

Lab 15C: Preparation of a Soap

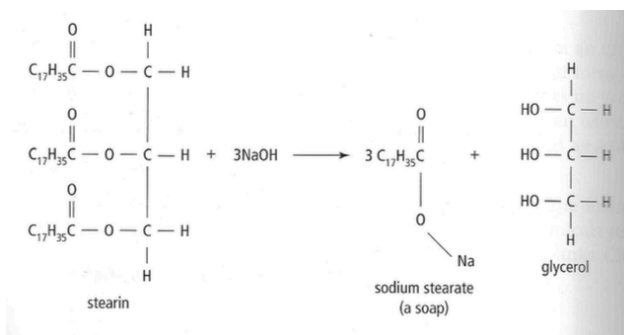
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Introduction:

The history of soap can be traced back 5000 years to the Middle East, where it was discovered that treating fat with alkali resulted in a substance with cleansing and healing powers. Soap making remained relatively primitive until the 16th century, when techniques that produced a purer soap were developed. The reaction that produces soap is called saponification.

Soaps are salts of mixed fatty acids. Today they are prepared by reacting fats (which are esters) with alkali solutions such as sodium hydroxide. Sodium hydroxide is added slowly to a molten mixture of fats and oils. High temperature and good mixing are important during this time. You will then be adding ethanol to help speed up the reaction. After a time, the fat is broken down to form an emulsified mixture of soap, glycerol, and unreacted NaOH. At this point the NaCl is added, which causes the soap to separate as a curd and float on top of the mixture. In the final commercial stages, perfumes, colorings, antiseptics, and other ingredients are added as necessary.

**Objectives:**

1. To prepare a soap by saponification
2. To compare the results of tests on the soap prepared in the experiment and a soap prepared commercially

Procedure:

Part I: Saponification

1. Put on your safety goggles
2. Label your four small beakers: "NaCl", "NaOH", "H₂O", "ethanol"
3. Label your large beaker: "Coconut oil"
4. Pour about 60 mL of NaCl into your beaker and set it on the hot plate on medium. Take off if boiling and set on a wire gauze, but maintain a warm temperature for step 15
5. Weigh out 15g of coconut oil in a large beaker and set it on the hot plate beside the NaCl – stir with a stirring rod until it melts, and then set it on a wire gauze. Record time of melting, as well as observations, on data table
6. Pour 25 mL of 6.0 M NaOH into your beaker labeled "NaOH" and set aside (NaOH is corrosive! Wash thoroughly with water)
7. Pour 40 mL of tap water into your beaker labeled "H₂O" and set aside
8. Pour 25 mL of ethanol into your beaker labeled "ethanol" and set aside
9. Pour the 25 mL of ethanol into the molten coconut oil. (Ethanol is flammable! Take off hot plate when adding) Place beaker back on hot plate on medium. Record the time as well as observations on data table
10. Slowly pour the 25 mL of NaOH into the mixture in a thin and steady stream, stirring constantly and slowly. Do this slowly to avoid the fat to separate from the mixture. Record the time as well as observations on data table
11. Continue to heat the mixture slowly and stir it regularly for the next 10-15 mins, until no evidence of fat globules remains. If any volume evaporates, add water to maintain the same volume
12. When no fat remains, turn hot plate off. Record the time as well as observations on data table
13. Place ice and water into tub for a cold water bath. Make sure you put in enough water so that it will submerge the beaker when you put it in
14. Set the large beaker containing the mixture in to the cold water bath. Add 40 mL of tap water to further cool down your mixture
15. Allow the mixture to cool for several minutes, then slowly add the 60 mL of warm NaCl solution. Record the time as well as observations on data table
16. After a few minutes, the soap should be visible as curds. Use a scoopula to scoop off a sample of soap and place it on a piece of paper towel
17. Save your soap sample for Part II

Part II: Laboratory Tests

1. Label 3 test tubes "A", "B", and "C" and place in test tube rack
2. Add a small sample of each to the following substances to your test tubes: a sample of coconut oil to A, a sample of your lab soap to B, and a sample of commercially prepared soap in C
3. Half fill each test tube with water and perform the following tests:
4. *Solubility and Sudsing*: place your thumb over the end of each test tube and shake vigorously for 15 sec. Note how well each substance dissolves and, if sudsing occurs, measure the height of the suds that form. Record your results on the data table
5. *Acidity*: Test the resulting water mixtures with neutral litmus paper or universal indicator solution and record your results on the data table
6. Wash the liquid down the sink with plenty of water. Throw any solid chunks in the trash
7. Wash the glassware
8. Wash your hands with soap and water
9. Give your partner(s) a compliment ☺