

Plant Enzymes That Digest Protein

Introduction

Meat tenderizer is often sprinkled on meat before it is cooked to make it easier to chew. Most meat tenderizers contain a *proteolytic* enzyme called papain that is extracted from unripe papaya, a tropical melon. This enzyme speeds up the break down of proteins into amino acids. Other fruits contain similar enzymes that have the same effect. When protein is broken down by these enzymes, we say that the protein undergoes *hydrolysis*.



In this lab, you will study the effect of proteolytic enzymes on protein. To simplify our observations, we will use gelatin as our protein source. We will use commercial meat tenderizer as well as fresh pineapple, both of which contain the enzyme bromelin. We will also test the effect of heat on the effectiveness of the enzyme.

Materials

fresh pineapple
ice

gelatin
meat tenderizer

Equipment

beaker, 600-mL or larger
beakers, 100-mL (4)
hotplate

stirring rod
tray (for ice bath)

Safety Considerations

- Sometimes chemicals from previous labs still remain in glassware and on other lab equipment; wash all lab equipment before and after performing this lab.
- Wash your hands thoroughly after completing this lab.

Procedure

1. In a 600-mL or larger beaker, prepare the gelatin per the directions on the package. Remember, 1 cup = 237 mL. You may want to share half of your gelatin with another group.
2. Fill four 100-mL beakers half full with the hot gelatin solution.
3. Prepare the beakers as follows:
 - Beaker 1: Add nothing; label and place in ice bath. This is your control.
 - Beaker 2: Sprinkle a generous amount of meat tenderizer into the hot gelatin mixture and stir; label and place in ice bath.
 - Beaker 3: Add nothing; label and place in ice bath. After it has solidified, sprinkle a generous amount of meat tenderizer on top. Wait 5-10 minutes and record your observations.
 - Beaker 4: Add nothing; label and place in ice bath. After it has solidified, add a piece of fresh pineapple on top. Wait 5-10 minutes and record your observations.

Clean-up

1. Dispose of any pineapple or solidified gelatin in the trash, NOT THE SINK.
2. Clean all used lab equipment with soap, water and a test tube brush.
3. Return all equipment to its proper location.
4. Wipe down your lab area and wash your hands before leaving the lab.

Data Table

Beaker	Observations
#1: gelatin	
#2: gelatin + meat tenderizer (added while hot)	
#3: gelatin + meat tenderizer (added while cold)	
#4: gelatin + pineapple	

Questions

1. What effect does the meat tenderizer have when it's added to hot gelatin, before it sets? Why?

2. What effect does the pineapple have when it's added to cold gelatin? Why?

3. Why do you think it's possible to make a gelatin dessert with canned pineapple but not fresh pineapple?

4. Some people like to use meat tenderizer while they are grilling or barbecuing meat. Based on the results of this lab, do you think this is effective? Why or why not?

5. List one way you could change this lab and describe how your results might be different.
