MINISTRY OF SCIENCE AND EDUCATION OF THE REPUBLIC OF KAZAKHSTAN
SOUTH KAZAKHSTAN STATE UNIVERSITY named after M.AUEZOV

SOAP AND DETERGENT

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WHAT IS A DETERGENT ?

Any substance which has cleansing action in water is called a detergent.

Detergents are of two types :-

- **Soapy**

  Also known as Soaps

- **Non-Soapy**

  Also known as Synthetic detergents

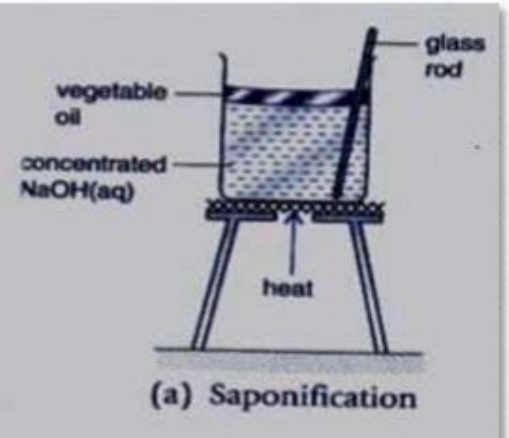
SOAPS

- A soap is the sodium salt (or potassium salt) of a long chain carboxylic acid (fatty acid) which has cleansing properties in water.
- It is a salt of a strong base (NaOH) and a weak acid (carboxylic acid), so a solution of soap in water is basic in nature.

HOW SOAPS ARE PREPARED ?

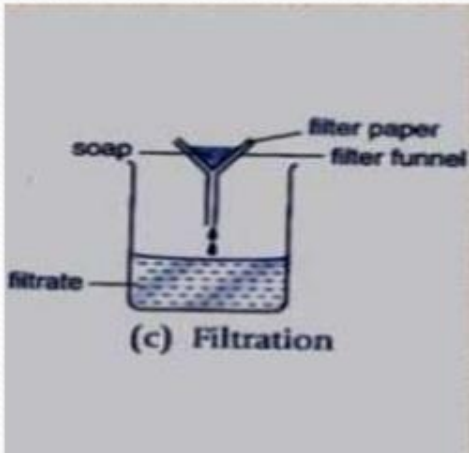
- Soaps are made by heating the animal fats and oils with concentrated Sodium Hydroxide Solution (Caustic Soda).
- The process of making Soaps by using Fats, Alkalis and Oils is called Saponification.

$$\underset{\text{(An ester)}}{\text{Fat Or Oil}} + \underset{\text{(An alkali)}}{\text{Sodium Hydroxide}} \xrightarrow{\Delta} \underset{\text{of fatty acid)}}{\text{Soap (Sodium salt}} + \underset{\text{An alchohol}}{\text{Glycerol}}$$



(a) Saponification

(b) Precipitation of soap



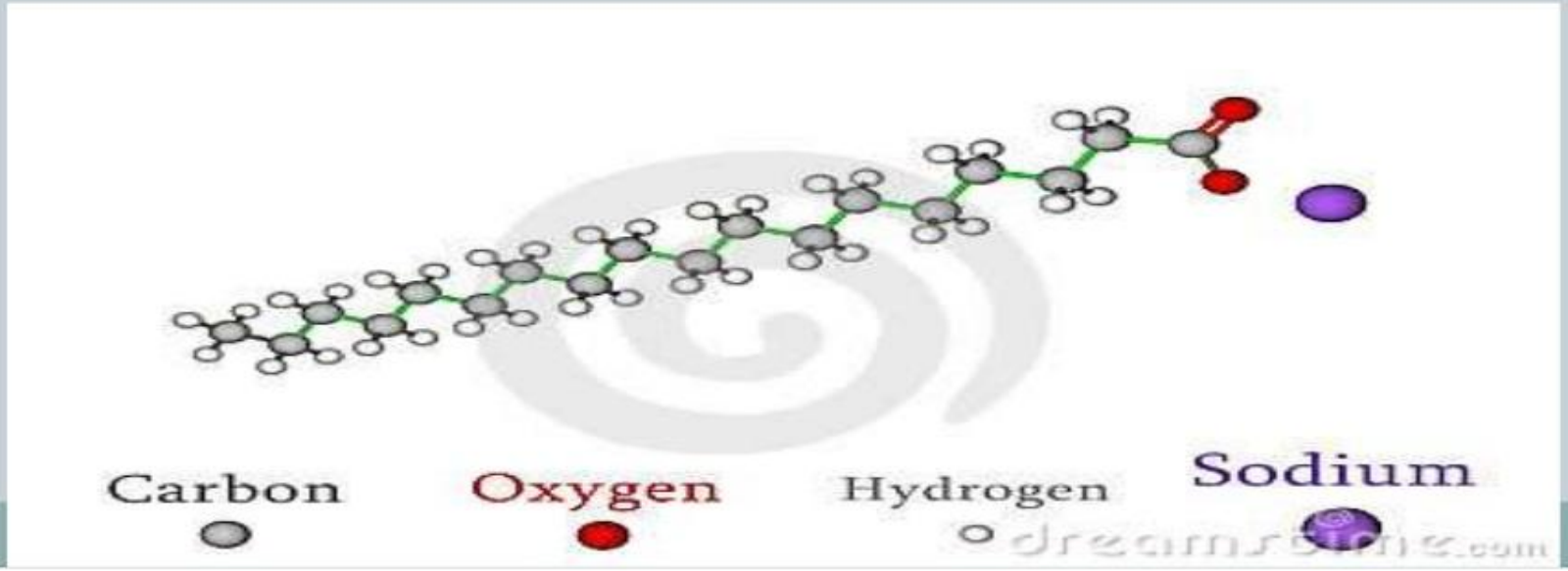
(c) Filtration

Examples of soaps are :

- Sodium Stearate
- Sodium Palmitate

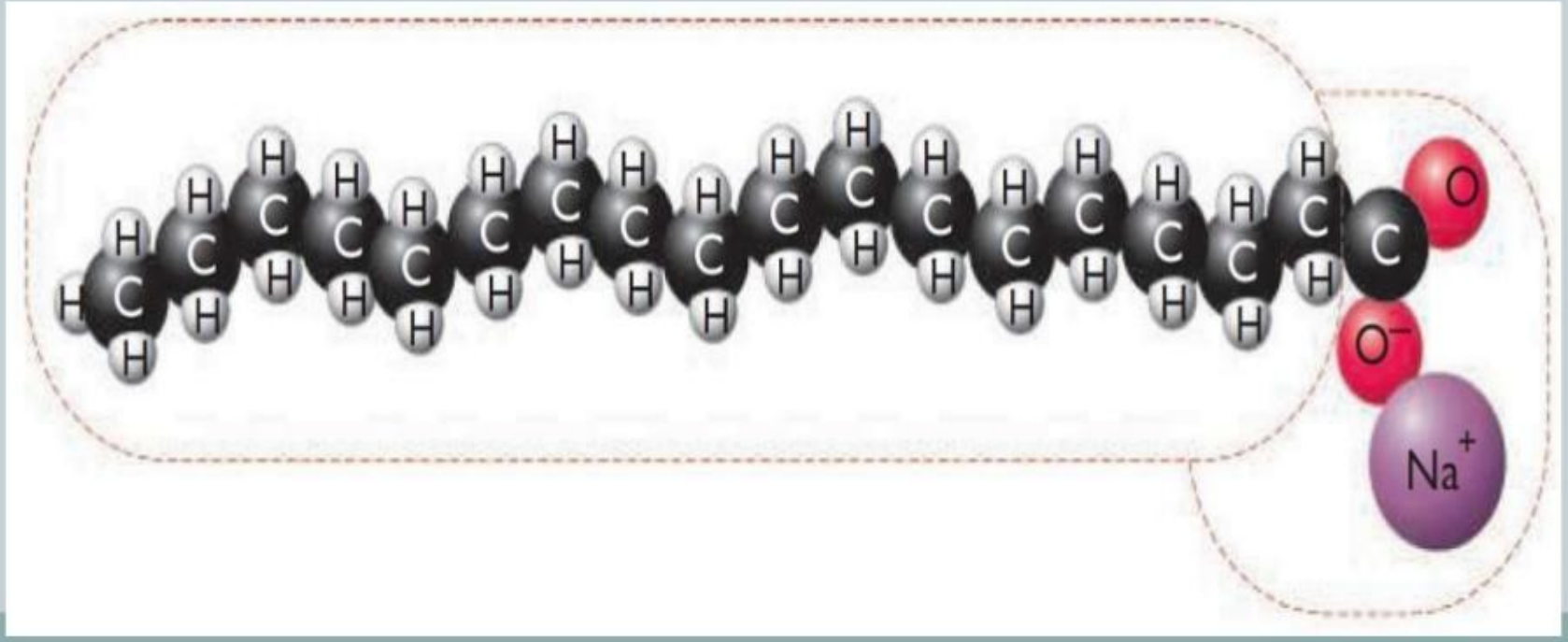
- **Sodium Stearate ($C_{17}H_{35}COO^{-}Na^{+}$) :-**

Sodium Stearate soap is the sodium salt of a long chain saturated fatty acid called stearic acid. Sodium stearate soap has along alkyl group ($C_{17}H_{35}$) and an ionic carboxylate group ($COO^{-}Na^{+}$).



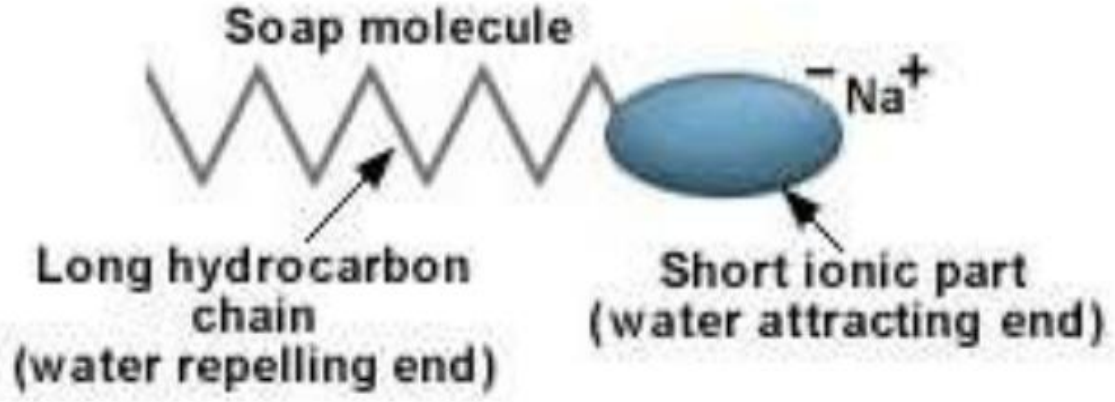
- Sodium Palmitate ($C_{15}H_{31}COO^-Na^+$) :-

Sodium Palmitate 'soap' is the sodium salt of long chain saturated fatty acid called stearic acid ($C_{15}H_{31}COOH$).

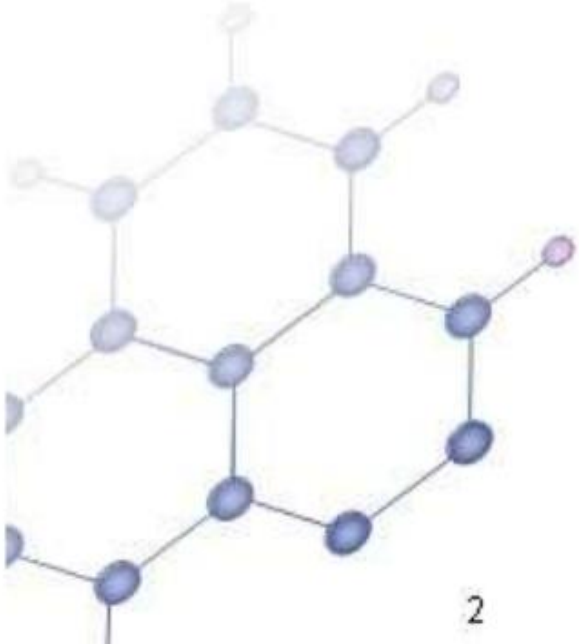


STRUCTURE OF A SOAP MOLECULE

A soap molecule is made up of two parts : a long hydrocarbon part and a short ionic part containing COO^-Na^+ group. The soap molecule is said to have a tadpole structure.



Representation of a soap molecule.



USES OF SOAPS

We use soaps on daily basis.

Following are some uses of soaps:-

- Washing hands
- Washing clothes
- Cleaning utensils

LIMITATIONS OF SOAPS :-

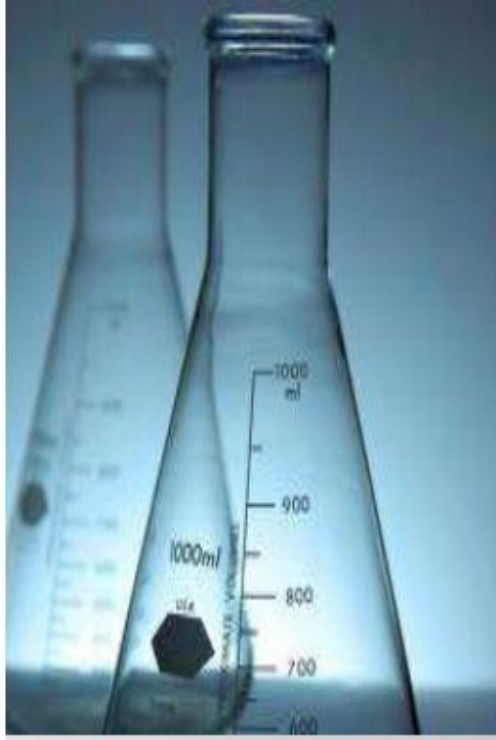
Hard water contains calcium and magnesium salts. Soap is not suitable for washing clothes with hard water because of two reasons :-

- **When soap is used for washing clothes with hard water, a large amount of soap is wasted in reacting with the calcium and magnesium ions of hard water to form an insoluble precipitate called scum, before it can be used for the real purpose of washing .**
  So a larger amount of soap is needed for washing clothes when the water is hard.
- **The scum (or the curdy precipitate) formed by the action of hard water on soap, sticks to the clothes being washed and interferes with the cleaning ability of the additional soap. This makes the cleaning of clothes difficult.**

WHAT IS A DETERGENT ?

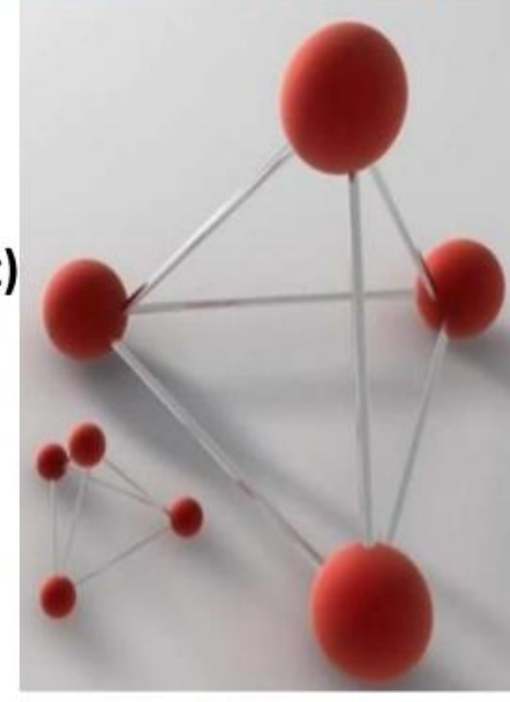
Detergents are also called 'soap-less soaps' because they act like a soap in having the cleansing properties, they do not contain the usual 'soaps' like sodium stearate, etc.

A detergent is the sodium salt of a long chain benzene sulphonic acid which has cleansing properties in water.



Examples of detergents are : Sodium *n*-dodecyl benzene sulphonate

$CH_3—(CH_2)_{11}—C_6H_4—SO_3^-Na^+$ **(A Common Detergent)**



Sodium *n*-dodecyl sulphate.

$CH_3—(CH_2)_{10}—CH_2—S\,O_4^-Na^+$ **(Another Detergent)**

ADVANTAGES OF DETERGENTS OVER SOAPS

- Detergents can be used even with hard water whereas soaps are not suitable for use with hard water.
- Detergents have a stronger cleansing action than soaps.
- Detergents are more soluble in water than soaps.

DIFFERENCE BETWEEN SOAPS AND DETERGENTS

SOAPS	DETERGENTS
• Soaps are the sodium salts of the long chain carboxylic acids.	• Detergents are the sodium salts of long chain benzene sulphonic acids.
• The action of soap is better when water is soft.	• These can be use in both in hard as well as soft water.
• Soaps are biodegradable.	• Detergents are non-biodegradable.
• More water and effort is required.	• Less water and effort is required.
• Soaps have relatively weak cleansing action.	• Detergents have a strong cleansing action.