SOAP AND DETERGENT

Soap is a salt of a fatty acid used in a variety of cleansing and lubricating products.[1] In a domestic setting, soaps are surfactants usually used for washing, bathing, and other types of housekeeping. In industrial settings, soaps are used as thickeners, components of some lubricants, and precursors to catalysts.

A **detergent** is a surfactant or a mixture of surfactants with cleansing properties when in dilute solutions. There are a large variety of detergents; often they are the sodium salts of long chain alkyl hydrogen sulphate or a long chain of benzene sulphonic acid. The most commonly found detergents are alkylbenzene sulfonates: a family of soap-like compounds that are more soluble in hard water, because the polar sulfonate (of detergents) is less likely than the polar carboxylate (of soap) to bind to calcium and other ions found in hard water.

In simple words soap **and detergent**, substances that, when dissolved in water, possess the ability to remove dirt from surfaces such as the human skin, textiles, and other solids.

The main difference between soap and detergent is the ingredients. **Soaps are made with biodegradable ingredients such as oils, lye and fats. Detergents are made with synthetic chemicals, such as surfactants, optical brighteners and perfumes.**

Soap Types

Soap are salts of fatty acids, soaps have the general formula $(RCO_2^-)_nM^{n+}$ (Where R is an alkyl, M is a metal and n is the charge of the cation). The major classification of soaps is determined by the identity of M^{n+}. When M is Na (Sodium) or K (Potassium), the soaps are called **toilet soaps**, used for handwashing. Many metal dications (Mg^{2+}, Ca^{2+}, and others) give metallic soap. When M is Li, the result is lithium soap (e.g., lithium stearate), which is used in high-performance greases.[4] A cation from an organic base such as ammonium can be used instead of a metal; ammonium nonanoate is an ammonium-based soap that is used as an herbicide.[5]

Unlike detergents, when used in hard water soap does not lather well and a scum of stearate, a common ingredient in soap, forms as an insoluble precipitate.

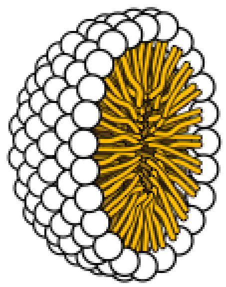
Non-toilet soaps

Soaps are key components of most lubricating greases and thickeners. Greases are usually emulsions of calcium soap or lithium soap and mineral oil. Many other metallic soaps are also useful, including those of aluminium, sodium, and mixtures thereof. Such soaps are also used as thickeners to increase the viscosity of oils. In ancient times, lubricating greases were made by the addition of lime to olive oil.

Metal soaps are also included in modern artists' oil paints formulations as a rheology modifier.

Toilet soaps

In a domestic setting, "soap" usually refers to what is technically called a toilet soap, used for household and personal cleaning. When used for cleaning, soap solubilizes particles and grime, which can then be separated from the article being cleaned. The insoluble oil/fat molecules become associated inside micelles, tiny spheres formed from soap molecules with polar hydrophilic (water-attracting) groups on the outside and encasing a lipophilic (fat-attracting) pocket, which shields the oil/fat molecules from the water making it soluble. Anything that is soluble will be washed away with the water.



Structure of a micelle, a cell-like structure formed by the aggregation of soap subunits (such as sodium stearate): The exterior of the micelle is hydrophilic (attracted to water) and the interior is lipophilic (attracted to oils).

Production of toilet soaps

Toilet soaps are made by **combining liquid fats (like vegetable oils or animal fat) with an alkali like sodium hydroxide (also called lye)**. The process is called “saponification”; the definition of “saponify” is literally “to turn fat or oil into soap by reaction with an alkali.

The production of toilet soaps usually entails saponification of triglycerides, which are vegetable or animal oils and fats. An alkaline solution (often lye or sodium hydroxide) induces saponification whereby the triglyceride fats first hydrolyze into salts of fatty acids. Glycerol (glycerin) is liberated. The glycerin can remain in the soap product as a softening agent, although it is sometimes separated.[10]

The type of alkali metal used determines the kind of soap product. Sodium soaps, prepared from sodium hydroxide, are firm, whereas potassium soaps, derived from potassium hydroxide, are softer or often liquid. Historically, potassium hydroxide was extracted from the ashes of bracken or other plants. Lithium soaps also tend to be hard. These are used exclusively in greases.

For making toilet soaps, triglycerides (oils and fats) are derived from coconut, olive, or palm oils, as well as tallow.[11] Triglyceride is the chemical name for the triesters of fatty acids and glycerin. Tallow, *i.e.,* rendered fat, is the most available triglyceride from animals. Each species offers quite different fatty acid content, resulting in soaps of distinct feel. The seed oils give softer but milder soaps. Soap made from pure olive oil, sometimes called Castile soap or Marseille soap, is reputed for its particular mildness. The term "Castile" is also sometimes applied to soaps from a mixture of oils, but a high percentage of olive oil.

Fatty acid content of various fats used for soapmaking	**Lauric acid**	**Myristic acid**	**Palmitic acid**	**Stearic acid**	**Oleic acid**	**Linoleic acid**	**Linolenic acid**
fats	**C_{12} saturated**	**C_{14} saturated**	**C_{16} saturated**	**C_{18} saturated**	**C_{18} monounsaturated**	**C_{18} diunsaturated**	**C_{18} triunsaturated**
Tallow	0	4	28	23	35	2	1
Coconut oil	48	18	9	3	7	2	0
Palm kernel oil	46	16	8	3	12	2	0
Palm oil	0	1	44	4	37	9	0
Laurel oil	54	0	0	0	15	17	0
Olive oil	0	0	11	2	78	10	0
Canola oil	0	1	3	2	58	9	23

Liquid soap

Liquid soap was not invented until the nineteenth century; in 1865, William Shepphard patented a liquid version of soap.[45] In 1898, B.J. Johnson developed a soap derived from palm and olive oils; his company, the B.J. Johnson Soap Company, introduced "Palmolive" brand soap that same year.[46] This new brand of soap became popular rapidly, and to such a degree that B.J. Johnson Soap Company changed its name to Palmolive.[47]

The global market for organic liquid soaps was $74.3 million in 2020. During the projected period from 2021 to 2030, it will grow at a compound annual growth rate (CAGR) of 8% and will be organic worldwide in 2030. The liquid soap market is projected to reach US $160.4 million. In the early 1900s, other companies began to develop their own liquid soaps. Such products as Pine-Sol and Tide appeared on the market, making the process of cleaning things other than skin, such as clothing, floors, and bathrooms, much easier.

Liquid soap also works better for more traditional or non-machine washing methods, such as using a washboard.

Chemical classifications of detergents

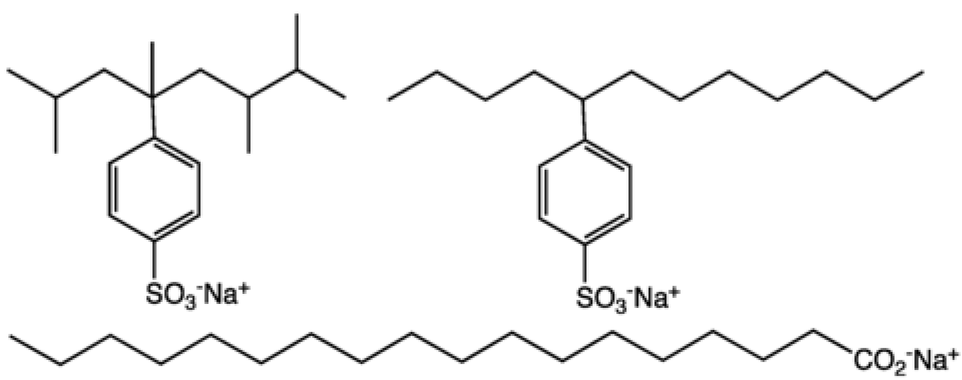
Detergents are classified into four broad groupings, depending on the electrical charge of the surfactants.

Anionic detergents

Typical anionic detergents are alkylbenzene sulfonates. The alkylbenzene portion of these anions is lipophilic and the sulfonate is hydrophilic. Two varieties have been popularized, those with branched alkyl groups and those with linear alkyl groups. The former were largely phased out in economically advanced societies because they are poorly biodegradable.[7]

Anionic detergents are the most common form of detergents, and an estimated 6 billion kilograms of anionic detergents are produced annually for the domestic markets.

Bile acids, such as deoxycholic acid (DOC), are anionic detergents produced by the liver to aid in digestion and absorption of fats and oils.



Three kinds of anionic detergents: a branched sodium dodecylbenzenesulfonate, linear sodium dodecylbenzenesulfonate, and a soap.

Cationic detergents

Cationic detergents are similar to anionic ones, but quaternary ammonium replaces the hydrophilic anionic sulfonate group. The ammonium sulfate center is positively charged.[7] Cationic surfactants generally have poor detergency.

Non-ionic detergents

Non-ionic detergents are characterized by their uncharged, hydrophilic headgroups. Typical non-ionic detergents are based on polyoxyethylene or a glycoside. Common examples of the former include Tween, Triton, and the Brij series. These materials are also known as ethoxylates or PEGylates and their metabolites, nonylphenol. Glycosides have a sugar as their uncharged hydrophilic headgroup. Examples include octyl thioglucoside and maltosides. HEGA and MEGA series detergents are similar, possessing a sugar alcohol as headgroup.

Amphoteric detergents

Further information: Surfactant § Applications and sources

Amphoteric or zwitterionic detergents have zwitterions within a particular pH range, and possess a net zero charge arising from the presence of equal numbers of +1 and −1 charged chemical groups. Examples include CHAPS.

Detergent Power

Detergent powders are **laundry-cleaning products that are made using a synthetic surfactant in place of the metal fatty acid salts, which are used in soaps**. Made in powder form, these detergents are also sold as laundry powders, hard surface cleansers, etc.

What is Enzymatic Detergent?

Enzymatic cleaners contain enzymes, which are naturally occurring substances that create catalytic actions to break down soils and stains. Broken-down soils result in smaller particles (even molecules) that can be quickly and simply washed away during a standard washing cycle.