Emulsifiers

Download the teacher notes,
student workbook and technician notes
that accompany this resource at
rsc.li/3cpvP4k.

ROYAL SOCIETY
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Learning objectives

By the end of this session, you will be able to:

- Explain how soap acts as an emulsifier in cleaning.
- Explain how emulsifiers are used to make hand creams.

What is soap?

Soap is made from fats and alkaline solutions (known as lye).

When fats and alkalis mix, a chemical process occurs called saponification.

The resulting substance is soap.

Everything else is just added scent and colouring.

Soaps have been used and developed since the ancient Roman times.

Career link

Senior scientist, household goods

Meet Phillip, a senior scientist, who leads a team of researchers working on ways to improve the quality and performance of household products such as soaps and shampoos.

Demonstration: why does soap clean?

While watching the demonstration, record your observations in your student workbook.

Think about the behaviour of the oil and water and how it may change when the washing up liquid is added.

Demonstration: why does soap clean?

1. (a) The oil and water do not mix. The oil forms an upper layer on top of the coloured water.

   (b) The oil and water do not mix. The oil is less dense than water so will float on top of the water.

2. (a) When the washing up liquid was added, the oil and water were able to mix together.

   (b) The washing up liquid allows the water and oil to mix by acting as an emulsifier. An emulsion is formed, where the oil is dispersed as small droplets throughout the water.

Demonstration: why does soap clean?

3. An emulsion is formed when one liquid is dispersed through another liquid in the form of small droplets.

4. An emulsifier is an agent which allows two liquids to mix to form an emulsion.

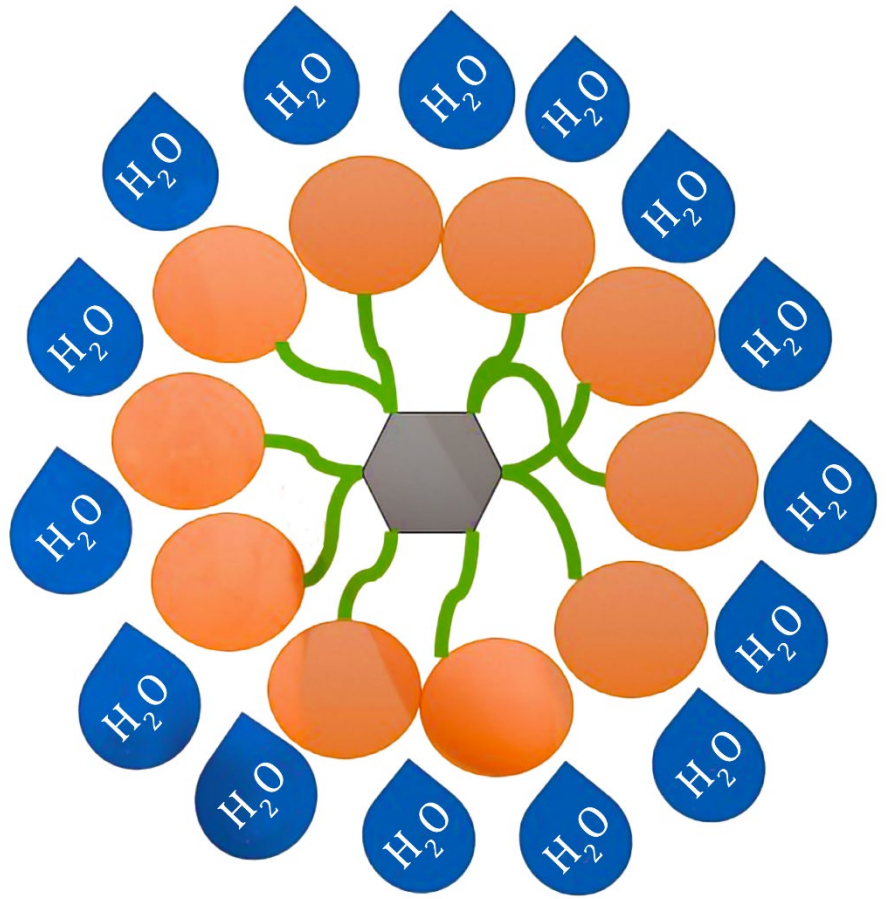
Removing grease and dirt

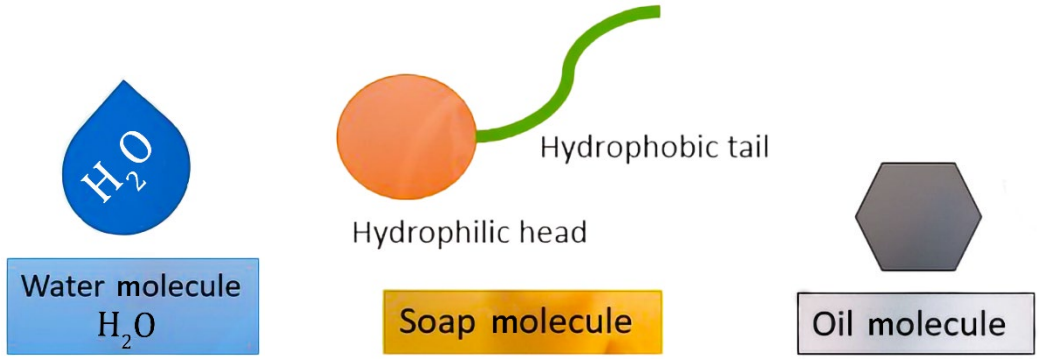
The washing up liquid (soap) molecules arrange themselves so the oil and water can mix.

The washing up liquid molecules each have a hydrophilic (water-loving) head and a hydrophobic (water-hating) tail.

The detergent molecules' hydrophobic tails attach to the oil and the hydrophilic heads stick out into the water.

This forms a droplet of oil which is suspended in the water.





Career link

Consumer products technician

Meet Robert, a consumer products technician, who develops materials which can improve the properties of household products such as washing up liquids and soaps.

Activity 1

Making hand cream

See student workbook

What are hand creams?

Hand creams are used to moisturise and soften the skin.

Hand creams are emulsions. They contain oil, water and an emulsifier, along with any other ingredients to add scent or moisture.

Making hand cream

1. Place 4 g of petroleum jelly and 4 g of coconut oil into a 250 ml beaker and warm in a hot water bath until they melt and turn to liquid.

2. Measure 40 ml of lecithin solution into a second beaker and place it in the hot water bath.

3. When the oils have fully melted, remove both beakers from the water bath. Take care when removing the beaker from the water bath as it may be hot.

4. Slowly add the melted oils to the warm lecithin solution while constantly stirring.

Making hand cream *(continued)*

5. Once all the oil has been added, a cream should start to form.

6. Add a drop or two of an essential oil with a scent of your choice.

7. Cool the mixture down in a cold-water bath.

8. Once cooled, use the spatula to scoop your hand cream into the sample vial provided.

Answer

(a) Lecithin is the emulsifier, which allows the oil and water to mix to make a cream.

Activity 2

Analysing hand cream using a microscope

See student workbook

Activity 2

Analysing hand cream using a microscope

In this activity you will use a microscope to look at the sample of hand cream you made in greater detail.

1. Place a drop of your hand cream on the microscope slide from the sample vial and carefully cover with a glass cover slip. Take care when handling the slide and cover slip.

2. Rotate the microscope's objective lenses so that the lowest power objective lens is above the stage.

3. Place the slide on the microscope stage and make sure the sample is in the middle. Secure the slide with the clips.

Analysing hand cream using a microscope *(continued)*

4. Adjust the height of the stage using the coarse focus dial.

5. Look down the eyepiece.

6. Increase the magnification by rotating the objective lenses to the next highest power and use the fine focus dial to bring the sample back into focus.

7. Draw what you see.

Answer

(b) Hand cream is an emulsion as it is made up of oil droplets suspended in a watery solution.

Acknowledgements

This resource was originally amended and adapted by the University of Reading to support outreach work delivered as part of the Chemistry for All project.

To find out more about the project, and get more resources to help widen participation, visit our Outreach resources hub: rsc.li/3CJX7M3.