

Activity 5:

Ripening of Fruits and Vegetables

Objectives

Compare and contrast the rate of ripening of fruits and vegetables when exposed to air and the effect of using a chemical inhibitor on that rate of ripening.

Measure the exposed surface area of ripened fruits and vegetables.

Science Standard

- **Science as Inquiry:** Abilities necessary to do scientific inquiry
- **Life Science:** Matter, energy, and organization in living systems
- **Science in Personal and Social Perspectives:** Personal health

Mathematics Standard

- **Measurement**

Materials Needed

Distilled water
Fruits such as apples and bananas
Vegetables such as carrots and celery sticks
Vitamin C tablets
Small deep plastic bowls
Knife
Large spoons
Paper plates

BACKGROUND

Food for the Space Shuttle is packaged and stowed in food lockers at Johnson Space Center in Houston, Texas, approximately a month before each launch and is kept refrigerated until shipped to the launch site. About 3 weeks before launch, the food lockers are sent to Kennedy Space Center in Florida. There, they are refrigerated until they are installed in the Shuttle 2 to 3 days prior to launch. Besides the meal and supplemental pantry food lockers, a fresh food locker is packed at Kennedy and installed on the Shuttle 18 to 24 hours before launch. The fresh food locker contains tortillas, fresh bread, breakfast rolls, fresh fruits such as apples, bananas, and oranges, and fresh vegetables such as carrots and celery sticks. During space flight, fresh fruits and vegetables have a short shelf life because of

the absence of a refrigerator and must be consumed within the first 7 days of flight. Carrots and celery sticks are the most perishable items in the fresh food locker and must be consumed within the first 2 days of flight.

Onboard the ISS, refrigerators will be present, and refrigerated foods for the Station will include fresh and fresh-treated fruits and vegetables. Certain types of fruits and vegetables can have an extended shelf life of up to 60 days.

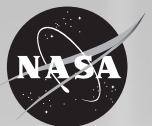
When certain fruits or vegetables are sliced open and exposed to air, the exposed cut surface turns brown in color. There are a number of processing techniques that can be employed to fresh-treat fruit and vegetables: irradiation, a wax coating, an ethylene inhibitor (ethylene is a plant hormone that causes ripening), controlled atmosphere packaging, modified atmosphere packaging, and the use of a chemical inhibitor.

This activity focuses on one of these processes the use of a chemical inhibitor as a way of packaging sliced fruits and vegetables as a single-serving, nonwaste food item. Slicing eliminates the weight and waste of a core and peelings.

Some foods are easily browned, such as bananas, apples, pears, and peaches. You can protect fresh fruit from browning by keeping it from being exposed to air. Another way is by treating the food with vitamin C.

Procedure

1. Pour water into two small deep bowls. Dissolve a vitamin C tablet into one, and leave the second as plain water. Label the first one Vitamin C and the second Plain Water.
2. Cut a piece of fruit into six equal wedges.
3. Place two wedges into each of the prepared liquids. Be careful that each wedge is completely immersed in the liquid for about 10 minutes.
4. Remove each wedge with a spoon, and place on separately labeled paper plates.
5. Place the last two wedges on a paper plate labeled Untreated.
6. Arrange the piece so that all of the cut surfaces are exposed to air.
7. Repeat steps 2 through 6 with each fruit and vegetable being tested.



8. Let all three plates sit for an hour, and observe for any browning.
9. Using a variety of tools (ruler, square centimeter graph paper, foil, etc.) to measure the brown, exposed area of the fruits and vegetables.

Discussion

1. Which fruit and which vegetable turned browner than the others?
2. Which fruit and which vegetable did not turn as brown as the others?
3. Can you think of another chemical inhibitive that could be used to preserve fruits and vegetables?
4. What would be the best way to pack fruits and vegetables for space flight?

Extensions

1. Does the amount of vitamin C in the water affect the rate that fruit and vegetables will turn brown? Test this

hypothesis by using one-half tablet, one tablet, and two tablets of vitamin C in the water.

2. Will temperature affect the rate of browning on fruits and vegetables? Try the experiment again, but this time place them in the refrigerator and in a warm dark place for the same amount of time.
3. Lemon juice is a common ingredient listed in recipes for fruit pies. Repeat the experiment again to determine whether lemon juice has an effect on browning.
4. Use a vacuum pump to keep fresh fruit from being exposed to air (vacuum sealing). Observe the rate of browning.
5. Slicing, coring, and peeling are techniques for providing single servings and eliminating waste. Determine the amount of weight and volume reduced by slicing, coring, and peeling apples and oranges.

Assessment

The students will present their findings to the class. Classroom graphs and charts may be used to illustrate information learned.

