

## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 4: Food Processing and Food Safety

**Competency/Objective:** Describe the importance of food processing and safety.

#### **Study Questions**

1. **What is food processing?**
2. **Why is food processed?**
3. **How are food products processed?**
4. **What are the steps in processing food from producer to consumer?**
5. **How do you know your food is safe?**
6. **How does food preparation affect quality and safety?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000. Unit IV.
2. Super Soynuts, Soybean Candies, and/or Mighty MO Munchies  
  
Lee Seed Company  
2242 Highway IA 182  
Inwood, IA 51240  
712-753-4403  
  
The Soy Bin  
Route 1, Box 99  
Marienthal, KS 67863  
316-375-2746  
  
Dwight and Rosemary Hall  
Highway 111 West, Box 335  
Oregon, MO 64473  
800-762-1384
3. Transparency Masters  
  
TM 4.1 Processing Food: From Producer to Consumer  
TM 4.2 Recommended Safe Cooking Temperatures
4. Activity Sheets  
  
AS 4.1 Popcorn Processing (Instructor)  
AS 4.1 Popcorn Processing (Student)  
AS 4.2 Soybean Processing (Instructor)  
AS 4.3 Ice Cream Processing (Instructor)  
AS 4.3 Ice Cream Processing (Student)  
AS 4.4 Food Safety Activities (Instructor)

## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 4: Food Processing and Food Safety

#### TEACHING PROCEDURES

##### A. **Review**

Foods of plant origin come from grains, vegetables, fruits, and other plants. Foods of animal origin come from beef, pork, poultry, sheep, fish, and seafood. Many consumers prefer to eat processed plant food products rather than the raw form. Most meat products are processed as well. This lesson will discuss reasons for food safety and techniques of food processing that help provide nutritious, quality foods for consumers.

##### B. **Motivation**

1. Bring in samples of dehydrated food such as dried fruit (raisins or apple slices), beef jerky, etc. for students to eat. Then ask students how the food items were processed and why.
2. Obtain samples of a soy-based snack food such as Super Soynuts, Soybean Candies, or Mighty MO Munchies. See References for where to get these foods. Perform a taste test with students to see if they can tell that soybeans were processed to make the product(s).
3. Bring a bag of potatoes to class along with a variety of products made from potatoes (e.g., chips, french fries, shoestring potatoes, and hash browns). Ask students to describe how each of the products was processed.
4. Bring in several different food items and draw a flowchart of the processes those food items go through from producer to consumer. Discuss these processes with the students.
5. Bring in processed meats (bologna, wieners, Spam, chicken strips, etc.) and discuss how they were processed.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

###### Q1. **What is food processing?**

###### A1. **Processing is used to change a raw agricultural product into a consumable product and includes the following steps.**

- a) **Cleaning**
- b) **Drying**
- c) **Weighing**
- d) **Refrigerating**
- e) **Preserving**
- f) **Storing**
- g) **Changing the form**

Discuss processing. Processing can be a very simple or complicated process. Processing strawberries to be frozen whole is quite simple as compared to processing flour. Strawberries have to be washed, sorted, and destemmed before freezing. Wheat has to be cleaned, dried, weighed, and graded for quality before it can be ground into flour.

Depending on the type of flour, it may also be separated into bran and germ before being ground. Have students complete the popcorn activity (AS 4.1). Note that processing also involves the methods and conditions of proper storage.

**Q2. Why is food processed?**

**A2.**

- a) **To improve taste**
- b) **To maintain quality**
- c) **To prevent spoilage**
- d) **To ensure food is safe to eat**
- e) **For the convenience of consumers**

Food is an important part of everyday life. Foods must not only be nutritious but also safe from spoilage or contamination. Maintaining food quality is important for consumer acceptance. High-quality foods generally command higher prices than would lower-quality food products. Although quality and safety are important, the convenience of food to the consumer is also an important factor affecting how food is processed.

**Q3. How are food products processed?**

**A3.**

- a) **Freezing - reducing the temperature to 0°F to stop microbial growth**
- b) **Heating - heating food to a temperature greater than 180°F; pasteurization for dairy products**
- c) **Dehydration - removing water from foods: beef jerky and raisins**
- d) **Fermentation - breaking down complex carbohydrates: pickles and yogurt**
- e) **Smoking and curing - preserving foods by using salt, brine, smoke, or aging**
- f) **Vacuum packing - removing air from the food product container**
- g) **Irradiation - using radiant energy to improve food safety and extend shelf life**
- h) **Grinding - reducing the particle size: flour and ground beef**
- i) **Homogenization - breaking large fat globules into smaller ones: milk**
- j) **Emulsification - holding together ingredients that normally repel and separate from each other: salad dressing and ice cream**
- k) **Extrusion - puffing a product with high pressure to form a new shape: cereal**
- l) **Separation - removing bone and fat from product**

Discuss the different techniques used to process food. Bring in sample foods that have been processed using these techniques. Conduct AS 4.2 to illustrate food processing procedures. Conduct AS 4.3 as an additional exposure to food processing.

**Q4. What are the steps in processing food from producer to consumer?**

**A4.**

- a) **Producer - grows plants or raises animals**
- b) **Harvesting - removing the edible portions from plants in the field**
- c) **Processing - cleaning, separating, handling, and preparing food for distribution**
- d) **Distributing - storing food until it is needed by wholesalers**
- e) **Wholesaling - selling fresh or processed foods to retailers**
- f) **Retailing - selling food to consumers**
- g) **Consumer - eats fresh or processed foods**

Raw agricultural products can go through many steps before they reach the consumer. The more steps a product goes through the higher the marketing cost. If the consumer purchases the product straight from the producer, much of the marketing cost is reduced. For products like apples, purchasing from the producer may be very cost-efficient. For other products like wheat, it would cost the consumer a lot of time to process the wheat into flour. Show TM 4.1 and explain how food is processed, step by step, from a raw commodity to a consumable product.

**Q5. How do you know your food is safe?**

**A5. Food quality is monitored by federal government agencies.**

- a) Environmental Protection Agency (EPA)
- a) Food and Drug Administration (FDA)
- b) U.S. Department of Agriculture (USDA)
- c) The livestock industry has responded by implementing quality assurance programs.

Food safety is a major concern to consumers. Many steps are taken to ensure that food sold to consumers is safe to eat and is high quality. Several government agencies such as EPA, FDA, and the USDA regulate practices that affect the safety of the nation's food supply. Government inspectors are trained to identify potential problems before they reach consumers. Ask students how they or their parents can avoid this problem.

**Q6. How does food preparation affect quality and safety?**

**A6. Food should be prepared according to the following four steps to keep it safe from harmful bacteria.**

- a) Clean - Wash hands in hot, soapy water before preparing food.
- b) Separate - Keep raw meats away from ready-to-eat foods.
- c) Cook - Cook foods long enough and at a high enough temperature to kill harmful bacteria.
- d) Chill - Refrigerate or freeze leftovers within 2 hours or less.

Review the four steps to keep food safe from harmful bacteria. Refer to TM 4.2 and explain the recommended safe cooking temperatures. Emphasize the importance of avoiding the temperature danger zone where bacteria grows most rapidly. Food needs to be either cooked quickly or chilled quickly to avoid this temperature zone. Conduct AS 4.4 to help students understand food safety issues.

**F. Other Activities**

1. Have each student bring a label from a food product. These can be read in class with a discussion about the different processing needs. Identify preservatives and additives that are used to maintain the quality of the food.
2. Bring a food product or raw food ingredient and put it through selected processes to become the finished product. This product can be eaten in class when complete. Examples of foods and their products include apples for applesauce, oranges for orange juice, chuck steak for hamburger.
3. Access the National Pork Producers' web page and take the "Can Your Kitchen Pass the Food Safety Test?" The address of the page is <<http://www.nppc.org/CONS/SAFETY/START.html>>.

G. **Conclusion**

Food safety and processing affects everyone because of the need for safe, wholesome food. Processing involves all the steps of going from a raw agricultural product to a consumable product. We process food to improve taste, maintain quality, prevent spoilage, and to provide a safe and convenient product for consumers. Many different methods and steps can be used to process food. U.S. government inspectors monitor the food processing industry to ensure safe food for consumers. Keeping food safe from harmful bacteria is an important food safety principle.

H. **Answers to Activity Sheets**

AS 4.1 Popcorn Processing

Answers will vary.

AS 4.2 Soybean Processing

There are no answers for this activity.

AS 4.3 Ice Cream Processing

1. The freezing point of water is actually lowered by adding rock salt to the ice. Ice cream freezes at 21<sup>o</sup>F.
2. The amount of milk fat affects the flavor and amount of calories in ice cream. The greater the milk fat, the richer the flavor and the higher amount of calories.

AS 4.4 Food Safety Activities

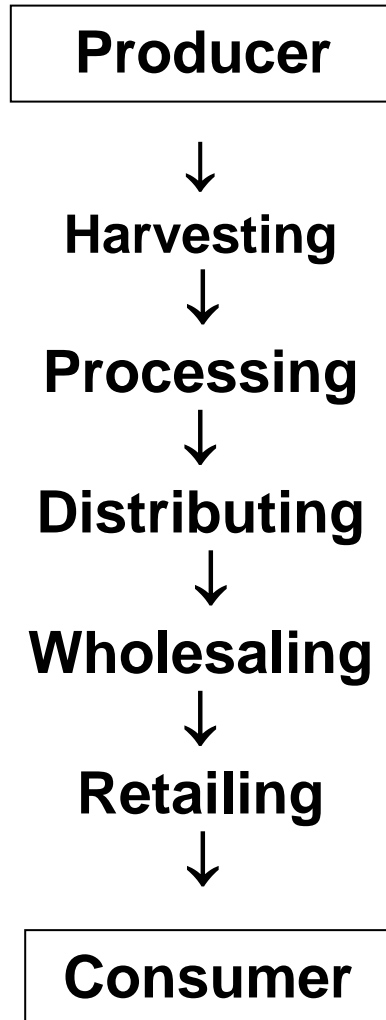
Results will vary.

I. **Evaluation**

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.



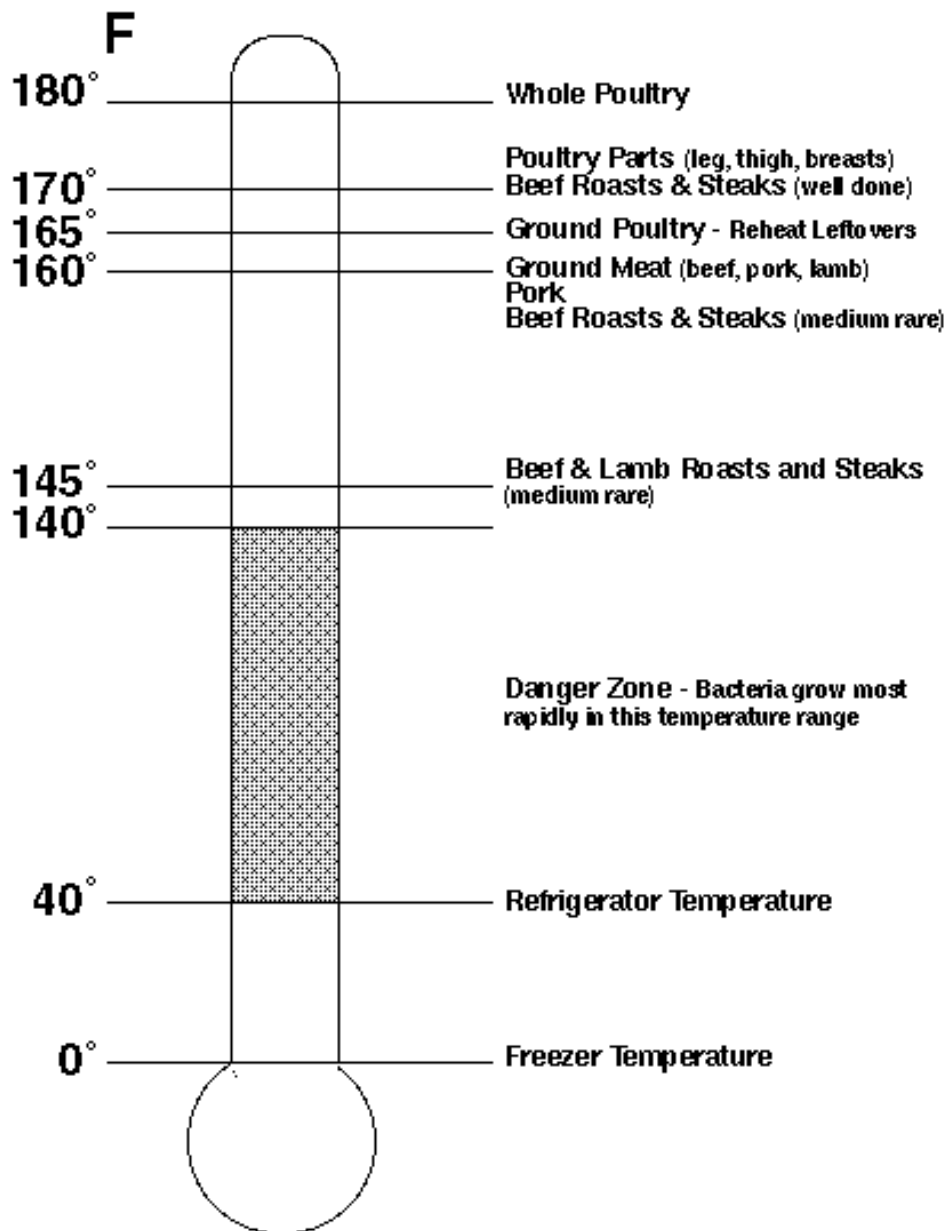
# Processing Food: From Producer to Consumer







# Recommended Safe Cooking Temperatures



Reference - The Partnership for Food Safety Education



### Popcorn Processing

**Objective:** Students will describe the importance of maintaining proper moisture level during the processing and storage of popcorn.

**Materials and Equipment:**

Popcorn (3/4 cup per group of five to six students)  
Water  
Oven  
Popcorn poppers (one per group)  
Vegetable oil (not needed if using air poppers)  
Paper towels or napkins  
Salt

Before conducting this activity the instructor should:

1. Divide popcorn into three equal-sized samples.
2. Place one sample of popcorn in water overnight.
3. Place a second sample of popcorn in an oven at 200°F for 2 hours.
4. Keep a third sample in a sealed plastic bag to maintain moisture content.

**Procedure:**

1. Divide class into groups of five or six students.
2. Have students follow the procedures outlined on AS 4.1 (Student). You may modify the activity by not discussing what happened to each popcorn sample before students begin. Then they could brainstorm ideas/theories of why the two samples did not pop.
3. Lead a discussion. What happened? Did all three samples pop? Why not?

The first two samples should not pop because the moisture level is not right. The third sample should pop because the moisture level was maintained around 13%. The moisture level must stay between 11.5 and 14.5% for the popcorn to pop. Have students sample the popped corn.

**Problem-Solving Challenge:**

Ask students to prevent a popcorn kernel from popping. They must understand that the hull (outer covering) on a popcorn kernel holds in water found inside. When the kernel is heated, the water boils, turns to steam, and expands. Finally, the pressure builds high enough for the kernel to explode. Students might think of puncturing the kernel to allow air to dry it out in addition to adding water or heating the kernel. Would freezing affect the popcorn kernel?

Discuss with the students that proper handling of the raw product during processing is a key step.



**Popcorn Processing**

**Objective:** Students will describe the importance of maintaining proper moisture level during the processing and storage of popcorn.

**Materials and Equipment:**

- 1/4 c - Sample #1 - popcorn that has been soaked in water
- 1/4 c - Sample #2 - popcorn baked in the oven
- 1/4 c - Sample #3 - popcorn straight out of the bag
- Vegetable oil (if needed)
- Popcorn popper
- Three bowls or containers for the popped corn
- Salt
- Paper towels or napkins

**Procedure:**

1. The instructor will place sample #1 in popper and turn popper on. Allow 10 minutes for popping then turn the popper off.  
  
CAUTION: Do not allow popcorn to pop too long. It will burn.
2. Pour corn into bowl.
3. Record the results in the table below.
4. Repeat steps 1, 2, and 3 for sample #2.
5. Repeat steps 1, 2, and 3 for sample #3.
6. Add salt to the popped corn. Enjoy!

Popcorn	Did the sample pop?	Why or why not?
Sample #1		
Sample #2		
Sample #3		

**Key Question:**

How do processing and storage affect the quality of popcorn?



### **Soybean Processing**

**Objective:** Students will process the soybean into an edible food product.

**Activity Length:** Overnight soak, 1-hour dry time, 1 lab period

**Materials and Equipment:**

Soybeans, dry (must be cleaned)

Water

1 quart vegetable oil for frying

Salt

Deep fat fryer

Paper towels

**Procedure:**

1. Clean soybeans by removing all foreign material and washing thoroughly.
2. Soak soybeans in water overnight.
3. Drain beans thoroughly. The skins may be removed if desired. Place beans on absorbent paper and allow to air-dry about 1 hour.
4. Place oil in a deep fat fryer or a heavy, deep saucepan. Heat oil to 350<sup>0</sup> F.  
  
CAUTION: Oil is very hot. Be careful when working around the heated oil.
5. Put about 1 cup of beans in a fryer basket. Lower basket slowly into the hot fat. Moisture in the beans may cause excessive splattering if beans are lowered rapidly into the fat.
6. Fry beans about 6 to 8 minutes or until crisp and lightly browned.
7. Remove from oil.
8. Drain beans on absorbent paper.
9. Sprinkle with salt.
10. When cool, sample. The remaining beans should be stored in a tightly covered container.

Credit: The Missouri Soybean Association and the Missouri Soybean Merchandising Council, P.O. Box 104778, Jefferson City, MO 65110.





### **Ice Cream Processing**

**Objective:** Students will process ice cream.

**Variations for the Activity:**

1. Nuts may be added to the ice cream by putting this ingredient with the 1 cup of milk, 1 cup of whipping cream, etc., that goes in the quart freezer bag.
2. We used 2% milk. Students could try this with 1% and skim milk to see if they like the flavor as well as the 2% milk.
3. If you want pairs of students to conduct this activity rather than groups of four, divide the ingredients in half and use pint and half-gallon freezer bags.



**Ice Cream Processing**

**Objective:** Students will process ice cream.

**Materials and Equipment (group of four):**

1 cup 2% milk  
1 cup whipping cream or half and half  
¼ cup sugar (4 tablespoons)  
½ teaspoon vanilla  
1 cup rock salt  
1-quart freezer bag  
1-gallon freezer bag  
Measuring spoon and measuring cup  
Duct tape  
Four 8-oz. sundae cups  
Four spoons

**Class Materials:**

Ice supply  
Various toppings for ice cream  
Towels, hot/cold mitts or old gloves  
Scissors

**Procedure:**

1. Each group adds 1 cup of milk, 1 cup of whipping cream or Half and Half, ¼ cup of sugar (4 tablespoons), and ½ teaspoon vanilla to a quart freezer bag. Use duct tape to seal the open end of the bag, keeping some air in the bag.
2. Place the quart freezer bag inside a 1-gallon freezer bag. Pack ice around the quart bag and add 1 cup of rock salt and ¾ cup of water. The gallon bag should then be tightly sealed using the duct tape.
3. Students should take turns shaking the bag until the ice cream is frozen, which usually takes 10-15 minutes. Towels, hot/cold mitts, or old gloves can be used to protect your hands from the cold.
4. Carefully cut open the gallon freezer bag and discard the ice and rock salt. Rinse the quart bag containing the ice cream. Cut a corner of the bag with clean scissors and squeeze out the ice cream.
5. Eat the ice cream plain or add your favorite toppings.

**Key Questions:**

1. Why is rock salt added to the ice?
2. How does the amount of milk fat affect ice cream?



**Food Safety Activities**

**Objective:** Students will develop an awareness of food safety.

## Activity 1 - Home Refrigerator Survey

**Procedure:**

Have students check the temperature of their home refrigerator and compile the results. Then tell them that refrigerators should stay at 40°F or less. This temperature won't kill the bacteria, but it will keep bacteria from multiplying.

## Activity 2 - Removing Bacteria from Your Hands

**Procedure:**

1. Ask for three student volunteers. (This activity could be modified for more students or the whole class.)
2. Each student rubs 1 tablespoon of cooking oil all over his/her hands until completely coated.
3. Next sprinkle bacteria (1 teaspoon of cinnamon) on each student's hands. Students should rub it around until evenly distributed.
4. Each student will wash hands by rubbing them briskly for 20 seconds as follows:  
Student 1: wash hands with cold water and no soap  
Student 2: wash hands with warm water and no soap  
Student 3: wash hands with warm water and soap
5. Have the class observe the student volunteers' hands after washing to determine the method that removed the least and most bacteria.

## Activity 3 - Visual Bacteria

**Materials and Equipment:**

Two small apples washed in advance

Small clean knife

Cutting board

Potato peeler (if available)

Two sterilized jars with screw-top lids (Use rubbing alcohol to sterilize. Label one "unwashed hands" and the other "washed hands.")

**Procedure:**

1. Ask students to raise their hands if they haven't washed their hands for several hours. Select one student to assist with the experiment. (This activity could be modified for the whole class.)
2. Have the student peel one apple and cut it in half on the cutting board. Place half of the apple in the jar labeled "unwashed hands." Screw the lid on tightly.
3. Next the student should briskly wash his/her hands in hot, soapy water for 20 seconds. In addition, wash the potato peeler, knife, and cutting board with hot, soapy water and wipe items

with a disinfectant cleaner.

4. Have the student peel the second apple and cut it in half. Place half of the apple in the jar labeled "washed hands." Screw the lid on tightly.
5. Place the jars in a warm place and observe daily for a week. (If the experiment was conducted properly, an increased level of bacteria-related growth should be evident on the "unwashed hands" sample.)