

Read the article about the chemistry of soap:

<https://education.australiascience.tv/cosmos-magazine-the-chemistry-of-soap/>

In this, we learn about the chemistry behind soap, where it began, its relationship with water and how it protects us from viruses.



## 1. The first soap

The first known use of soap was by the Mesopotamians who lived in the 15,000 square-kilometre space between the Euphrates and Tigris rivers in Western Asia. Today, the areas span Iraq and parts of Turkey, Iran, Syria and Kuwait<sup>1</sup>.

The people living in Mesopotamia made an alkali substance by combining water and wood ash. This reacted to produce hydroxide. They then mixed this with animal fat resulting in a greasy, smelly substance.

As yucky as this sounds, the water and alkali substance removed dirt and grime and is still the basis of our soaps today.

## 2. Key terms

Saponification – the process of breaking down fat molecules by sodium hydroxide into four smaller molecules: three soap and one glycerol molecule. The glycerol keeps the soap moist.

Emulsion – a temporary mixing of two insoluble liquids such as oil and water.

Amphiphilic – a molecule that has a hydrophobic end and a non-hydrophobic end.

### 3. Make your own soap – preparation for the teacher

**Safety note:** ethyl and isopropyl alcohol are flammable and sodium hydroxide is caustic so use these chemicals with care. There should be no open flames in the classroom for the duration of this experiment and everyone should be wearing safety equipment including goggles, lab coats or aprons and gloves.

This will prepare enough for 50 experiments.

Prepare the sodium hydroxide and alcohol solution:

- A. Place 120 g of sodium hydroxide in a 1 L glass container.
- B. Add enough water to make 500 ml of solution.
- C. Stir to dissolve.
- D. Add 500 ml of ethyl or 70% isopropyl alcohol

Prepare the fat:

- A. Solids such as Crisco work best.
- B. Put 1 kg of Crisco or another vegetable shortening in a heat-proof container
- C. Heat the fat to 40-45 °C. At this point the fat should have melted.
- D. The fat must remain in liquid form as it is distributed to the students.

#### 4. Make your own soap – procedure for students

This activity should be done in pairs and safety equipment must be worn at all times.

##### Apparatus:

100 g table salt

20 ml sodium hydroxide/alcohol solution

20 ml melted fat or oil

50 ml beaker

500 ml beaker x2

120 ml ice water

Balance scale

Water bath

Wooden stirrer

Test tube

Pie tray (or similar for mould)

Cheesecloth

Rubber band

##### Procedure:

- A. Add the liquid fat to the beaker and place it into the water bath
- B. Add the sodium hydroxide/alcohol solution to the fat whilst stirring
- C. Continue to heat and stir until a small sample can be fully dissolved in a test tube half-filled with water.
- D. Keep stirring whilst the partner weights 90 g salt into a 500 ml beaker
- E. Add 300 ml water to the salt and stir until dissolved.
- F. Carefully pour the soap solution directly into the salt water
- G. Put the cheesecloth over a new 500 ml beaker and secure it with a rubber band.
- H. Pour the salt solution and soap through the cheesecloth and let it drain into the beaker. The soap will remain in the cheesecloth.
- I. Pour 120 ml ice water on the soap and into the beaker. This will remove the salt from the soap.
- J. Gently squeeze the excess water from the cloth.
- K. Spread out the cheesecloth in the pie tray and allow the soap to dry. This will take 1-3 days. The soap is then ready to use but avoid contact with eyes. It is for external use only.

**References:**

BBC History: Mesopotamia -

[https://www.bbc.co.uk/history/ancient/cultures/mesopotamia\\_gallery.shtml](https://www.bbc.co.uk/history/ancient/cultures/mesopotamia_gallery.shtml)