical reactions.

2. Warm temperatures and plenty of air exposure enhance the browning process. An enzyme called polyphenol oxidase acts as a catalyst to speed up the process which can occur rapidly at warm temperatures when the pH is between 5.0 and 7.0.

3. Acids such as ascorbic acid and citric acid are commonly used in the food industry.

4. Citric acid acts as a delating agent to prevent the fruit from browning. Citric acid inhibits the polyphenol oxidase enzyme by reducing copper ions which are necessary for the enzyme to be active.

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EVALUATION

Match the processing technique on the left with the descriptions on the right.

1.	Treating with ethylene gas	a.	Prevents enzymatic browning
2.	Blanching	b.	Inactivation of enzymes by heating
3.	Adding sodium bisulfite	c.	Blanching, peeling, can filling, air removal, sealing, retorting
4.	Canning	d.	Washing and polishing
		e.	Used in ripening chambers
		f.	Heated, oiled, salted, oiled

Complete the following short answer questions.

5. Rank the following in the order of their nutrient quality. Begin by placing a "1" by the item with the most nutrients.

   _____ dried fruit

   _____ fresh fruit

   _____ canned fruit

6. The fruit, vegetable, and nut industries are characterized by contract production, cooperatives, and migrant workers. Explain what these three terms mean.

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Enzymatic Browning

Objective: The student will investigate the process of browning in fruits and test the effects of various substances in preventing browning.

Activity Length: 1 hour

Materials and Equipment:

Fresh fruit or vegetable (apples, bananas, peaches, pears, avocados will work well)
Vinegar - acetic acid
Lemon juice - citric acid
Fruit Fresh®
Beakers or wide-mouth jars
Tongs
Paper towels
Water

Procedures:

1. Prepare 200 ml of each of the following solutions and place them in 4 separate jars.

   fruit fresh
   lemon juice
   vinegar
   water

2. Cut the pieces of fresh fruit or vegetables into six pieces of approximately equal size.

3. Using tongs, dip a separate piece of the sample fruit into each of the three acid solutions and water and place the samples on a paper towel. Rinse the tongs after each use.

4. Put an untreated piece of the sample on the paper towel.

5. Record on the 0 min line what each piece looks like as soon as they are all placed on the towel. For texture, look at the fruit but do not touch. Touching the surface of the fruit adds bacteria from your hands.

6. Observe all 5 samples every ten minutes for the class period. Record your observations.

Time	Record Observations														
	Fruit Fresh			Lemon Juice			Vinegar			Water			Air		
	Color*	Odor	Texture	Color*	Odor	Texture	Color*	Odor	Texture	Color*	Odor	Texture	Color*	Odor	Texture
0 min															
10 min															
20 min															
30 min															
40 min															
50 min															

*Color Code

5 completely dark brown
4 fully covered light brown
3 half covered light brown
2 slight or scant brown patches
1 no browning present

Questions

1. What causes browning when fresh fruits and some vegetables are peeled or cut?

2. What conditions enhance the browning process? Why?

3. How do food additives or treatment processes in use today prevent or retard browning in fruits and vegetables.

4. Why do citrus juices retard browning in fresh fruits?