

Soap Lab

Learning Objectives:

- Gained an understanding of the saponification process.
- Gained an understanding of raw soap and its uses.
- Developed and processed different oil based soaps.
- Gained “hands-on” experience in the preparation, processing and fabrication of different oil based soaps.

Learning Outcomes:

- Define saponification.
- Be able to discuss the process of saponification.
- Be able to define what a base and acid are.
- Be able to explain what triglycerides are.
- Be able to use pH strips to test soap after curing process.

Pre-Lab

Background

Saponification is a process in which a fat molecule is broken down by sodium hydroxide (lye) into four smaller molecules; three of the new molecules are soap and one is glycerol. In simple terms saponification is the name for a chemical reaction between an acid and a base to form a salt. An **acid** is a molecule or ion that donates protons or hydrogen ions (H^+) and/or accepts electrons, and a **base** is any substance that donates electrons or hydroxide ions (OH^-) and/or that accepts protons.

When you make soap, you mix an oil or fat (which is your acid) with Sodium Hydroxide or Lye (which is your base) to form soap (which is a salt). There are many different types of acids that will react with your base and saponify. Your acid could be olive oil, coconut oil or vegetable oil just to name a few. Each acid has a unique combination of **triglycerides** (compounds made of three fatty acids attached to a single glycerol molecule) which combines with the base (sodium hydroxide or lye) differently.

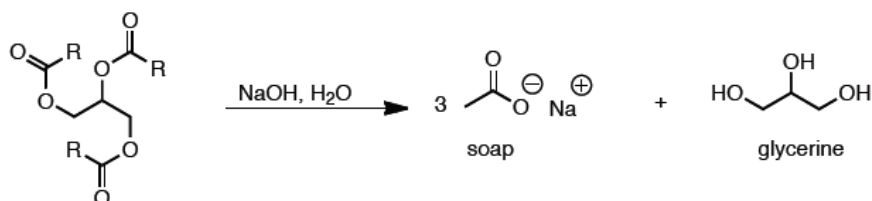


Figure 1. General saponification reaction

Health and safety information for materials used:

- Sodium hydroxide: Strong base which must be handled with care. Corrosive and caustic. It is important to make sure you are careful when mixing the water and sodium hydroxide.

Safety Checklist:

- Proper attire is worn (long pants and closed-toe shoes).
- Food and drinks are stored and consumed outside of the laboratory.
- Lab coat and safety glass are worn.
- Latex or nitrile gloves are used when handling samples and chemicals.
- Insulated gloves are used when handling hot materials.
- Chemical aprons are worn when handling methanol or sodium hydroxide.

Spill containment and clean up procedures:

- If a spill occurs it is important that you wash any parts of your body that comes in contact with the spill. Do not wipe your face or body until everything has been washed completely. Regular cleaning spray and paper towels work fine for cleaning small spills.

Soap Production

Problem Statement:

You may be aware about the use of triglycerides to produce biodiesel. This lab uses triglycerides to produce soap. Soap making relies on an ester and a strong base to perform a saponification reaction. We will create a small bar of soap with the lab procedure discussed later.

Lab Checklist

- 10 g of Sodium Hydroxide
- 60 g of chosen oil: Soybean, Canola, Coconut, Vegetable oil, etc. (Most oils can be used).
- 27 mL of distilled water
- Erlenmeyer flask
- Beaker
- Hot plates (2)
- Magnetic stir bar
- Thermometers (2)
- Weigh boat (Soap Container)
- Transfer pipet
- 2-3 mL of essential oils (for scent)

Procedure

The following steps are that of conventional heating with a hot plate:

1. Weigh out 10 g of Sodium Hydroxide (lye).
2. Pour 27 mL of distilled water into an Erlenmeyer flask.
3. Pour the sodium hydroxide into the water and mix. Keep mixing until it is homogenous on a stir plate.
4. Heat mixture and maintain the temperature around 115° C.
5. Measure 60 g of your chosen oil. Begin warming the oil in a small beaker on a hotplate. Use a magnetic stir bar to keep the oil moving and to avoid burning. Maintain the temperature around 115°C.
6. Pour the Sodium Hydroxide solution into the beaker with oil when they are within 10 degrees of each other.
7. Stir the reaction vigorously and maintain at 115 °C.
8. Add 2-3 mL of desired essential oils using transfer pipet
9. Keep heating and stirring for 30-40 minutes.
10. Pour the contents in to an aluminum weigh boats.

Curing

After pouring the contents into weigh boats they must cure for 3-4 weeks. To aid in the curing process covering the weigh boats with plastic wrap and a towel are suggested.

It is important after curing that you test the pH for use on the body. A simple way; is to pour a drop of water on the soap and rub a pH strip and compare to a pH chart. Soap should be between 7 and 10. Above 10 would be considered unsafe because lye may still be present and harsh on the body.

Emergency Contacts

Jacquelyn Baughman

Lab Supervisor
Cell: (515) 505-9509

Marjorie Rover

Lab Manager
Office: (515) 294-2984 Cell: (319) 230-1163

Ryan Smith

BEI Program Coordinator
Office: (515) 294-6244 Cell: (515) 203-1640 Home: (719) 660-2262

Patrick Johnston

Assistant Scientist III
Office: (515) 509-0027 Cell: (515) 509-0027 Home: (319) 231-9140

Approved Trainers:

Gabriel Domingues
Matt Schul