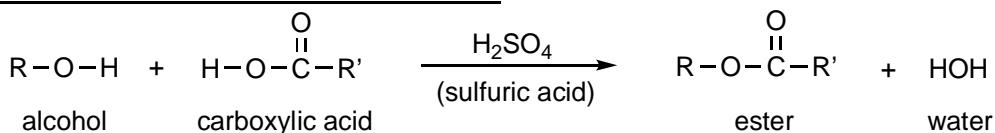


ESTERS: Those Wonderfully Odoriferous Chemicals

INTRODUCTION

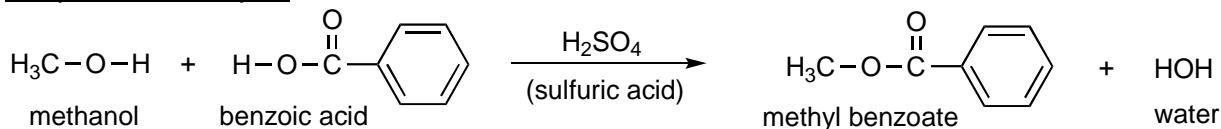
In this experiment, you will make three different esters using the Fischer esterification method. Each ester is made from a different alcohol and a different carboxylic acid; it requires an acid catalyst, too. The reaction is called a “condensation” reaction because when it combines these two reagents to make the ester, it also forms water (a small molecule by-product).

A Generic Fischer Esterification Reaction:



[Note that R is used by chemists to represent a general hydrocarbon chain that is considered unreactive in a chemical reaction. Since the two reagents can have different carbon chains here, we let one be R and the other be R'.]

A Specific Example:



TECHNIQUES

To determine the odor of a volatile compound, it is safest to wave the fragrance toward your nose with your hand. With this **wafting** technique, you should not be overwhelmed with a very strong odor. Please don't stick your nose in any container when you don't know the potency of the odor!

SAFETY AND DISPOSAL

- Concentrated sulfuric acid causes severe burns on skin and clothing. If any is spilled, first add water, then wipe it up. If you spill it on your skin, immediately go to the sink and run cold water over it for 5 minutes.
- The butyric acid really stinks and should remain in the hood **at all times**. Use the plastic condenser provided for the butyric acid reaction to contain odors. (Leave it in the hood when finished for others to use.)
- The "water bath" is made in Styrofoam™ cups using hot water from a large coffee pot. Please put these cups back on the counter when finished, so we can use them again. (Since the alcohols are very flammable, we cannot use an open flame from a Bunsen burner and a beaker of water for this purpose.)



will appear to indicate helpful hints, additional information, or interesting facts.



will appear to remind you of potential dangers and hazards.

EXPERIMENTAL PROCEDURE

I. Preparation of isoamyl acetate

- A. Waft each of the reagents GENTLY toward your nose and describe their odor before you begin the reaction.
- B. In a small test tube, mix 1 mL (20 drops) of isoamyl alcohol with 1 mL (20 drops) of acetic acid. Then, cautiously add 5 drops of concentrated sulfuric acid.



ALL ACIDS MUST BE HANDLED WITH CARE!

- C. Make your water bath by adding about 1 inch of HOT water (from the coffee pot) in the Styrofoam™ cup. Place the test tube in the water bath for 5-10 minutes.
- D. Put the warm water from your Styrofoam cup into a beaker and pour your reaction mixture into the water in the beaker. Carefully determine the odor of the products using the wafting technique.
- E. Complete the equation and give the name of each organic compound under its formula.

II. Preparation of methyl salicylate

- A. Waft each of the reagents GENTLY toward your nose and describe their odor before you begin the reaction.
- B. Place 0.2 g of salicylic acid in a test tube and add 1 mL (20 drops) of methyl alcohol. Next add 5 drops of concentrated sulfuric acid.
- C. Remake your water bath by adding 1-inch of HOT water (from the coffee pot) in the bottom of the Styrofoam™ cup. Place the test tube in the water bath for 5-10 minutes.
- D. Put the warm water from your Styrofoam cup into a clean beaker and pour this reaction mixture into the water in the beaker. Carefully determine the odor of the products using the wafting technique.
- E. Complete the equation and give the name of each organic compound under its formula.

III. Preparation of ethyl butyrate **PERFORM UNDER HOOD ONLY.**

- A. Waft each of the reagents CAREFULLY toward your nose and describe their odor before you begin the reaction.



Butyric acid is responsible for the odor of rancid butter.

- B. Place 3-4 drops of butyric acid in a test tube. Add 1 mL (20 drops) of ethyl alcohol and then 5 drops of concentrated sulfuric acid.
- C. Place the plastic condenser over the top of the test tube. Remake your water bath by adding 1-inch of HOT water (from the coffee pot) in the Styrofoam™ cup. Place the test tube in the water bath for 5-10 minutes.
- D. Put the warm water from your Styrofoam cup into a clean beaker and pour this reaction mixture into the water in the beaker. Carefully determine the odor of the products using the wafting technique.
- E. Complete the equation and give the name of each organic compound (reactants and products) under its formula.