Western Engineering

Outreach

Fruit in Space

Grade 6-8

Meet Today's ENG HERO!

Lauren Flynn – Associate Professor with Western Engineering

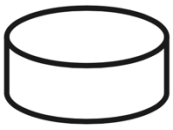
Lauren Flynn is an associate professor with the Chemical Engineering and Biochemical Engineering Department at Western University. She has PhD Chemical Engineering & Applied Chemistry/IBBME. The focus of Dr. Flynn's research is on the development of cell-based regenerative therapies with applications in soft connective tissue regeneration. To learn more about Dr. Flynn visit:
https://www.eng.uwo.ca/chemical/faculty/flynn_l/index.html

Learning Goal:

- Students will expand their knowledge of space nutrition
- Students will discuss be able to the effects of chemical treatments to inhibit the ripening of fruit
- Students will have knowledge of many different ways to preserve fruits
- Curriculum Connections: Grade 6 - Understanding Earth and Space Systems, Grade 7 - Pure Substances and Mixtures, Grade 8 - Understanding Life Systems

Materials Needed:

- Water
- Apples/Bananas (slices)
- Vitamin C tablets and/or lemon juice
- Small bowls
- Ruler
- Plates



Engineering and Science Connections:

Food for the Space Shuttle is packaged and stored in food lockers at Johnson Space Center in Houston, Texas, about a month before each launch and is kept refrigerated until shipped to the launch site. Around 3 weeks before a launch, the food lockers are sent to Kennedy Space Center in Florida. They are then refrigerated until they are installed in the Shuttle about 2 days prior to launch.

During space flight, fresh fruits and vegetables have a short lifespan because of the fact that there is no refrigerator onboard a space shuttle and this means that they must be consumed within the first 7 days of space flight. The International Space Station has refrigerators on board, 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.

There are a number of techniques that can be employed to treat fresh fruit and vegetables: irradiation, a wax coating, an ethylene inhibitor (ethylene's a plant hormone that causes ripening), modified or controlled atmosphere packaging, freeze drying, and various chemical treatments.

This activity focuses on one of these processes: the use of a chemical inhibitive (vitamin C tablets or lemon juice) as a way of packaging sliced fruits and vegetables as a non-waste, single serving 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.

Video Recommendation: *Food Processing and Food Processing Engineering*

https://www.youtube.com/watch?v=zTdsQ3f4xYQ

Activity:

Before beginning, think about the following questions:

- Do you think the vitamin C and/or lemon juice will protect the fruit? Why or why not?
    - (if using both chemicals), which do you think will protect the banana more?
- Would this work with any fruit or vegetable?
- What do you think is the best way to pack food for space travel?
- Will adding more vitamin C/lemon juice protect them more?
- Which fruit (if using more than one) do you think will brown first?

Part 1: Preparing the Chemical

- Pour water into two small deep bowls. Dissolve a vitamin C tablet into one and leave the second as just water. Label the first one "Vitamin C" and the second "Plain Water."
- If using lemon juice, you will just brush it on your fruit

Part 2: Applying the Chemical

- Cut a piece of fruit into equal wedges.
- Place two wedges into each of the prepared liquids. Be careful that each wedge is completely immersed in the liquid for about 10 minutes.
- Remove each wedge, and place on a separately labeled paper plate.
- Place the last two wedges on a paper plate labeled Untreated.
- Arrange the piece so that all of the cut surfaces are exposed to air.

Part 3: Watch and Ask Questions

- Let all the plates sit for an hour and while you wait, try and observe any browning.
- After an hour, try and measure the brown exposed area of the fruits and vegetables using a ruler
- If done correctly, the fruit which you were not treated with chemicals should have turned colour. Why do you think the chemicals stopped the fruit from browning?

Extensions:

- 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.
- Does the amount of lemon juice effect the rate at which the fruit and vegetables will turn brown? Try the experiment again but this time, with more lemon juice.
- 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.

What's Happening?

Vitamin C (AKA ascorbic acid) and Lemon juice (which contains citric acid) are antioxidants! In the air there is oxygen which reacts with the fruit's cells. The reaction that happens is called oxidation, and antioxidants slow down this process of oxidation. Normally the skin of the fruit protects the insides from oxidation, but now our chemical is acting as the skin.

What Did You Learn?

- Why is this a big deal in regard to space travel?
- What are some of the techniques used to treat fruit and vegetables to prevent spoiling?
- Why does a fruit not turn brown when you treat it with ascorbic/citric acid?

Future Learning

- Try this experiment with several other fruits and vegetables! Try it with different concentrations and at different temperatures and/or sealing it away from the air. There are many different ways to continue on with this experiment. Which combination of treatments protects the food the best?

Share your creations!

We would love to see your ideas and what you made. Email as at discover@uwo.ca or tag us on social media.

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Thanks for discovering with us!