

The Chemistry of Fruits and Vegetables

Purpose

The purpose of this lesson is for students to perform scientific experiments where they examine fruit and vegetable preparation and storage.

Time

Teacher Preparation

Twenty minutes

Introduction

Fifteen minutes

Experiment

One 50-minute session

Concluding Discussion

Twenty minutes

Materials

For each student or partnership:

- Two different fruits (apple, avocado, peach, plum, or pear)
- Two different whole vegetables (potato, eggplant, zucchini, sweet potato, or carrot)
- Paper or plastic plates (12)
- Knife (metal or heavy-duty plastic)

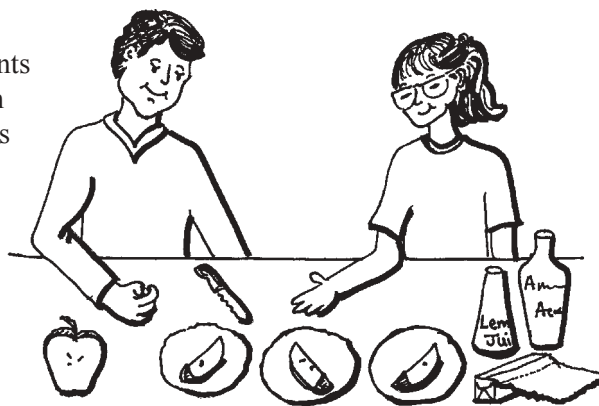
Background Information

All plants are made up of living cells that are held together by cell walls. When some fruits and vegetables are cut, the cell walls are broken and a chemical reaction occurs which causes the cut surfaces to darken. The chemical reaction is caused by exposure of the fruit or vegetable to oxygen in the air. This chemical reaction is called oxidation and is promoted by enzymes that are released when the cells are cut open. Fruits and vegetables that have been discolored from oxidation are still edible, despite the change in appearance. The chemical reaction that causes darkening will not occur when:

- Ascorbic acid is present naturally in the fresh produce, or added right after cutting.
- The produce is heated to destroy the enzymes that cause discoloration due to oxidation.
- The food is covered to prevent oxygen from entering the cut cells.

Bruised and blemished produce is also edible if the imperfections are removed with a knife. However, moldy fruit and vegetables should be discarded because some molds produce toxins that are potentially harmful.

In this lesson, students will experiment with fruits and vegetables to determine if high enough levels of ascorbic acid are present to prevent discoloration.



It is important to discuss with students that the agricultural industry establishes guidelines on how fresh produce should be shipped and stored so that quality produce gets to the consumer. It is equally important to discuss with the students the appropriate produce storage and handling techniques they should use at home.

The Chemistry of Fruits and Vegetables

Materials *(continued)*

- Plastic wrap
- Lemon or orange juice
- *Chemistry of Fruits and Vegetables* activity sheet (page 29)

For the teacher:

- Sharp metal knife
- Storage area for student experiments

Procedure

Day 1

1. Divide the class into small cooperative groups. Explain to the students that they will be doing an experiment using fresh fruits and vegetables. Outline the safety requirements students should follow when using a sharp knife. Ask the students what they think will happen to various fruits and vegetables when they are cut open. Go over the following procedure with the students and have them record their hypotheses on their papers.
2. Pass out two types of vegetables and two types of fruit to each group of students. Students will need to slice three equal portions of each fruit and vegetable.
3. Without delay, treat the three slices of each type of fresh produce as follows:
 - **First slice**—leave exposed to the air (the control).
 - **Second slice**—apply lemon or orange juice to all exposed surfaces.
 - **Third slice**—seal tightly in plastic wrap.
4. Have students record their observations on *The Chemistry of Fruits and Vegetables* activity sheet (page 29). Observations should be made and recorded immediately after cutting and at regular 10-minute intervals for thirty minutes.



Day 2

1. Have the students make their final observations.
2. Hold a class discussion on produce discoloration and the effect ascorbic acid has on fresh produce. Take time to discuss types of discoloration that affect the healthfulness of the food such as mold and bruising.

The Chemistry of Fruits and Vegetables

Content Standards

Grade 4

Science

Life Sciences • 2c
Investigation and
Experimentation • 6, 6f

Reading/Language Arts

Listening and Speaking • 1.1,
1.6

Grade 5

Science

Physical Sciences • 1a
Investigation and
Experimentation • 6, 6g,
6h, 6i

Grade 6

Science

Investigation and
Experimentation • 7, 7a, 7d

3. Have student groups discuss results as well as draw and write conclusions. Students should be able to make conclusions about the following and then complete their worksheets:

- The ascorbic acid content of the different types of produce in their natural states.
- The effectiveness of orange or lemon juice in preventing discoloration.
- The effectiveness of plastic wrap in preventing discoloration.

Variations

- Have the students write a formal lab report, which includes a purpose, hypothesis, materials list, procedure, results, and conclusion sections.
- Have students design their own experiments that will determine how discoloration of fresh produce can be reduced.
- Before the activity, have students brainstorm what the results of the experiment will be (hypothesis). After the experiment, have the students compare their data with their predictions.

Extension

- Conduct a blind taste test. Divide the students into groups. Have each group select a student to be a taster and blindfold him or her. Give this student a fresh cut piece of fruit, then give him or her a piece of the same kind of fruit that has oxidized (turned slightly brown). Have the taster comment on the differences in taste and texture.

The Chemistry of Fruits and Vegetables

Name _____

Introduction: The appearance of fruits and vegetables is very important to most people. Some imperfections do not affect the taste or healthfulness of the fresh produce. Examples include skin blemishes, browning of cut fruit, and odd shapes or sizes. Other imperfections such as bruises may be cut off and not affect the taste, while others such as molds make the fruit or vegetable inedible. In this activity, you will experiment with the browning of cut fruits and vegetables.

Hypothesis: _____

Produce Name	Treatment of Food <ul style="list-style-type: none"> • None (control) • Lemon/Orange Juice • Plastic Wrap 	Color Immediately After Cutting	10 Minutes After Cutting	20 Minutes After Cutting	30 Minutes After Cutting	Color After 24 Hours

Think About It! *(Complete after you have finished the experiment.)*

Suppose you were only going to eat 1/2 of an apple and wanted to store the other half to eat the next day. What storage technique would you use? _____
 Why? _____

Explain what your experimental results might mean to a chef who wants cut fruits and vegetables to look attractive. _____

Other than those mentioned in this lesson, what other food storage techniques can you think of that keep food fresh, tasty, and healthful? _____

How do your results compare to those of another group? _____