



BROWNING APPLES

Grade Level

2-6

Length of Lesson

45 minutes

Objective

By the end of this lesson, students will have a better understanding of why apples brown and what might slow that process.

Materials Needed

- 8 bowls per group
- 1 apple per group
- Various solutions:
 - Salt (1/2 tsp)
 - Honey (1 tsp)
 - Lemon-Lime Soda (1 cup)
 - Carbonated Water (1 cup)
 - Vitamin C (1 tablet crushed)
 - Lemon Juice (1 tsp)
 - Tap Water
 - Copies of student worksheet and Scientific Inquiry worksheet

Standards

Common Core

CCSS.ELA-Literacy.W.2-3.1; RL.2.1-6; RL.3.1-6

NGSS

K-2-ETS1; 3-5-ETS1; 2-PS1-1-3; 4-PS3-4; 3-5-ETS1-3; MS-PS1-3

Lesson Summary

This lesson is designed to help students learn how to form a quality hypothesis and complete an experiment while learning about apples.

Suggested Sequence of Events:

1. Read through the AITC Apple Ag Mag to allow students to gain background knowledge of apples! Interactive online versions can be found on our website.
2. Read through the introduction of the student worksheet and discuss why apples turn brown after they're sliced (oxidation).
3. For students in 5-6th grade, have them fill out the Scientific Inquiry worksheet instead of the student worksheet.
4. Discuss the possible solutions that will slow down the browning process and have them make their predictions on which solution will work the best.
5. Complete the activity following the procedures:
 - Give each group an apple and eight bowls. Make sure the bowls are large enough to cover the apple slice completely with the solution.
 - Students should label the bowls for each solution being used. Make sure to label one bowl "control."
 - Add the solutions with their suggested amounts into their designated bowls. Leave the "control" bowl empty.
 - Then add 1 cup of tap water to the honey, salt, lemon juice, and vitamin C bowls and mix.
 - Now, cut the apple into eight slices approximately the same size.
 - Immediately place one apple slice into each bowl.
 - Wait 10-15 minutes and then take the apples out of their solutions.
 - Record observations.
4. Whole class discussion and reflection of activity. Have students share their hypotheses with the class and explain the outcome of their experiment. Have students brainstorm and explain why some solutions worked and others didn't.
5. Share the explanation from the teacher resources page and have students compare their thoughts.

TEACHER RESOURCES

Extension Ideas:

- Read "[Seed by Seed](#): The Legend and Legacy of John "Appleseed" Chapman" by Esmé Raji Codell. Look at the pictures and have students analyze the images.
- Have students tell a story or create a comic strip from the apple's perspective.
- Take a closer look at oxidation. What other materials oxidize?
- Take the experiment to the next level and have students taste test the apples after being in the solutions. Do the solutions affect the taste of the apples?
- Watch a time lapse video of an apple growing.
- Show a labeled diagram of an apple and/or apple tree.
- Watch a video from a local farmer discussing apple growth and harvest.
- Take a field trip to an orchard and pick your own apples.
- Invite an apple farmer into the classroom.
- Go to agintheclassroom.org to contact your County Literacy Coordinator for free classroom sets of our Ag Mags!

Explanation:

The enzyme in apples will oxidize in an environment with a pH between 5-7, which is considered a basic environment. Lowering the pH by creating a more acidic surface will slow that process. This is because the acids or enzymes in those substances have to react with the oxygen in the air first. Once that reaction is complete, the enzymes from the apples will be exposed to the air and oxidation will begin, causing the apples to turn brown.

You should find that the lemon juice worked the best because it is full of Vitamin C, a.k.a. ascorbic acid, which has a low pH.



BROWNING APPLES

STUDENT WORKSHEET

Why do apples start to turn brown?

Enzymes are special proteins that are responsible for a lot of the work happening inside the cells of living things! One of their jobs is to help speed up chemical reactions. But, enzymes are very picky and will only react with specific chemicals. When apples are sliced, an enzyme is released. This enzyme, called *polyphenol oxidase*, specifically reacts with oxygen. This chemical reaction is called “oxidation” and is what turns the apples brown.

Is there something that could stop the apple from browning? You could cook the apple, which would destroy the enzyme, but that also means you’re not eating fresh, crisp apple slices! BUT there is something that could slow down oxidation without having to cook your apples. Oxygen must not be allowed to get to the surface of the apple. This means there needs to be a barrier between the air (where oxygen is found) and the enzymes on the apple!

Try using different solutions to cover or coat the apple slices and see how good of a barrier they are! Which solution worked the best? Make your prediction, test your materials, and create your conclusion!

Materials:

Control:

Variables:



Science

BROWNING APPLES

STUDENT WORKSHEET

Prediction!

Which solution will slow down the browning the best?

Draw how you will set your experiment up. Make sure to label your diagram!

Conclusion!

Which solution actually slowed down the browning the best?



Science

SCIENTIFIC INQUIRY WORKSHEET

It all starts with a question! Everything we have today came from someone questioning the current beliefs, technologies, and practices of that time with hopes to gain new knowledge, discover something new, or to make something better or different!

Scientific Inquiry is investigating and finding evidence from observations in order to create logical explanations and answer questions!

Phenomenon:

What do you already know about this phenomenon?

Write 3 questions that will help you learn more about the phenomenon:

?

STOP

Before you move on, you want to make sure you know exactly what you're investigating! Choose 1 question you hope to answer through your investigation and circle it!

Brainstorm Box: What type of experiment could you design to answer your question?



Science

SCIENTIFIC INQUIRY WORKSHEET

Materials:

Control:

Variables:

Now that you brainstormed, finalize your experiment. Using complete sentences, explain how you will set it up!



Science

SCIENTIFIC INQUIRY WORKSHEET

Use the blank space below to record observations and data!

Did your experiment help answer your question? Explain, using evidence as support!

What was the most challenging part of this activity?



Science

SCIENTIFIC INQUIRY WORKSHEET