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Cleaning action of soap

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Abstract

Aim is To investigate foaming capacity of different washing soap (i.e to find cleaning capacity of soap) and effect of addition of sodium carbonate on them. Soaps and detergents are cleaning ingredients that are able to remove oil particles from surfaces because of their unique chemical properties.

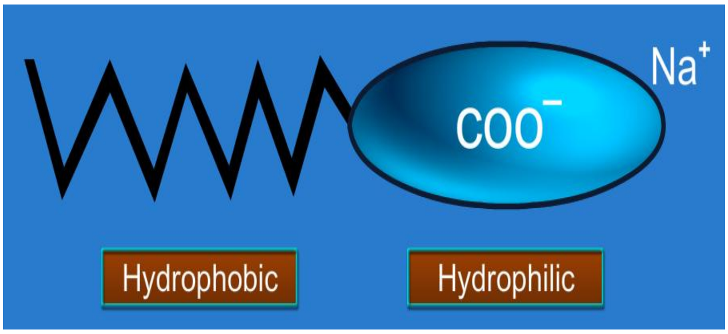
In a chemical sense soap is a salt made up of a carboxylic acid and an alkali like sodium of potassium. The cleaning action of soap and detergents is a result of thrill, ability to surround oil particles on a surface and disperse it in water.

Bar soap has been used for centuries and continues to be an important product for batching and cleaning. It is also a mild antiseptic and ingestible antidote for certain poisons. Soap is a common term for a number of related compounds used as of washing clothes or bathing. Soaps are sodium or potassium salts of higher fatty acids such as stearic acid (C17 H35 COOH), palmitic acid (C15 H31 COOH) and oleic acid (C17H35 COOH) they have the general formula RCOONa and R COONa. Soap is produced by a saponification or basic hydrolysis reaction of a fat or oil. Currently sodium carbonate or sodium hydroxide is used to neutralize the fatty acid and convert it to the salt..

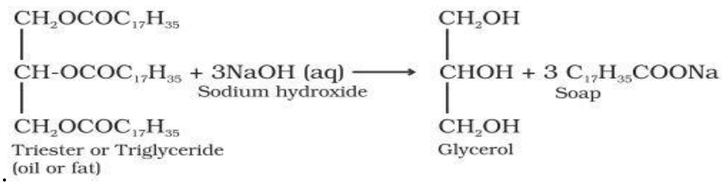
KEYWORDS- PREPARATION OF SOAP, CLEANSING ACTION, Cleaning Capacity of Soap with Hard and*Soft Water*

I. PREPARATION OF SOAP.

Soaps are sodium or potassium salts of higher fatty acids like stearic, palmitic andoleic acids can be either saturated or unsaturated. They contain a long hydrocarbon chain of about 10-20 carbon with one carboxylic acid group as the functional group.A soap molecule a tadpole shaped structure, whose ends have differentpolarities. At one end is the long hydrocarbon chain that is non-polar andhydrophobic, i.e., insoluble in water but oil soluble. At the other end is the shortpolar carboxylate ion which is hydrophilic i.e., water soluble but insoluble in oil andgrease.



When soap is shaken with water it becomes a soap solution that is colloidalin nature. Agitating it tends to concentrate the solution on the surface and causesfoaming. This helps the soap molecules make a unimolecular film on the surface ofwater and to penetrate the fabric. The long non-polar end of a soap molecule thatare hydrophobic, gravitate towards and surround the dirt (fat or oil with dustabsorbed in it). The short polar end containing the carboxylate ion, face the wateraway from the dirt. A number of soap molecules surround or encircle dirt andgrease in a clustered structure called 'micelles', which encircles such particles andemulsify them.Cleansing action of soaps decreases in hard water. Hard water containsCalcium and magnesium ions which react with sodium carbonate to produceinsoluble carbonates of higher fatty acids



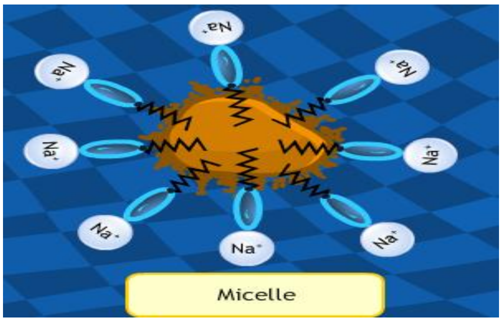
II.CLEANSING ACTION OF SOAPS AND DETERGENTS

Most of the dirt is oily in nature and oil does not dissolve in water. The molecule of soap constitutes sodium or potassium salts of long chain carboxylic acids. In the case of soaps, the carbon chain dissolves in oil and the ionic end dissolves in water. Thus the soap molecules form structures called **micelles** .In micelles, one end is towards the oil droplet and the other end which is the ionic faces outside. Therefore, it forms an emulsion in water and helps in dissolving the dirt when we wash our clothes.

Soap is a kind of molecule in which both the ends have different properties.

- Hydrophilic end
- Hydrophobic end

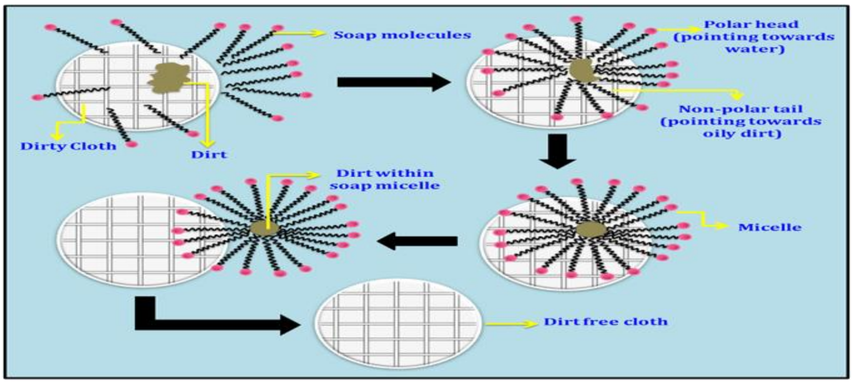
The first one is the hydrophilic end which dissolves water and is attracted towards it whereas the second one is the hydrophobic end that is dissolved in hydrocarbons and is water repulsive in nature. If on the surface of the water, soap is present then the hydrophobic tail which is not soluble in water will align along the water surface.



Micelles

In water, the soap molecule is uniquely oriented which helps to keep the hydrocarbon part outside the water. When the clusters of molecules are formed then hydrophobic tail comes at the interior of the cluster and the ionic end comes at the surface of the cluster and this formation is called micelle. When the soap is in the form of micelles then it has the ability to clean the oily dirt which gets accumulated at the center. These micelles remain as a colloidal solutions. Therefore the dirt from the cloth is easily washed away. The soap solution appears cloudy as it forms a colloidal solution which scatters light.

Read more about Soap and Detergents. We have briefly seen the properties of soaps and detergents, for any further query on this topic install Byju's the learning app and enjoy an innovative approach to learning



III. CLEANING CAPACITY OF SOAP WITH HARD AND SOFT WATER

Although soap is a good cleaning agent, its cleaning capacity is reduced when used in hard water. Hardness of water is due to the presence of sulphates, chlorides or bicarbonate salts of Ca2+ or Mg2+ ions. Soaps are sodium or potassium salts of long chain fatty acids. When soap is added to hard water, the Ca2+ and Mg2+ ions present in hard water react with soap. The sodium salts present in soaps are converted to their corresponding calcium and magnesium salts which are precipitated as scum. $Mg^{2+} + \underset{\text{Soap}}{RCOONa} \rightarrow \underset{\text{Magnesium salt(Scum)}}{RCOOMg} + 2Na^{+}$

$Ca^{2+} + \underset{\text{Soap}}{RCOONa} \rightarrow \underset{\text{Calcium salt(Scum)}}{RCOOCa} + 2Na^{+}$ The insoluble scum sticks on the clothes and so the

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cleaning capacity of soap is reduced.

The cleaning action of soap is very effective in soft water because it contains negligible calcium and magnesium ions.

Synthetic detergents are used in the case of hard water also because the calcium and magnesium salts of detergents are soluble in water. Detergents are more soluble than soaps and hence form more lather than soaps.

III. Theory

There is no quantitative method for the determination of foaming capacity of a soap. The foaming capacity of soap depends upon concentration of soap in the sample. Solution of different soap are prepared by dissolving their equal weights in equal volumes of distilled water. These solutions are shaken vigorously to produce foam and then they are allowed to stand. Time taken for the disappearance of foam are measured for different samples. Longer the time taken for the disappearance of foam in a given sample of soap, greater is its foaming capacity

IV. Materials Required:

(a) Apparatus three 100ml conical flasks, five 20ml test tubes, 100ml measuring cylinder, test tube stand, weight box and stop watch.

(b) Chemicals three different samples of soap and distilled water.

V.Procedure

1.Take three 100ml conical flasks and label them as A,B,C.

2.Take 50ml of water in each conical flask and then add 2g of different samples of soap to each flask.

3.Warm to dissolve and get a clear solution. Arrange three test tubes on a test tube stand labelled as A,B,C.

4.Take ICC of the soap solution from each conical flask ad to the corresponding test tube.

5.Shake the test tube for 1 minute by covering its mouth by the thumb.

6.Foam will be formed in the test tube. Start the stop watch and note the time taken for the disappearance of foam.

7.Repeat the same procedure for the test tubes B, C

8.Shaking each tube with the same force and noting the time taken for disappearance of the foam

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VII. **Observations:**

SI.No	Soap solution	Initial length of soap solution (cm)	Length of foam produced (cm)	Final length of soap solution (cm)
1	With distilled water (soft water in test tube A)	10 cm	7 cm	6 cm
2	With well water (hard water in test tube B)	10 cm	4 cm	8 cm
3	Distilled water with calcium chloride (very hard water in Test tube C)	10 cm	1.5 cm	9.5 cm

- take three pieces of white cloth of size 5 cm x 5 cm each.
- Put a drop of ink in the centre of each cloth by means of a dropper and allow it to dry.
- Place one piece of cloth with ink spot in the remaining soap solution in beaker A, another piece of cloth in beaker B and the third piece of cloth in beaker C.
- Leave the three beakers undisturbed for about 10 min.
- Remove the pieces of cloth from the beakers and rub each piece.
- The ink spot on the cloth in soap solution A has almost disappeared
- The ink spot on the soap cloth in soap solution B partially disappeared.
- There is no change in the colour of the ink spot on the piece of cloth dipped in soap solution C, and some scum has been deposited on the surface of the cloth piece.

Figure 1: the material requited

Figure 2: take three beakers

Figure 3 : dissolve soap solution

Figure 4 : drop the dirty cloths in beaker

Figure 5 : observation.

VIII.CONCLUSIONS:

Soap solution	Length of foam	Cleaning capability
With distilled water (soft water)	Maximum	Most cleansing capability
With well water (hard water)	Smaller length	Less cleansing capability than soft water
Distilled water with Calcium chloride (very hard water)	Minimum length	Least cleansing capability

IX.PRECAUTIONS:

- Use the same sample and same weight of soap for the beakers A, B and C.
- While stirring the soap solution, do not spill any solution out of the beaker.
- In case the soap does not dissolve completely, heat the beaker gently with constant stirring on a Bunsen flame. Place the wire gauze on the tripod stand, to ensure heating is gentle and evaporation of water is avoided. Evaporation will reduce the volume of the water.
- Carefully measure the same quantity of soap solution from the beakers A, B and C to put in the experimental test tubes A, B and C.
- Give equal number of shakes to the test tubes A, B and C in the same way, without spilling any soap solution.
- Immediately measure the length of foam produced.
- The quantity of ink put on each piece of cloth should be equal.

X.LIMITATION

Disadvantages of Soap: Formation of soap (or scum) in water containing Ca2+and Mg2+ions (hard water).The calcium and magnesium ions react with soap molecules to produce calcium and magnesium salts of fatty acids. These salts are insoluble in water and impair the surfactant properties of soap because the amount of soap available for cleaning is reduced. Soap scum is difficult to rinse away and can be visible, i.e., on fabrics, bathtubs and sinks .Poor adaptability to diversity of bars, washing temperatures and water conditions .Tendency to clog sewage systems due to their gelling properties.

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