

Soap, Detergent, and Water quality

By

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Overview

- Introduction
- Soap
- Detergents
- Water quality
- Difference between soap and detergent
- Eutrification and Biodegradation
- Conclusion

History

- Ancient peoples employed wood ashes and water for washing
- Soap gradually evolved from crude mixtures of alkaline and fatty materials.
- Pliny the Elder first described the manufacture of both hard and soft soap in the first century.
- But it was not until the thirteenth century that soap was produced in sufficient quantities to call it an industry.
- Up to the early 1980 soap was believed to be a mechanical mixture of fat and alkali.
- The chevreul, a French chemist, showed that soap formation was actually a chemical reaction.
- Domieier did a recovery of glycerine from saponification mixture

History

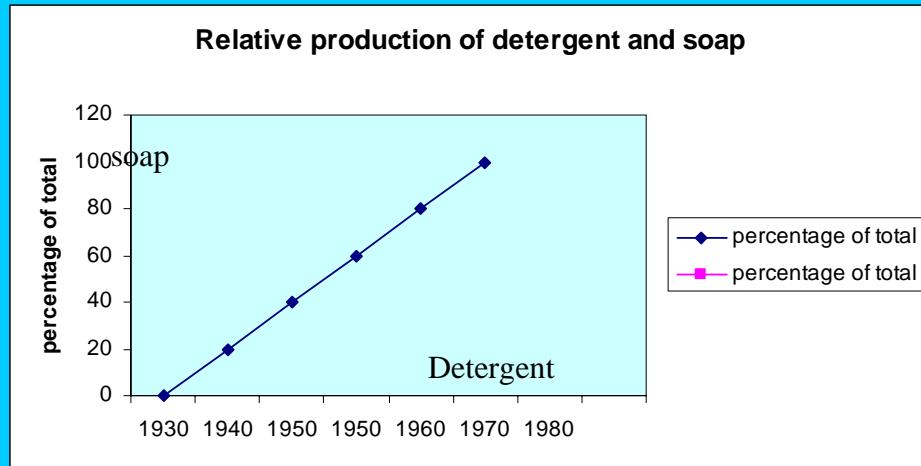
- Soap got its name, according to an ancient Roman legend, from Mount Sapo, where animals were sacrificed.
- From American colonial days to the early 1940s, soap was manufactured by an alkaline hydrolysis reaction called saponification.

soap



- Soap comprise the sodium or potassium salts of various fatty acids, But chiefly of oleic, steric, palmitic, lauric and myristic acids.
- For generation its use has become an industry essential to the comfort and health of civilized human beings.
- Main classes of soap are: Toilet and Industrial soap.

Usage of soap and detergents



- Household uses of these materials are Laundry products, toilet soaps, shampoos, dishwashing products, and cleaning products
- Industrial uses include cleaning compounds, speciality surfactants for hospital germicides, fabric conditioners, emulsifiers for cosmetics, flowing and wetting agents for agricultural chemicals, and rubber processing aids.

Detergent

- The surfactant in the detergent is absorbed into the oil in the soil and sets up forces that loosen the soil and suspend it in the water.



The 3 major components of detergent are

- Surfactants (to remove dirt and other unwanted materials),
- Builders (to treat the water to improve surfactant performance), and
- Additives (to improve cleaning performance).
 - Additives may include bleaches, bleach activators, antistatic agents, fabric softeners, optical brighteners, antiredeposition agents, and fillers.



Detergents are divided into four main groups:

1. anionic,
2. cationic,
3. nonionic and
4. amphoteric.

Detergents can be formulated to produce a product of then desired characteristic ranging from maximum cleaning power, maximum cleaning/ unit of cost, to maximum biodegradability.

Difference between soap and detergent

- Detergent is soap plus **builders** that reduce the hardness of the water

Detergents differ from soap in their action in hard water.

- Soap form insoluble compounds with the calcium and magnesium ions present in hard water these insoluble compounds precipitate out and reduce forming and cleaning action.
 - Detergent may react with the hard water ions, But the resulting products are either soluble or remain colloidal dispersed in the water.

Colour-Odour-Taste of Water

- Colors caused primarily from dissolved organics, suspended or colloidal particles.
- Odour is expressed as threshold number and is the ratio by which the sample has to be diluted for the odor to become “unnoticeable”.
- Taste is also expressed as a threshold number . Taste and Odour are very subjective and depend on the sensitivity of the sampler.
- These criteria are important for aesthetic reasons.

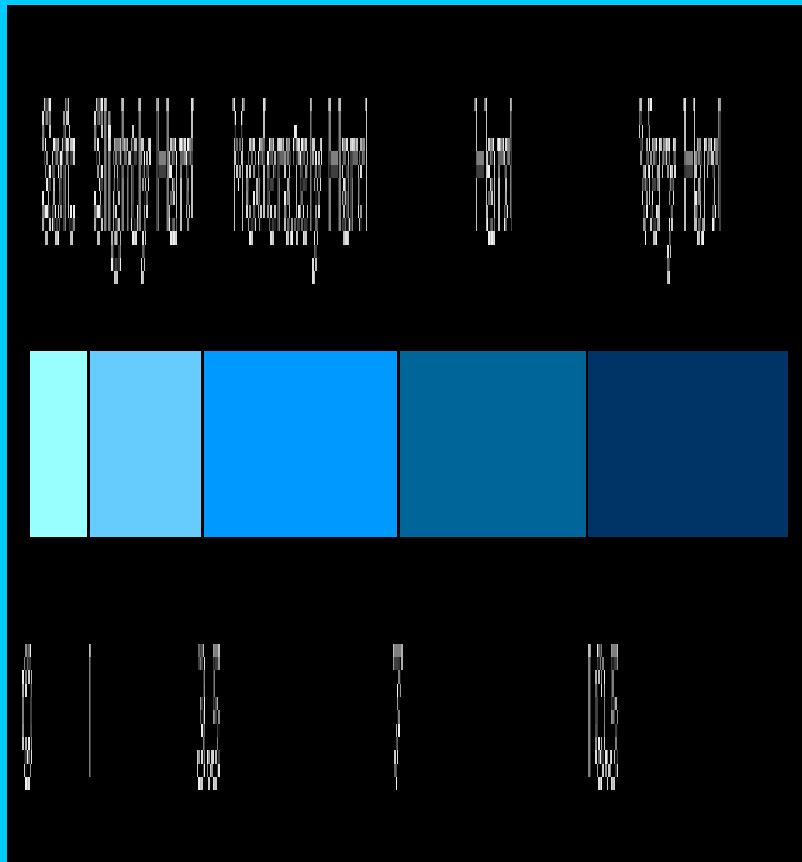
Hardness

- The hardness of water depends on the presence of calcium or magnesium hydroxides and carbonates.
- The effect of hard water is to form a scum when soap is added.
- This has a double effect in that it requires more soap to generate a lather hence increasing the pollution in the waste water and that it requires more water to eliminate the scum and extra soap in what has been washed.

Hardness

- There are several ways of expressing the hardness of water, some of them being used in a specific country: these ways are not necessarily convertible as the method of measurement may be different. One of the commonest methods of measurement is to add enough of a standard soap solution to form a stable lather, the hardness being related to the quantity of soap used.
- Whereas hard water is not desirable, neither is very soft water which is unpalatable for drinking.
- In many areas where the water is naturally soft, lime is often added to increase the hardness, such as in Scotland.
- Much purified water is very soft.

Hard water requires the use of more soap and detergent



- The quality of your water has a direct relationship to how much money you spend on cleaning products for your home.
- Have you ever poured detergent into your clothes washer and wondered why very few soap bubbles formed? That's because the mineral hardness in your water is making it impossible for lather to form.
- Most detergent manufacturers assume your water is hard. That's why over 60 percent of detergents are nothing more than chemical water softeners. That means you're getting less SOAP for your money when you buy detergent.

Water Hardness

Calcium carbonate in milligrams per liter (mg/L)	
soft	0-75 mg/L (or 0 - 4.4 grains per gallon)
moderately hard	75-150 mg/L (or 4.4 - 8.8 grains per gallon)
hard	150-300 mg/L (or 8.8 - 17.5 grains per gallon)
very hard	> 300 mg/L (or >17.5 grains per gallon)

- Water hardness is caused by dissolved minerals such as calcium and magnesium.
- Although there is little health risk associated with hard water, it can cause soap and scale deposits in plumbing fixtures and appliances.
- Hard water can also decrease the cleaning performance of soaps and detergents.

Water Hardness

- Water hardness is a common water-quality problem, and it is often necessary to test for water hardness if you intend to evaluate and treat other problems..
- The levels relate to the concentration of dissolved minerals, which can be expressed in either grains of calcium and magnesium per gallon of water, parts per million, or milligrams per litre.
- Labs can measure colour, corrosiveness, odour, and pH, and they can test for the presence of detergents and other contaminants.
- **Colour.** A visible tint in the water can be caused by iron, copper, manganese, organic chemicals, and organic matter.
- **Corrosiveness.** Your water may be corrosive if the pipes are pitted, the water has a metallic taste, or the fixtures are stained.
- **Detergents/foaming agents.** Household and industrial wastes can give the water a frothy, cloudy appearance, a soapy taste, and an unpleasant odour.

Forming of soap in water

Most familiar of all surfactants is soap, a simple substance which, in water, clearly demonstrates two effects.

1. It produces foam due to its action at the air–water interface, and
2. it makes the grease transfer from grubby hands into the soapy water as a result of its activity at the water–oil (grease) interface.



Forming in water

Tap water in many parts of the country contains minerals that can interfere with the cleaning ability of detergents. Water can be softened in a number of ways.

- An automatic water softener connected to water supply pipes removes magnesium and calcium from water and replaces them with sodium. Sodium does not react with soap or detergents. If you don't have an automatic water softener, you can still soften laundry water by adding softeners directly to the wash water.
- These softeners combine with calcium and magnesium, preventing the minerals from forming a soap scum.

soap scum

- Why we wash our clothes in detergent but wash our hands in soap?
- What's the difference?
- Soap has molecules that surround the dirt and oil on your hands and then they get washed away with water..
- **Hard water** is a problem because of calcium and magnesium ions in it. These ions bond with soap to make a greasy film that is called **soap scum**.
- This causes the soap not to bubble as well makes it harder to rinse off.

Phosphate



- Surface water contaminated with sewage will have high levels of complex organic molecules and ammonia.
- High concentration of phosphate resulting from nitrification can lead to eutrophication.
- Nitrates enter the groundwater mainly from fertilizers and sewage they can pose an health threat causing “bluedesease” in babies by forming of nitrite.
- Nitrate in groundwater can also caused by pollution with manure or sewage

Eutrophication

- For a long time, people used **phosphates** as builders. Phosphates were the ideal builder; they easily removed the hard water ions.
- However, all water that you wash your clothes in ends up in a stream or other body of water. Algae love to eat phosphates. This caused a problem known as **eutrophication**.
- What happens during eutrophication is that there is too much algae in the lake.
- The algae eat up all of the nutrients in the water and choke off the pond or stream so that no light can get to the bottom. This kills off the other plants and fish that live in the pond or stream. Normally, eutrophication occurs slowly over time (thousands of years), but phosphates speed the rate up (less than a decade).
- Phosphates were the cause in the eutrophication of many of the bodies of water in the world, and soon phosphates were taken out of detergents.

Eutrophication

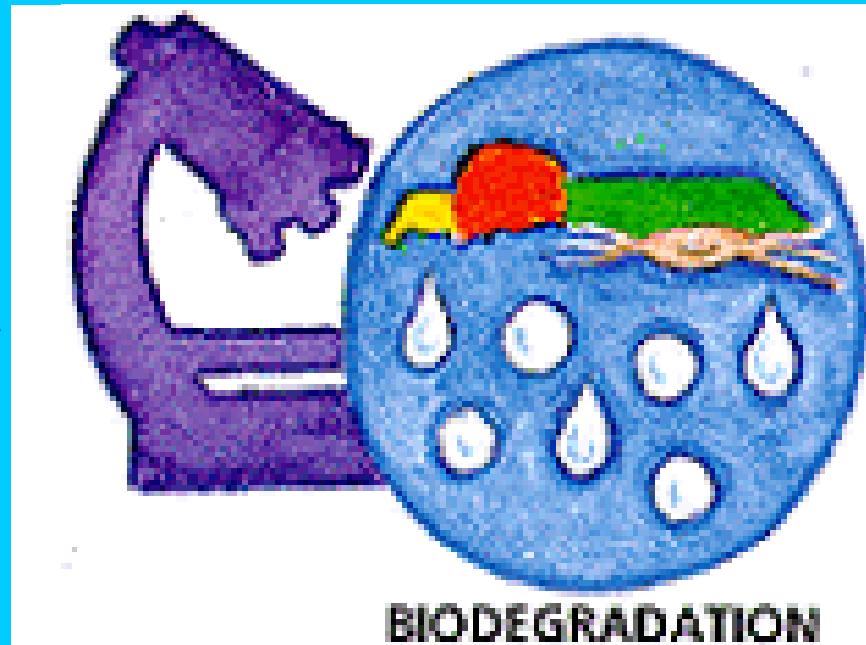


Solution of Eutrophication

- A new builder was chosen called **sodium zeolite A**.
- This zeolite will **ion exchange** the calcium and magnesium ions (the hard water ions) for sodium ions.
- Sodium ions do not interact with soap to form hard water, so your clothes will not be covered in soap scum.
- Sodium zeolite A also has the added benefit of not hurting the environment. If you look on the side of a box of detergent, you might see the phrase
- “contains no phosphates: contains aluminosilicates.” The **aluminosilicates** that the box is talking about is sodium zeolite A, which is made up of aluminum, silicon, and oxygen.
- Overall, sodium zeolite A is a much better choice for a detergent builder than phosphates.

Biodegradation

- **What does ‘biodegradable’ mean?**
- The term ‘biodegradable’ refers to the ability of a material to be broken down, by a group of biological organisms called decomposers, into various other compounds.
- Decomposers are necessary component of a balanced ecosystem present in natural waters and sediments, and are encouraged in sewage treatment works.
- Bacteria are the most common decomposers.
- The ease with which a surfactant is decomposed by microbial action has been defined as its biodegradability .



Testing established for biodegradability

To have broad application, such standards must recognise the breath of variation in environmental conditions. materials which may be only partly degraded in inefficient treatment systems.

Methods of testing radiolabeled surfactants of anionic, cationic, and nonionic types and builders have been developed to determine

- The rate of biodegradation in parts per billion in natural waters and also

Biodegradation

- Some surfactants, like tetrapropylene-derived alkylbenzen sulfonate, degrade slowly, leaving a persistent residue. Others are more readily decomposable by microorganisms and leave practically no persistent residues
- The Australian Standard for biodegradability (AS1792—*Methods to Determine the Biodegradability of Surfactants*) requires 80% of the mixture to be degraded within 21 days if the product is to carry the label ‘biodegradable’.
- To determine if threshold concentrations, below which degradation is not observed, exist.

European Biodegradation directive

Biodegradation on Surfactants Directive (73/404/EEC; 82/242/EEC; 82/243/EEC)

Objective

- The objective of this European directive is environmental protection by stipulating a minimal level of surfactant biodegradability.

Background

- These directives were drafted to block the use of low-biodegradability surfactants, known to cause foaming in the rivers. The directives are :

1. The Master Directive, 73/404/EEC, defines the precise biodegradability criterion for surfactants
2. Two Implementation Directives :

82/243/EEC, which covers the class of anionic surfactants

82/242/EEC, which covers the class of non-ionic surfactants

These Implementation Directives describe the precise methodology by which the surfactants must be extracted, isolated and tested for their biodegradability.

- Implementation**

- The Manufacturer may only use those surfactants that meet the biodegradability criteria as described in 73/404/EEC, using the test methods described in the appropriate implementation directives. Using these methods, surfactant biodegradability must be no less than 80%, which translates to a "real world" biodegradability of at least 90%.

- Enforcement**

- The Authorities monitor all detergents in the trade and extract their surfactants
- determine biodegradability of the extracts and thereby compliance with these directives

Conclusion

Cleaning products play an essential role in our daily lives.

- By safely and effectively removing soils, germs and other contaminants,
- they help us to stay healthy, care for our homes and possessions, and make our surroundings more pleasant.
- Detergent has a special substance in it called sodium zeolite A which takes the calcium and magnesium ions out of hard water.
- These ions prevent the soap in the water from bubbling.
- In the hard water, the detergent should bubble better than the soap.

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Thank you for your attention