SOAP AND DETERGENTS

Reference: Shreve's Book Ch. 29, pp. 482- 505

History of Soap

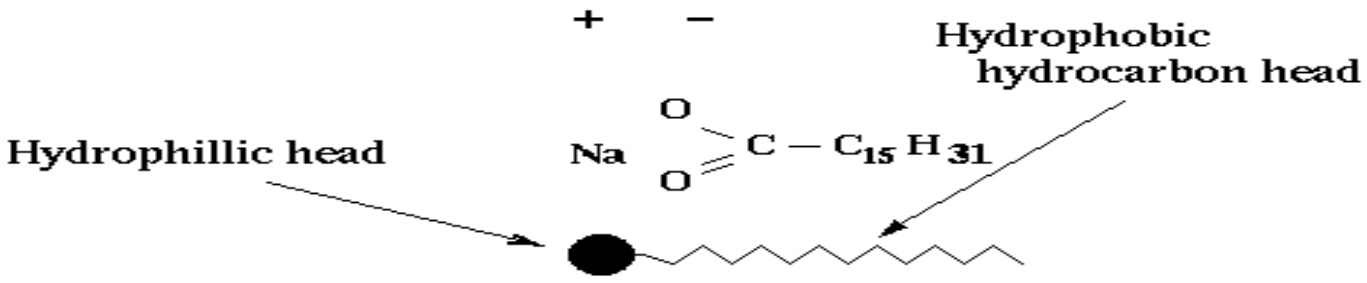
- Soap was one of the first chemical compounds ever made by man.
- The first soaps were probably the saps of certain plants, such as the Soap Plant (*Chlorogalum pomeridianum*), whose roots can be crushed in water to form a lather, and used as a shampoo.
- Later, people learned that fats would react with alkalies in the ashes left over from a fire to produce saponified compounds
- **Saponification is commonly used to refer to the reaction of a metallic alkali (base) with a fat or oil to form soap.**

How does soap clean dirts

- **Soap, consists of a polar end and a non-polar end.** Because like dissolves in like, the non-polar end (hydrophobic or water-fearing part) of the soap molecule can dissolve the greasy dirt, and the polar or ionic end (hydrophilic or water-loving part) of the molecule is attracted to water molecules. Therefore the dirt from the surface being cleaned will be pulled away and suspended in water.
- Thus soap acts as an emulsifying agent, a substance used to disperse one liquid (oil molecules) in the form of finely suspended particles or droplets in another liquid (water molecules).

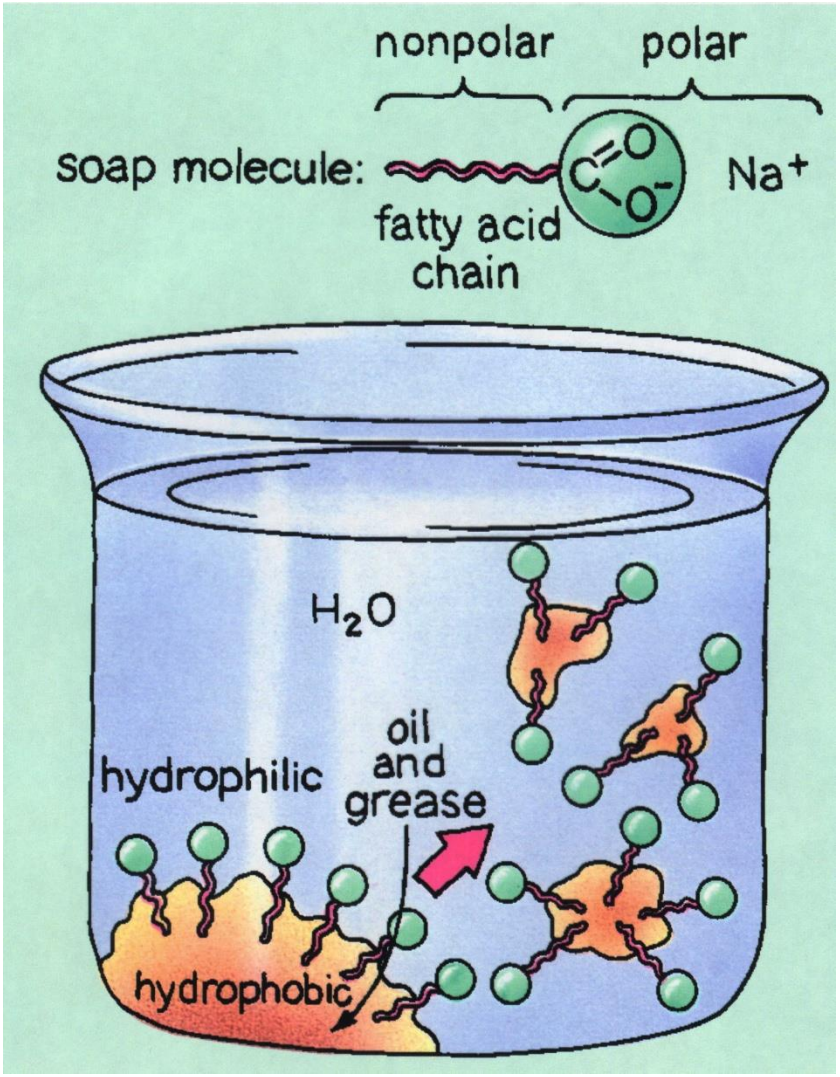
How does soap clean your clothes?

- When soap is added to the water, the hydrophilic (polar) heads of its molecules stay into the water (they like it!), while the long hydrophobic (nonpolar) chains join the oil particles and remain inwards (escaping from the water).



A typical amphiphillic molecule.

Cleaning Action of Soap



Difference between soap and detergents

- There is a clear difference between natural soap and detergent. Soap is a natural fatty substance (called fatty acids) which reacted with lye (sodium or potassium hydroxide) to form sodium or potassium salt of fatty acids, while a detergent is any type of cleaner which does not have soap in its main ingredients.
- Soaps perform great in soft water, but are not as successful as detergents in hard water. Detergents, on the other hand, work wonderfully in both hard and soft water.
- The general formula of detergent is R-C6H4-SO3- Na+ (sodium alkyl benzene sulphonate). All these detergents contain a polar group, -SO3Na, and a non-polar group R-C6H4-.

Classifications of soap and detergents

- Solid soap (bars)
- Liquid soaps
- Liquid hand soap
- Dishwashing liquid

Solid and liquid Soap

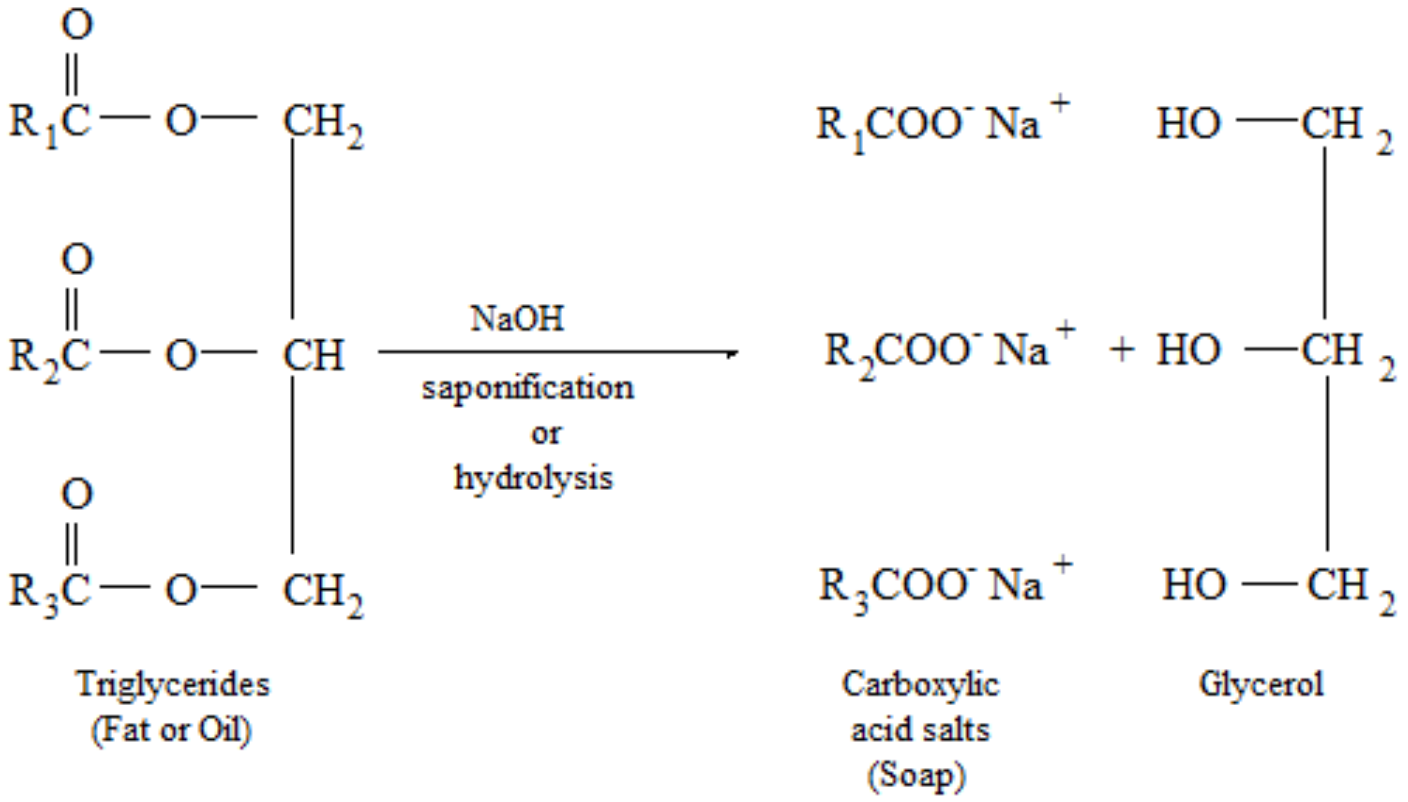
- A soap is the sodium or potassium salt of a long chain fatty acid. The fatty acid usually contains 12 to 18 carbon atoms.

- Solid soaps usually consist of sodium salts of fatty acids whereas liquid soaps usually are potassium salts of fatty acids.

Solid Soap

- Animal fats and vegetable oils are called triglycerides. Soap can be prepared from the natural triglycerides by alkaline hydrolysis (saponification).
- Saponification : chemical reaction between fatty acids and (NaOH, KOH).
- You may also choose to add a scent to your soap by adding an essential oil. You can purchase the scent you want to add or isolate it from the natural source using a process of steam distillation.

Solid Soap


NaOH
saponification
or
hydrolysis
Triglycerides
(Fat or Oil)
Carboxylic
acid salts
(Soap)
Glycerol

Solid Soap

Ingredients go into Solid soap making:

- Triglycerides :(or tri-esters of fatty acids) are the raw material for the production of soap (olive, coconut, castor, palm) or stearic acid.
- KOH, NaOH : Alkali compound to complete soponification reaction.
- Glycerin : Emollient and texture enhancer.
- Sorbitol : Helps make glycerin soaps more transparent .
- Titanium Dioxide : Makes soap opaque.

Solid Soap

- The amount of caustic soda (NaOH) required neutralizing a fatty acid blend can be calculated as follows:

NaOH = [Weight fatty acid x 40] / Mwt Fatty acid

- The average molecular weight of a fatty acid is calculated from the following equations:

Mwt Fatty acid = 56.1 x 1000 / AV

Where :

AV (mg/g) = Acid Value of fatty acid blend = mg of KOH required to neutralize 1 g of fatty acid.

Detergents raw material

- Surfactants (cleaning agent) : Any compound that affects(reduce) the surface tension when dissolve in water e.g. high molecular weight (long chain)[one end of the chain is hydrophobic and the other is hydrophilic

The hydrophilic functional group may vary to form :

A) Anionic surfactant : —$SO3^-$, —$OSO3^-$
B) Cationic surfactant : —$N(CH_3)_3^-$, C_5H_5N—
C) Non-ionic surfactant: —(OCH2CH2)n OH

Detergents raw material

- Emulsifiers : Any compound used to disperse oil molecules in the water molecules e.g. coconut diethanolamid .
- Humectants : Emollient and texture enhancer e.g. glycerin.
- Chelating agents: to remove hardness of water e.g. EDTA.
- Neutralizers : to adjust pH e.g. citric acid.

Detergents raw material

- Preservative : e.g. formaldehyde.
- Stabilizer : Is a chemical that is used to prevent degradation e.g. urea.
- Solvent : e.g. water, isopropyl alcohol, Ammonia.
- Sanitizer : Reduce bacteria on a surface e.g ethanol, Nonyl phenol 9 .
- Disinfectant : kill a wider range of microorganisms (than **sanitizers**) e.g. Quaternary ammonium chloride.

Gelling agent : used to thicken and stabilize detergent e.g. carbobol, CMC

Liquid hand soap

Component	Trade Name	Function
Cocoamide propyl Betaine (35%)	CAPB	Surfactant
Sodium Laureth Sulfate	SLES (Texapon)	Surfactant
Coconut diethanolamide	CDE (Camberlan)	Emulsifier ,foam increaser and thickening agent
Triethanolamine (99%)		Neutralizer
Glycerin		Humectant
EDTA		Chelating agent ,antioxidant
Citric Acid		Preservative, PH adjustment
Color (Rose, Green, Blue)		
Fragrance		

Dishwashing Liquid

Component	Trade Name	Function
Sodium Laureth Sulfate	SLES (Texapon)	Surfactant
linear alkyl benzene sulfonates (Sulfonic Acid)	LABS	Anionic surfactants
Coconut diethanolamide (Camberlan)	CDE	Emulsifier, foam increaser and thickening agent
Trisodium phosphate		cleaning agent, degreaser
Glycerin		Humectant
EDTA		Chelating agent, antioxidant
Citric Acid		Neutralizer
Urea		Stabilizer
formaldehyde		Preservative
NaOH		
Color(Pink,Green)		
Fragrance		

Glass Cleaner

Component	Trade Name	Function
Sodium Laureth Sulfate	SLES (Texapon)	Surfactant
Ammonia		To prevent the appearance of streaks (evaporates quickly)
Ethanol		Sanitizer
Isopropyl alcohol	Rubbing alcohol	solvent
Propylene glycol		To ensure even distribution of the ingredients throughout a product, to help it work better
Color(blue)		
Perfume		

Pine oil Disinfectant

Component	Trade Name	Function
Sodium Laureth Sulfate	SLES (Texapon)	Surfactant
Pine Oil		Fragrance
Nonyl phenol 9 (98%)	Semsol	Sanitizing agent
Quaternary ammonium chloride 80%		disinfectant
Isopropanol		Solvent
Color (yellow +Red)		

Bathroom Cleaner Gel

Component	Trade Name	Function
Sodium Laureth Sulfate	SLES (Texapon)	Surfactant
Triethanolamine (99%)		Neutralizer
Carbopol polymer or CMC		Gelling agent
2-Butoxy Ethanol		Sanitizer
Fragrance		
Color (Green)		