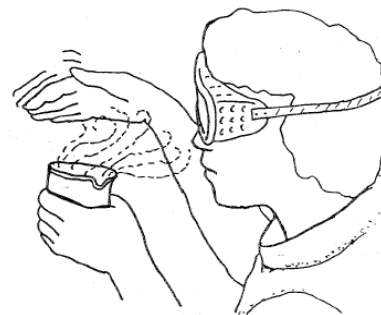


Artificial Fragrances

Introduction

In order to enhance their appeal, many foods contain artificial flavorings, while many other consumer products contain artificial fragrances. The molecules that give these products their distinctive odors are called 'esters'. Esters are produced by reacting various alcohols with organic acids, usually with a strong acid such as sulfuric acid, which works as a catalyst to speed up the process.



In this lab, you will prepare three types of fragrant ester molecules from their original components.

Materials

alcohols:

- n-amyl alcohol ($C_5H_{11}OH$)
- methyl alcohol (CH_3OH)
- ethyl alcohol (C_2H_5OH)

aluminum foil

organic acids:

- salicylic acid ($C_7H_6O_3$)
- butyric acid ($C_4H_8O_2$)
- glacial acetic acid (CH_3COOH)

sulfuric acid, concentrated (H_2SO_4)

Equipment

beaker, 400 mL

graduated cylinder, 10 mL

hot plate

small test tubes, 3

Safety Considerations

- **Concentrated sulfuric acid is EXTREMELY dangerous!** You must wear goggles, gloves and a lab apron at all times while working with chemicals. Your teacher will dispense the sulfuric acid for you.
- Glacial acetic acid is also VERY dangerous! Take special care not to inhale its vapors or spill any on your skin.
- Because some of the fragrances may have acid remaining after they have reacted, you must use the 'wafting' method when sampling the odor of your product as shown.

Procedure

1. Prepare a water bath by filling a 400 mL beaker half full with tap water. Place the beaker on a hot plate to begin heating it.
2. Using the following table, determine three ester fragrances you will produce in this lab:

Ester Fragrance	Alcohol	Organic Acid
apple	ethyl alcohol	butyric acid (s)
apricot	n-amyl alcohol	butyric acid (s)
banana	n-amyl alcohol	glacial acetic acid (aq)
fruity	ethyl alcohol	glacial acetic acid (aq)
pineapple	n-amyl alcohol	salicylic acid (s)
wintergreen	methyl alcohol	salicylic acid (s)

3. For your first fragrance, obtain 2 mL of the necessary alcohol and add it to a small test tube.

4. If your ester fragrance requires solid acid, obtain 1.0 g of acid and add it to the test tube. If your ester fragrance requires liquid acid, obtain 2.0 mL of acid and add it to the test tube.
5. Carefully add 1.0 mL of concentrated sulfuric acid to the test tube. (*Your teacher will perform this step.*)
6. Gently tap the bottom of the tube to mix the reactants in a safe manner.
7. Place the test tube in the water bath and allow it to be heated for one minute.
8. Check for any possible odor of an ester by using the 'wafting' method. Record your observations in your lab notebook. If no odor is detected, allow the test tube to remain in the water bath for 5-10 more minutes.
9. Repeat steps #3-8 for your second and third ester fragrances.
10. If an odor still cannot be detected, cover the test tube with a small piece of aluminum foil, label it with your or your lab partner's name, and leave it to sit overnight.

Clean-up

1. **DO NOT POUR ANYTHING DOWN THE SINK.** Dispose of any remaining residue in your test tubes in the waste beaker.
2. Return all equipment to its proper place.
3. Dispose of any weigh paper, paper towels or rubber gloves in the trash can.
4. Wipe down your lab area and wash your hands before leaving the lab.

Questions

1. Which fragrance smelled the best? Which fragrance smelled the worst?

2. Why is it necessary to heat the reactants in a water bath as opposed to over an open flame?

3. What is the purpose of using concentrated sulfuric acid, which is dangerous, instead of dilute sulfuric acid or a weak acid, which would be safer?

4. Name two foods and two non-food products that use artificial fragrances.

foods: _____

non-foods: _____

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