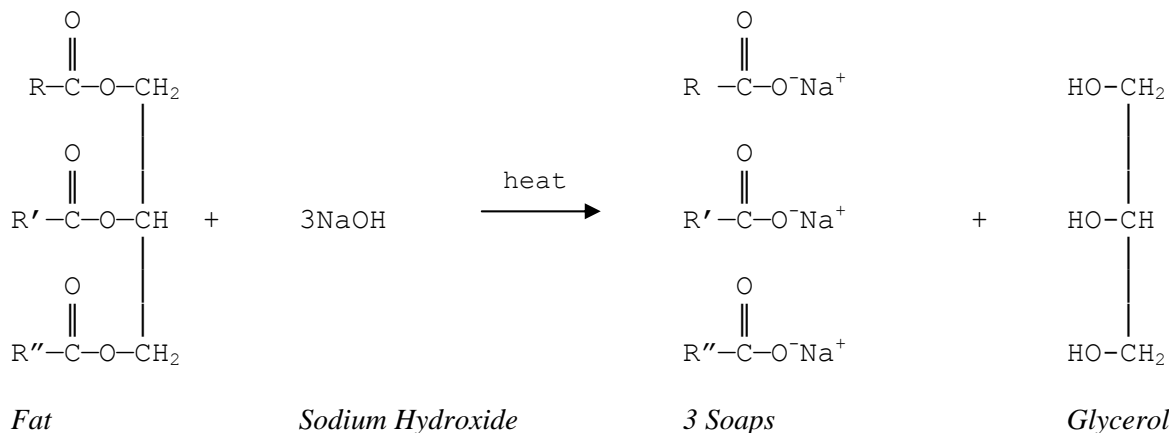


Preparing Soap (Saponification Lab)

Soap has been used for cleaning purposes for a long time. In the Middle Ages soap was prepared by boiling fats and oils in a water solution of the ashes from burnt wood or seaweed. Pioneering Canadian families prepared their own soap by heating kitchen fat and lye (sodium hydroxide). Fats and sodium hydroxide will react when heated to form glycerol and soaps. This reaction is shown below.



This process is called saponification. The soaps produced are metallic salts of long-chain fatty acids.

Problem

To produce soap by saponification.

Materials

Fat, oil, or lard
6 M NaOH
Sodium chloride
Ethyl alcohol
Beakers

Hot plate
Ring stand
Stirring rod
Test tube
De-ionized water

CAUTION: Ethyl alcohol flammable
CAUTION: NaOH is extremely caustic

Procedure

1. Turn on fume vents.
2. Place 100 mL of water in a beaker and bring the water to a boil using a hot plate. Lower the heat and add 30 g of sodium chloride. Stir the solution. Keep it warm over low heat. You will need it later in the experiment. Your teacher may already have this solution prepared at the front of the room.
3. Place 10 g of fat, lard, or oil in a 250-mL beaker.
4. Add 15 mL of 6M NaOH to the beaker containing the fat. Also add 50 mL of ethyl alcohol.
5. Place the beaker in a water bath of boiling water.
6. Stir the contents of the beaker. If some of the volume is lost by evaporation, add deionized water to maintain the original volume.
7. Heat the solution for at least 30 minutes and stir frequently. After that time, remove a small amount of the solution from the beaker with a wooden splint or a stirring rod. Dip the splint or rod into a test tube ½ full of deionized water. Shake the tube thoroughly. Record your observations. Dip the splint or rod into a test tube ½ full of tap water. Shake the tube thoroughly. Record your observations.
8. a) If suds form and no fat globules are present, add 20 mL of deionized water to the beaker. Then add 50 mL of the warm salt solution you prepared in step 1.

- b) If no suds form or fat globules are present continue to heat the solution. After 15 minutes, repeat step 7.)
9. Remove the beaker from the bath and let it cool. Record your observations.
 10. The soap will float to the top of the beaker and form a cake.
 11. Lift out the soap formed in the reaction and use paper towel to dry it.
 12. You may have to filter the soap to remove it from the beaker. Use a paper towel in a large funnel to remove the soap.

WARNING! *The soap is fairly crude, and still contains sodium hydroxide at the end. It could therefore be dangerous if you got it in your eyes.*

Questions

1. Complete a lab report in your lab book.
2. Describe the soap you produced.
3. Your soap should not be used on the skin because it may contain some unreacted alkali (NaOH). How could you test for the presence of unreacted alkali?
4. To what class of compounds do fats belong? Soaps?
5. In your own words, what happens during saponification?
6. What substances might have been used instead of the sodium hydroxide?
7. Why was the saturated sodium chloride solution added?
8. Describe the contents of the test tubes after shaking them (step 7). Did any white precipitate (scum) appear in the second test tube with tap water? If so, explain its presence.
9. The formula for the hydrocarbon radical (R) in the fat glycerol stearate is $C_{17}H_{35}$. Write an equation using structural diagrams showing the reaction of glycerol stearate with sodium hydroxide to produce the soap sodium stearate.
10. How are soaps treated commercially before they are marketed?