

Food Explorations Lab I: Enzymatic Reactions

STUDENT LAB INVESTIGATIONS

Name: _____

Lab Overview

There are two parts to this investigation. In Part A, you will observe and compare three types of fruit for enzymatic browning. In Part B, you will choose two substances to test for their ability to inhibit or slow enzymatic browning.

Lab Objectives

In this lab, you will learn how to...

1. Determine which types of fruit are susceptible to enzymatic browning.
2. Explore potential methods for inhibiting enzymatic browning.

Lab Safety: Before beginning ANY investigation you should put on your safety goggles and apron. It is important to avoid getting chemicals on your body. Always wash your hands following completion of an investigation. When handling food, you should also wash your hands prior to beginning an investigation.

PART A: Observation of Enzymatic Browning in Fruit

MATERIALS

- 1 cutting board
- 3 plastic or blunt knives
- 3 paper plates (any size)
- Kitchen timer or stopwatch
- Fruit ($\frac{1}{4}$ of an apple, $\frac{1}{4}$ of an orange, $\frac{1}{4}$ of a banana)
- Paper towel or napkin
- Safety goggles
- Aprons (optional)

PROCEDURE

1. Prepare your fruit types. Cut the apple and orange into thirds using a different knife for each fruit. Cut the banana into small slices.
2. Separate each fruit type onto separate plates (you should have a total of three plates). Make sure the flesh of the fruit is facing upward.
3. Once your fruit samples have been prepared, you are ready to begin. Describe your *visual* observations of each fruit in Table A under "0 minutes". *DO NOT smell or taste any of the samples.*
4. Allow each fruit to sit for 10 total minutes (set your timer). While you wait, predict what you think will happen to each fruit after 10 minutes have passed and provide evidence to support your prediction. Will you observe changes in texture? Changes in color?

	After 10 minutes, I predict...	because...
the apple will...		
the orange will...		
the banana will...		

5. Describe your observations after 10 minutes in Table A. While you wait, proceed to Part B of the lab investigation.

6. Set aside one sample of apple for Part B.

Table A: Enzymatic Browning Observations

Fruit	0 minutes	10 minutes
Apple		
Orange		
Banana		

Conclusion:

1. Compare and contrast the fruits' chemical reactions.

2. Infer why this reaction is occurring in some fruit types and not others.

3. Remember to set aside the apple sample for Part B. The apple sample will serve as a *control* in the next investigation.

PART B: Methods to Decrease Enzymatic Browning

Lab Questions

Which of the following substances will decrease enzymatic browning on an apple?

- Vitamin C
- Cream of Tartar
- Lemon Juice
- Sugar-water
- Baking Soda
- Vinegar
- Salt water
- Water

Choose two substances from above that your group believes will decrease enzymatic browning:

- 1. _____
- 2. _____

Complete Table B with your choices and explanations. The substances you chose as having the ability to decrease enzymatic browning should be identified under the "Identity of Substance" column below.

Table B:

	Identity of Substance	Explanation
Sample A		
Sample B		

MATERIALS

- | | |
|--|--|
| 2 household substances (based on prediction) | 1 black permanent marker |
| ½ teaspoon measuring spoon (if applicable, based on substances chosen above) | 1 beaker or measuring cup containing water |
| 2 – 9 oz plastic cups | 1 apple |
| 2 plastic spoons | 1 kitchen timer or stopwatch |
| 1 paper plate (any size) | Apple sample from Part A |
| 1 plastic or blunt knife | Safety goggles |
| | Aprons (optional) |

PROCEDURE

1. Use the marker and draw a line dividing the paper plate into two sections. Label the sections: Sample A and Sample B.
2. Label one cup Sample A and the other Sample B.
3. Obtain and prepare the two substances from your prediction using the directions provided:

Substance Preparation Procedures

- *Vitamin C Tablet*: Obtain 1 vitamin C tablet. Fill the cup ½ full of water. Crush the tablet before adding it to the water for better dissolution. Dissolve the tablet in the water.
 - *Cream of Tartar*: Obtain ½ tsp. of the cream of tartar in a 9 oz cup. Fill the cup ½ full of water. Stir the mixture until the cream of tartar has completely dissolved.
 - *Lemon Juice*: Fill one 9 oz cup ½ full of lemon juice.
 - *Sugar-Water Solution*: Obtain ½ tsp. of sugar in a 9 oz cup. Fill the cup ½ full of water. Stir the mixture until the sugar has completely dissolved.
 - *Sodium-Bicarbonate Solution (baking soda)*: Obtain 3 ½ tsp. of baking soda in a 9 oz cup. Fill the cup ½ full of water. Stir the mixture until the baking soda has completely dissolved.
 - *Vinegar*: Fill a 9 oz cup ½ full of vinegar.
 - *Salt Solution*: Obtain ½ tsp. of salt in a 9 oz cup. Fill the cup ½ full of water. Stir the mixture until the salt has completely dissolved.
 - *Water*: Fill a 9 oz cup ½ full of water.
4. Obtain and prepare your apple by cutting it in half. Place ½ of the apple in each of the two sections on your labeled plate. Make sure the flesh of the fruit is facing upward.
 5. Dip each fruit sample into the cup with the same label. For instance, the apple on the plate labeled *Sample A* should be dipped into the cup labeled *Sample A*.
 6. Allow the apple samples to sit for a total of 15-20 minutes (set your timer). While you wait, start Food Explorations Part II. Record your observations after 10 minutes and 20 minutes in Table C.

Table C: Color Change Observations

Sample	10 minutes	20 minutes
Sample A		
Sample B		

Conclusion:

1. Including the control (apple half from Part A), order each sample from greatest to least amount of enzymatic browning.

Greatest: _____

Least: _____

2. Compare and contrast the effectiveness of the substances you tested on inhibiting enzymatic browning.

3. As a class, discuss the list of substances used and complete the chart below:

Substance	Browning (Yes, None, Some)
Vitamin C	
Cream of Tartar	
Lemon Juice	
Sugar-water solution	
Baking Soda	
Vinegar	
Salt water	
Water	

4. Consider the properties of the substances tested including acidic and basic properties. How might these properties impact the ability to decrease enzymatic browning?

5. When making a fruit salad that includes apples and bananas, it is desirable to reduce the enzymatic browning of each fruit. Suggest a substance that could be used in the recipe for this purpose.