

Detecting Calcium Propionate in Bread

Introduction

One of the greatest problems in the food industry is spoilage, and bread is one of the foods that spoils very easily. Bread can be kept in a refrigerator to slow the growth of mold, but bread can also be made resistant to mold. Calcium propionate is the chemical most often used for this purpose. It is mixed with the dough before the bread is baked.

You could check for the presence of calcium propionate in bread by identifying the calcium ion, Ca^{2+} . However, there are other compounds in bread which also contain calcium. Therefore, in this lab, you will identify the propionate group, since there are no other compounds in bread containing propionate. Your task is complicated by the fact that the amount of propionate in bread is very small. You will first convert the propionate into propionic acid. Then you will convert the propionic acid into an ester, which is an organic chemical that is characterized by a pleasant odor. This particular ester has the odor of pineapple, so you will use this odor to detect the presence of propionate in bread.



Materials

bread (must contain calcium propionate)
ethyl alcohol, 95%

sulfuric acid, 6M [H_2SO_4]

Equipment

beakers, 250-mL and 400-mL
hot plate

stirring rod
test tube, large

Safety Considerations

- **Sulfuric acid is extremely dangerous to skin and eyes! You must wear goggles, gloves and a lab apron at all times during this lab.**
- Ethyl alcohol is flammable – open flames will not be used in this lab.
- 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. Set up a water bath on the hot plate by adding around 200 mL of tap water to a 400-mL beaker and begin heating the beaker on the hot plate. Do not allow it to boil!
2. Using your hands, break up a slice of fresh bread and put it in a 250-mL beaker.
3. Add 100 mL of distilled water to the 250-mL beaker.
4. Stir the mixture thoroughly with a stirring rod. Calcium propionate will dissolve in the water.
5. Pour off about 10 mL of the calcium propionate solution into a large test tube, leaving the solid bread behind.
6. While wearing gloves, add 6 M H_2SO_4 to the test tube dropwise, 1 mL at a time. Add no more than 5 mL of acid. Record your observations in the Data Table.
7. Add 4 mL of ethyl alcohol to the test tube and heat the tube gently in the hot water bath.
8. After a few minutes and before the liquid in the tube begins to boil, carefully wave some of the vapor toward your nose. Describe the odor of the vapor in your Data Table.

Data Table

Time	Test Tube Observations
immediately after adding H ₂ SO ₄	
after several minutes in the hot water bath	

Clean-up

1. Dispose of the acid solution from the test tube in the waste beaker, NOT THE SINK.
2. Dispose of all bread in the trash, NOT THE SINK.
3. Clean all used lab equipment with soap, water and a test tube brush.
4. Return all equipment to its proper location.
5. Wipe down your lab area and wash your hands before leaving the lab.

Questions

1. Is there any evidence that calcium propionate is harmful when used as a preservative in bread? Why or why not?

2. What is another, less scientific way you can use to determine if bread contains calcium propionate?

3. Besides detecting calcium propionate, what is another potential use of this experimental method?

4. Using the library or the Internet, determine two other preservatives that are commonly used in food.

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