

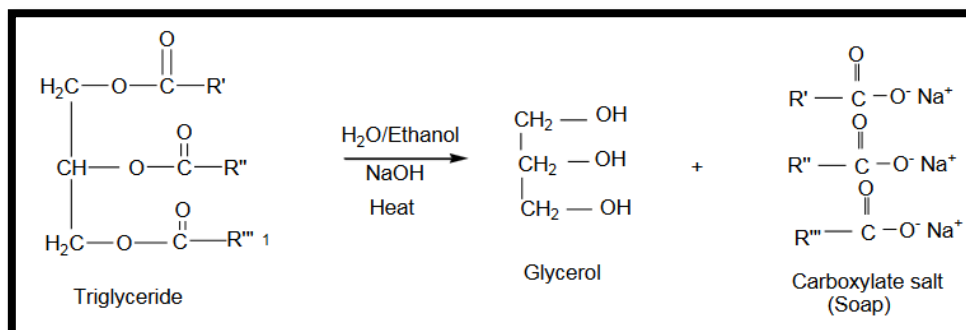
PW 2: Saponification (Preparation of soap)

1. Introduction

The discovery of soap dates back to about **6000** years ago. In **1500 B.C.E**, records from ancient **Egypt** described how **animal** and **vegetable oils** were combined with **alkaline salts** to make soap. This procedure for making soap remained unchanged for **centuries**, with American colonists collecting and **cooking down animal tallow** (rendered fat) and then mixing it with an **alkali potash** solution obtained from the accumulated hardwood ashes of their winter fires. Similarly, Europeans made **castile soap using olive oil**. Since the mid-nineteenth century, the process became commercialized and soap became widely available at the local markets.” To date, most people use similar methods to make home-made soaps.

Two main types of soap are known: **bar Soap**: Usually made with sodium hydroxide and **liquid Soap**: typically made with potassium hydroxide.

A classic example of a saponification reaction involves the reaction of a triglyceride (fat or oil) with sodium hydroxide (lye). Here’s a simplified version of the reaction:



2. Materiel and products

Materiel	Product
- Graduated cylinder - 250 mL beakers. - Heating magnetic stirrer - Double necked flask - Büchner - Pumice stone - pH paper - Large crystallizer.	- Vegetable oil. - NaOH. - Ethanol 95%. - saturated solution of NaCl. - distilled water.

3. Protocol

In a 250 mL flask, carefully introduce:

- **20 mL** of sodium hydroxide solution at **8 mol/L**
- 20 mL of 95 % ethanol
- Stir until dissolving the sodium hydroxide.
- Then add **10 mL** of vegetable oil.
- Add a few grains of pumice stone.
- Heat for 30 minutes, without **exceeding 90 °C**. At the end of the heating, pour the contents of the flask into a beaker containing a saturated sodium chloride solution (20 g of NaCl in 100 mL of water). A layer of yellowish solid is observed floating on the surface of the saline water: this is the **soap precipitating**.
- Filter the content using a large-diameter Büchner funnel; wash the soap successively with ice-cold water and measure the pH of the filtrate;
- Place the soap in a mold and let it dry.
- Measure of foaming properties of soap:
- Cut a small piece of the obtained soap and introduce it into test tube;
- Add approximately 3mL of distilled water and shake.

Note: It is not recommended to use the obtained soap for hand washing; indeed, it still contains a lot of sodium hydroxide and is therefore caustic.

4. Questions

- What is saponification?
- Write the general equation for the saponification reaction and name all reagents and products.
- Provide the reaction mechanism.
- To which class of chemical compounds do fatty substances belong?
- What substance can be used instead of sodium hydroxide (lye)?
- Why was ethanol added to the reaction mixture of fat and base?
- How could we measure the foaming properties of soap?
- Explain how soaps emulsify oils and fats
- Calculate the yield of the reaction.