

Clean and green activity

Teachers' sheet

Learning objectives:

- Understand the environmental drawbacks associated with packaging for liquid soaps
- Understand how soap works as a cleaning agent
- Understand that traditional bar soap can be as effective as modern alternatives for killing germs with a lower environmental impact.

1. What are soaps and what are they used for?

Soap is the term for a salt of a fatty acid or for a variety of cleansing and lubricating products produced from such a substance. Household uses for soaps include washing and bathing where soaps act as surfactants, emulsifying oils to enable them to be carried away by water.

2. Show the first slide. Ask pupils to match the cleaning product to the correct era.

2800 B.C. – clay cylinders discovered during excavations in Babylon contained a soapy substance, and the writing on the cylinders confirms that animal fat and ashes were boiled together to produce it.

The Egyptians used milder soap containing vegetable oils and animal fats for washing their bodies.

The Greeks and Romans preferred coating themselves with sand and oil and scraping it off with a special scraper called a strigil.

In the Middle Ages European boiled animal fats and ashes together to make a soap that was used to wash clothes and floors but was too harsh for bodies. They made do with plain water, to which they added herbs.

During the sixteen, seventeenth and most of the eighteenth centuries many people avoided water and believed that a clean linen shirt extracted dirt. Toilet soap, which was made from olive oil in Marseilles, Italy and Spain began to be used by rich women on their face and hands. But this was thought of more as a perfume or cosmetic.

In the nineteenth century people began to debate the pros and cons of using soap to clean themselves and by the end of the nineteenth century toilet soap had triumphed.

19th Century soap recipe:

‘Allow sixteen pounds of grease and potash, each, for a barrel of soap. The grease should be neither mouldy nor wormy. Cut the grease into pieces of one or two ounces and put it in a tight barrel with the potash. Then pour in two pailsful of either rain or spring water...Add a pailful of soft water every day until the barrel is half full, stirring it well every day...It is best to keep it three or four months before using’.

The processes that helped in the development of toilet soap were those that produced soda ash from salt rather than wood ash reduced the price and made a product that was harder and milder. Better transportation made importation of olive oil soaps more affordable.

3. How was toilet soap ‘improved’ on? What were the environmental impacts of these improvements?

Liquid soap was invented in the nineteenth century. In 1865 William Sheppard patented a liquid version of soap. In 1898 the B.J. Johnson Soap Company introduced Palmolive brand soap that same year and the company changed its name to Palmolive. In the early 1900s, other companies began to develop their own liquid soaps.

Liquid soap versus bar soap – get the pupils to do a comparison of bar vs liquid soap.

Effect on the skin. Some people find bar soap drying on the skin. This is because bar soap can have a higher pH level. However, you can buy lower pH soaps and most bar soaps contain glycerin which moisturises skin.

Ingredients. Bar soap is made from saponified (process where an alkali is used to add water molecules to hydrolyze) animal fat and/or plant oils. Liquid soaps are petroleum based and require emulsifying agents and stabilizers in order to maintain their consistency.

Bacteria. Researchers found that one minute of rigorous handwashing with a bar of soap was as effective as hand sanitizer for removing both bacteria and viruses. Dirt or germs on our hands cling to us because of the natural oils on our skin. Soap molecules are designed to break up that oil into smaller drops, loosening up any sticky microbes in the process. The other end of the soap molecule remains ‘hydrophilic’ or water loving. When you turn on the tap, the soap takes the dirt and germs down the drain.

Environment. Liquid soaps leave a 25% larger carbon footprint than bar soaps. Because of the chemical formula of soap and its ingredients, it takes more chemical feedstocks and processing to manufacture liquid soap. In fact, it takes about 7 times

more than when manufacturing hand bar soap. In each visit to the sink, we use almost 7 times more liquid soap (2.3 grams) than bar soap (0.35 grams). Liquid soaps rely on single-use plastic packaging which is made from fossil resources and can end up in waterways. Pumps can be difficult to recycle due to being made of mixed materials. These disadvantages from liquid soaps are offset somewhat by the fact that we tend to use about 30 percent more heated water washing with bar soap than liquid.

Convenience. Liquid soap manufacturers tend to spend more money on marketing and are so successful that they have induced consumers to spend more money on something we don't need.

4. Now make your own soap

Ingredients

Soap base

Essential oils

Colorant

Mixing bowl

Spoon

Microwave

Pipette

Silicone mould

Put the soap into the mixing bowl and heat it in the microwave in 20 second bursts.

Once melted add your colour and fragrance.

Mix thoroughly and pour into the mould. There may be some small bubbles or drips on the top, but that's okay.

Allow to cool for several hours. Press out of the mould. Your soap is ready to use now. It will last longer if you let it cure in a cool, dry place with plenty of air.

5. The future

Don't just replace your hand soaps with bar soaps. Companies are now making solid shampoo, conditioners, dish washing and even tooth soap!

Clean and green activity

Pupils' sheet

Match the cleaning product to the era



Egyptians (1550 BC)



Romans (1st Century AD)



Middle Ages (476-1492 AD)



Sixteenth and Seventeenth Century (1500-1600)



Victorians (1837 -1901)



Present Day



Comparison of bar vs liquid soap

	Bar Soap	Liquid Soap	Winner
Effect on the skin (how does the skin feel after using and why?)			
Ingredients* (see below – where are these from?)			
Cleaning properties (how does soap clean – see below?)			
Effect on the environment (packaging, manufacturing)			
Convenience			

And the winner is?



Research England



THYME Project

Teesside, Hull and York - Mobilising Bioeconomy Knowledge Exchange

* Ingredients:

Bar soap.



Coconut oil, Olive Oil, Beeswax, Sweet Orange Essential oil

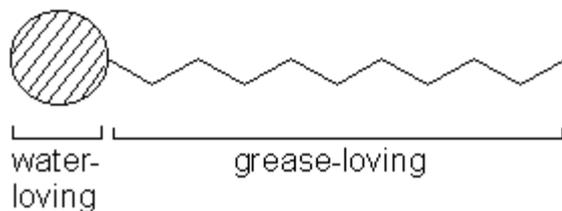
Liquid soap



Aqua (water), Sodium Laureth Sulfate (from coconut or palm kernel oil), Cocamidopropyl Betaine (from coconut oil), Sodium Chloride (salt), Glycerin (from vegetable oils), Polyquaternium-7 (synthetic polymer), Parfum (fragrance), Sodium Benzoate (preservative), Lactic Acid, Tetrasodium Glutamate Diacetate (from plants), Benzotriazolyl Dodecyl p-Cresol (stabilizer), Limonene (from oranges), Alpha Isomethyl Ionone (group of naturally occurring and synthetically produced scent chemicals), Hexyl Cinnamal (fragrance ingredient can be naturally occurring or synthetic), Butylphenyl Methylpropional (synthetic fragrance ingredient), Linalool (naturally occurring fragrance), CI 42051 (synthetic colourant).

How does soap clean?

Soaps and detergents are made from long molecules that contain a head and tail. These molecules are called **surfactants**; the diagram below represents a surfactant molecule.



The head of the molecule is attracted to water (hydrophilic) and the tail is attracted to grease and dirt (hydrophobic). When the detergent molecules meet grease on hands, the tails are drawn into the grease but the heads still sit in the water.

The attractive forces between the head groups and the water are so strong that the grease is lifted away from the surface. The blob of grease is now completely surrounded by detergent molecules and is broken into smaller pieces which are washed away by the water.

Make your own soap

Ingredients

Soap base in small (1 inch) chunks

Essential oils

Colourant

Mixing bowl

Spoon

Microwave

Pipette

Silicone mould

Greaseproof paper and sellotape for wrapping.



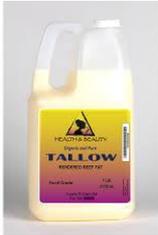
1. Put the soap base into the mixing bowl and heat it in the microwave in 20 second bursts. Stir until it is melted. It should be smooth and liquid, with no lumps or chunks.
2. Add your colour and fragrance. 5 drops of each should be enough.
3. Mix thoroughly and pour into the mould. There may be some small bubbles or drips on the top, but that's okay.
4. Allow to cool for several hours. Press out of the mould. Wrap in greaseproof paper. Your soap is ready to use now. It will last longer if you let it cure in a cool, dry place with plenty of air.

Clean and green activity

Teachers' answer sheet

Match the cleaning product to the era

Egyptians (1550 BC) – soap containing vegetable oils and animal fats



Romans (1st Century AD) – coated themselves with sand and oil and then scraped these off using a tool known as a strigil



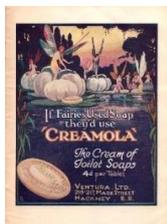
Middle Ages (476-1492 AD). Washed with plain water with added herbs.



Sixteenth and Seventeenth Century (1500-1600). A clean linen shirt.



Victorians (1837 -1901). Toilet soap.



Present day. Liquid soaps.

Comparison of bar vs liquid soap

Teachers' answer sheet

	Bar Soap	Liquid Soap
Effect on the skin (how does the skin feel after using and why?)	Some people find it drying on the skin due to higher ph	Some soaps have added moisturising agents
Ingredients* (see pupil worksheet – where are these from?)	Made from saponified fats/oils	Often petroleum based and require emulsifying agents and stabilizers
Cleaning properties (how does soap clean – see pupil worksheet?)	Both soap and liquid handwash are equally effective at killing germs	
Effect on the environment (packaging, manufacturing)	Use 0.35 grams per handwash but 30% more heated water. Packaging can be plastic-free.	25% larger carbon footprint Use 2.3 grams per handwash. Relies on plastic. Could be refilled?
Convenience	Can be used for travel, easily available and cheap	Potentially less messy