INDUSTRIAL CHEMISTRY

CHAPTER- SOAPS AND DETERGENTS

ONLINE LECTURE

NO. 1

DATE:- 3, APRIL 2021

TIME: (10.00A.M.)

Introduction: -

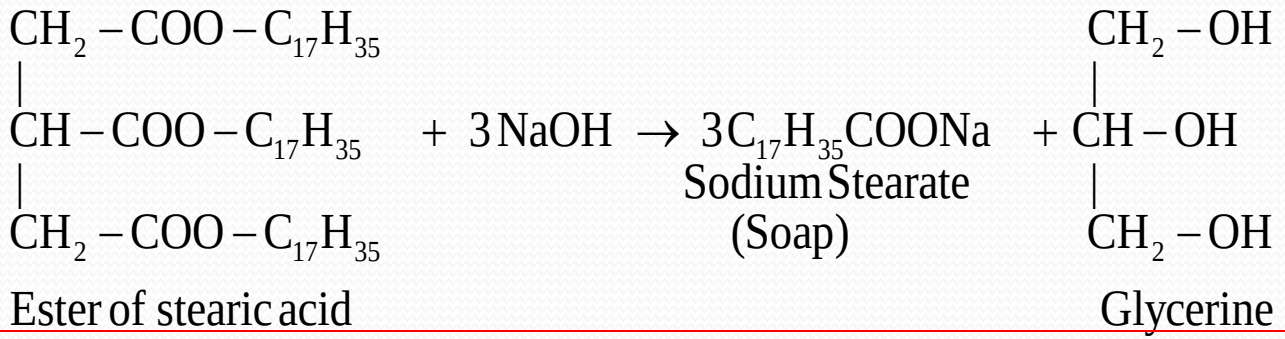
Cleaning products play an essential role in our daily lives. They help us to stay healthy, care for our homes and possessions, and make our surroundings more pleasant, by safely and effectively removing soils, germs and other contaminants. These are the products that are used for personal hygiene, cleaning floor, laundry and dish washing. They are also used as ingredients in dry cleaning solutions, antiseptic agents, lubricating oils and gasoline.

Soaps and detergents are the substances that, when dissolved in water, possess the ability to remove dirt from surfaces such as the human skin, textiles and other solids. Hence these are called as cleaning agents.

Soaps:- Soap is a mixture of chemicals used for human comforts, cleanliness and for industrial surface active applications. The soaps contain fats and oils. Ordinary soap is obtained by the action of alkali on fats, oils or free fatty acids. “Any compound formed by the reaction of a water-insoluble fatty acid with an organic base or an alkali metal may be called as soap”. Or “The sodium and potassium salts of higher fatty acids or many combinations of fatty acids such as oleic, stearic, lauric, palmitic and myristic acids having cleansing action in water are called as soaps”. Soaps are compounds of general formula $(RCOO^{-})_nM^{+n}$, where $(RCOO^{-})_n$ is a higher fatty acid residue while M^{+n} is an alkaline residue. The pH of soap is around 9-10. Sodium salts are known as hard soaps, which are moderately soluble in water and does not lather easily, while potassium salts are known as soft soaps which are fast dissolving and lathers readily. Tallow, animal fats and coconut oils are the main sources of hard soaps, while linseed oil castor oil, etc. produce soft soaps. Shaving creams, liquids soaps are soft soaps, while other types are hard soaps.

Now a day's numbers of types of soaps are available like laundry soap, toilet soap detergent powder, cheap and flake soaps, soap bars, deodourant soaps, liquid soaps, creams, shampoos, paste etc are used as the cleaning agents. But the basic principle of making all kind of soaps is the same i.e. the combination of higher fatty acids with sodium or potassium hydroxide or carbonate.

Soap is made by the action of a hot caustic soda solution on fatty oils, refined tallows and greases, with the simultaneous formation of glycerine. This process of hydrolysis of esters by alkali is known as saponification e.g.



Soap also contains filling materials, germicides perfumes, dyes, etc. The usual fats and oils are not composed of the glyceride of any one fatty acid, but a mixture of fatty acids.

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ONLINE LECTURE

NO. 2

DATE:- 5, APRIL 2021

TIME: (10.00A.M.)

Raw materials used in soap manufacture:

•Source of glycerides: -

The fats and oils required for manufacturing of soaps are extracted from the plants and animals.

A] Animal oils and fats: -

i) Tallow (Beef and mutton): Tallow is the main fatty material used in the soap making. It is derived from the fat of cow, oxes, sheep, goat and other animals.

It is a low melting (40-50^{o}C) animal fat and is obtained by digesting solid animal fat with steam. It contains mixed glycerides and essentially consists of olein (40%) and stearin (60%). It is usually mixed with coconut oil to reduce the hardness and to increase the solubility of the soap.

ii) Grease of lard: It is a low grade tallow and is softer than tallow. These are obtained from hogs and smaller domestic animals. It is a soft fat like butter and consists mainly of olein (60%) and stearin (40%). These are used after refining.

B] Vegetable oils and fats: -

Amongst oils, coconut oil, palm oil, linseed oil, lower grades olive oil, castor oil and cottonseed oil are the most commonly used oils for soap making.

2. Alkaline materials: -

The alkaline materials such as caustic soda (NaOH), caustic potash (KOH), Na_2CO_3, NH_4OH and ethanolamines can be used. But the most commonly used alkali is caustic soda. It is available in the form of flakes, blocks and sticks as well as in solutions of various strengths.

3. Common Salt (NaCl): - It is used for salting out of soap.

4.Other additives: i) Rosin: Rosin is a plant product obtained from pine trees which mainly contains abietic acid. Rosin makes lather formation faster, increases the cleansing action of soap and also in the softening of hard soaps.

ii) Builders or Binding materials: The cleansing capacity of ordinary soaps increases by adding certain binding materials such as sodium silicate (5%) soda ash (Na_2CO_3) trisodium phosphate and borax. The binding materials improves soap texture, correct alkalinity of the soap solution and prevent the formation of precipitates in hard water.

iii) Fillers: The weight of soap is increased by adding certain fillers such as talc, starch, Glauber's salt, pearl ash, clay etc. without affecting the detergency.

iv) Colouring matters: The colouring matter should be inert to alkali used in making of soap, should not separate out on cooling the blended soaps, should not hinder in any way the fragrance of the soap and should reproduce the natural shade. Organic dyes and inorganic pigments are generally used e.g. methyl violet (for violet shade), Rhodamine or Safframine (for red), ZnO (for white), chrome green (for green), cadmium yellow (for yellow), ultramarine blue (for blue), eosin (for pink), etc.

v) Perfumes: The essential oils known as perfumes give fragrance to the soap to attract the customer. Perfumes may be natural or synthetic. Examples of natural perfumes are sandal wood oil, lemon grass oil, clove oil eucalyptus oil, lavender oil, cinnamon oil etc. Examples of synthetic perfumes are jasmine (Benzyl acetate) rose (phenyl ethyl alcohol), lilac (terpeneol) and musk (benzoate).

vi) Anti-oxidants: Soap is susceptible to rancidity. Antioxidants when mixed in soaps are very effective in preventing rancidity. Examples of anti-oxidants are sodium hyposulphite ($Na_2S_2O_4 \cdot 2H_2O$), sodium thiosulphate and EDTA.

vii) Superfatting agents: These are added to prevent the skin from becoming rough and dry. They improve gloss and texture of soap, help in steady lather formation and also prevent cracks on soap when dry.

viii) Germicides: Sulphur is added as a cure for dandruff and pimples, mercuric iodide is added as a germicide in mercury soaps, hexachlorophene as an effective germicide against skin microorganisms.

ix) Optical Brighteners: Basically these are fluorescent compounds which absorb uv radiations from the incident rays of the sun and emit visible radiations. These give an effect of increased whiteness. e.g. phenyl benzo thiazole and benzo coumarin.

x) Disinfectants: Extracts of various plants such as neem, eucalyptus, chaulmoogra etc. are added as disinfectants.

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NO. 3

DATE:- 6, APRIL 2021

TIME: (3.00P.M.)

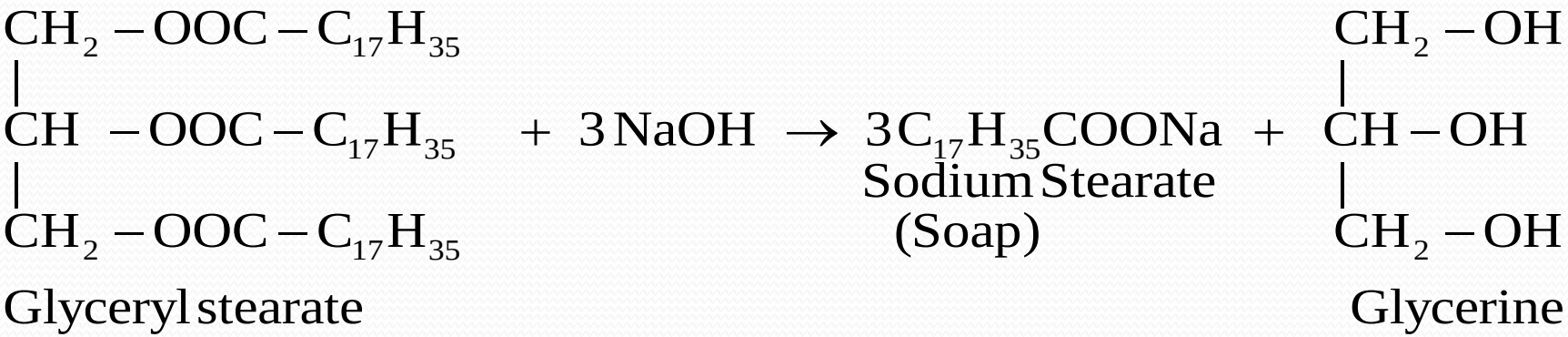
•Manufacture of soaps: (Ittner's process)

(Continuous alkaline saponification):

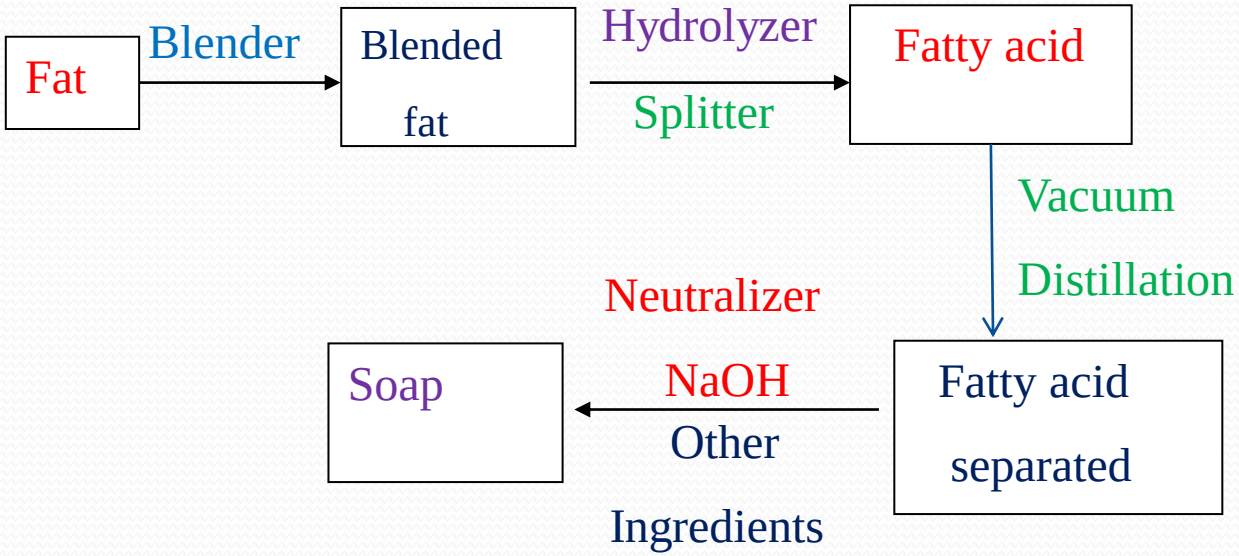
•Raw materials: Tallow, greases, vegetable oils and fats, alkali, additives, ZnO catalyst, etc.

•Principle: The fat is split or hydrolyzed with high pressure steam to yield crude fatty acids, which are then purified by distillation and separated from glycerin. The purified fatty acids are neutralized with caustic soda solution to produce soap.

C) Chemical reaction:



Flowsheet:


Fat
Blender
Blended fat
Hydrolyzer
Splitter
Fatty acid
Vacuum Distillation
Fatty acid separated
Neutralizer
NaOH
Other Ingredients
Soap

E) Process:

1) Fat splitting: The fat from animal or vegetable sources is degenerated under a vacuum to prevent darkening by oxidation during processing. The fat is then blended with a catalyst ZnO and heated with steam in a blend tank. The mixture of hot molten fat and catalyst is introduced at the bottom of hydrolyzer. The hydrolyzer is 20 m high and built up of stainless steel. It is fitted with steam coils through which steam is passed for heating the charge. It's inside temperature is 250^{o}C and pressure is 40 atm. Hot water is introduced from top of hydrolyzer. Splitting of fat takes place in the hydrolyzer and the fat globule rising against a descending aqueous phase. The glycerin dissolves in water and separated at the bottom, while the liberated crude fatty acids are discharged from the top of hydrolyzer to a flash tank, where the water is separated.

2. Purification of fatty acids: The composition of fatty acid depends on the types of fat or oils used. The fatty acid is then purified in high vacuum still by fractional distillation. The high boiling long chain fatty acids are removed from the bottom of the still. They are either recirculated for splitting or are removed as pitch, while the purified and rectified low boiling fatty acids are recovered by condensation.

3. Neutralization: The purified fatty acid is then pumped to neutralizer, fitted with a high speed mixer, where fatty acids are neutralized by a 50% solution of caustic soda. The neat soap is discharged at 150^{o}C into a slowly agitated blending tank. In blending tank, additives, preservatives, germicides, colour, perfumes and builders etc. are added and mixed thoroughly to complete the neutralization. The neat soap is then sent to finishing.

4. Finishing:

The neat soap contains NaOH, NaCl and water. The pressure on this neat soap is raised to about 35 atm and the temperature is kept at 200^{o}C. The hot soap is released to the flash tank at 1 atm pressure. A partial drying takes place because the soap is well above its boiling point. Desired amount of air is mixed with this viscous pasty soap and is cooled to about 65^{o}C. At this temperature, the soap get slightly solidified and taken out in the form of strip which is then cut, cooled, stamped and wrapped. It is thus ready for marketing. The solid soap thus obtained contains about 70% soap, 30% water and 0.2 – 5% NaCl. The entire procedure requires 6 hours.

•Cleansing action of soap:

The cleaning process of any surface by soap involves following steps:

1) The surface to be cleaned is made wet with water.

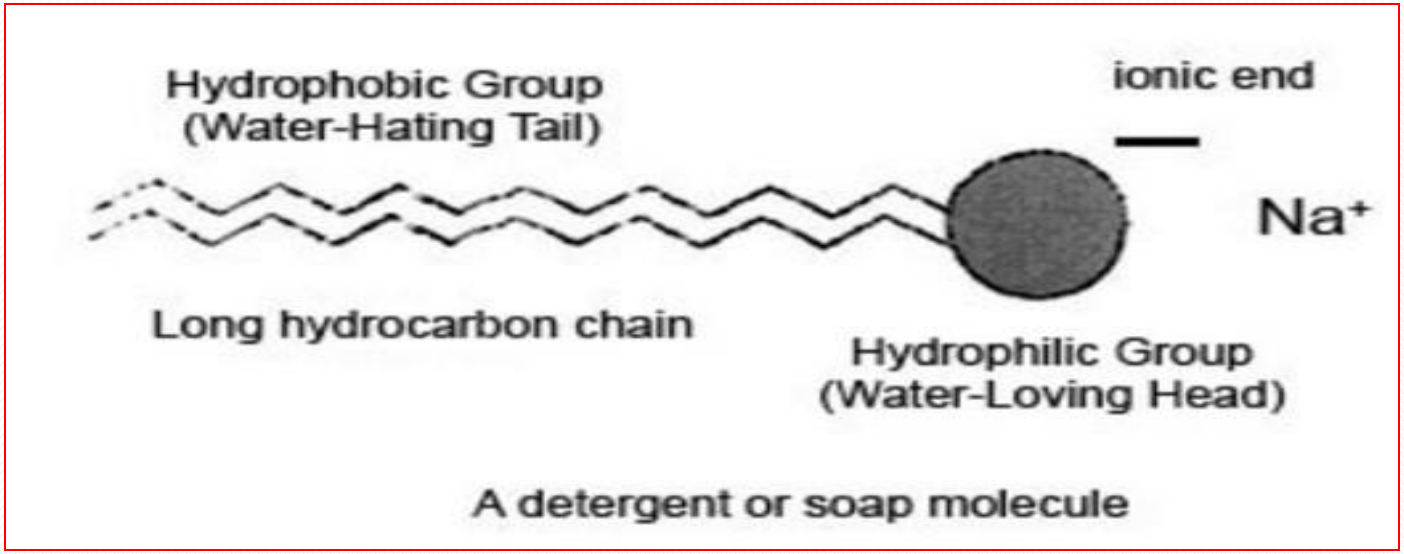
2) Soap or detergent is applied to the surface to be absorbed.

3) Soap removes dirt particles from the surface, prevents the redeposition of dirt and brings them in water layer which can be removed with water by squeezing or rinsing from the surface.

In these steps, the following mechanism is observed:

•Formation of emulsion: Soap is represented by a general formula $R\,COO^{-}\,Na^{+}$

where 'R' represents a long chain alkyl radical which is water insoluble but oil soluble and is known as a hydrophobic (water hating) group. The negative carboxylate ion ($-COO^{-}$), is molecule water soluble and is known as a hydrophilic (water loving) group. The molecule containing both the hydrophilic and hydrophobic groups in the same molecule, are called as amphiphilic or amphipathic molecules.



A detergent or soap molecule

When oil and water are shaken together an emulsion is formed. When soap molecule comes in contact with an oil drop, it orients itself in such a way that, its hydrophobic end dissolves in the oil. The oil drop thus gets charges on its surface. These charges being similar tend to keep the oil drops away from each other due to repulsion. The oil thus cannot form a layer, but the greater tendency of the hydrophil (Charged oil drops) to dissolve in water will drag the tiny oil droplets in water. Thus an emulsion of oil in water is formed.

b) Wetting action: In an emulsion, the hydrocarbon chains (R) of soap are attracted towards the oil while, the COO- groups are attracted towards water and the interfacial tension between oil and water is lowered. Such substances which concentrate at the interface between water and hydrophobic surface and lower the surface tension between the two are known as wetting agents. This property helps the soap solution to wet a fabric more readily than water itself and the ability to wet is the basic requirement of any soap.

c) Cleansing action: When greasy dirty clothes are washed with the soap solution, the soap lowers the interfacial tension between the greasy spots and the solution. As a result of this, the soap solution spreads over the fibres and displaces the greasy dirt in suspension in the foam produced and does not allow it to redeposit on the fabric, which is finally washed away by squeezing and rinsing in water.

Thus the cleansing action of soap is due to the properties –

i) It emulsifies oils and fats.

ii) It lowers surface tension of water and

iii) It avoids redeposition of dirt particles by forming protective film on fabric.

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NO. 4

DATE:- 12, APRIL 2021

TIME: (10.00A.M.)

•Classification of Soaps: -

1. Toilet Soaps: -

These are very rich in sodium oleate. Their manufacture requires purest, whitest and least odorless fats and oils. They are usually made from mixture of tallow and coconut oil in the ratio of 80:20 or 90:10. They are neutral and contains about 10-15% water with small amount of perfume and dye. They may contain small percent of TiO_2 as a whitening agent.

2. Laundry (washing) soaps: -

These are prepared from tallow, rosin grease, palm oil etc. Its water content varies from 5 to 15%. The filling agents or inorganic builders include sodium silicate, carbonate, phosphate, borates and soda ash are added as additives. These are used for washing clothes in the form of soap powders, bars, chips, flakes and spray dried soap powders.

3. Transparent soaps: -

These are prepared by dissolving soap in methylated spirit, filtering and distilling off the alcohol. Addition of alcohol, sugar, glycerine or caster oil to the hot soap inhibits the crystal growth during cooling and yields a glassy or transparent soap. The glycerin in this soap acts as a skin conditioner and maintains a thin film of moisture on the skin, so as to keep it smooth and flexible.

4. Medicated or deodourant soaps: -

These soaps contain small quantities of antibacterial or disinfecting agents. These agents are effective in suppressing the growth of gram-positive skin bacteria responsible for body odour, even at very low concentrations.

These agents are added during milling process. Deodourant soaps contain an agent such as 3, 4, 5 – tribromosalicylanilide (TBS) which prevents the decomposition of perspiration into odourous compounds.

5. Shaving soaps and creams: -

These are prepared by saponifying a mixture of best quality tallow and Cochin coconut oil with caustic potash and soda. Shaving soap contains a considerable proportion of potassium soap and an excess of stearic acid, the combination giving a slower drying lather. Small amount of white paraffin and glycerine are added during milling process to improve soothing and emollient properties. This soap is perfectly neutral in order to prevent irritation.

Shaving creams are formulated by saponifying a mixture of Cochin coconut oil and stearic acid with mixed solution of caustic potash and soda. About 5-10% glycerol is added and 4-8% stearic acid is left unneutralized to have the pearly creamy and lasting lather. The brushless shaving creams contain stearic acid and fats with much less soap.

Shaving soaps and creams may contain antiseptics and menthol.

6. Scouring soaps and cleansing powders: -

These soaps contain one or more finely powdered insoluble abrasive materials (e.g. talc, quartz, sand pumice, china clay, feldspar, kieselguhr etc.) in addition to the filling agents (e.g. sodium silicate, Na_2CO_3, trisodium phosphate sodium borate, etc.). These soaps ate used for cleaning of mechanics hand, pots, floor tiles, walls, dishes, sanitary wares, kitchen wares, reactor vessels, tanks, etc. These scouring soaps are used in textile industry for scouring raw wool.

7. Liquid soaps and shampoos: -

These soap products are made with the more soluble potassium, triethanol amine or NH_3 soaps of coconut, olive oil. Liquid soap is generally prepared by coconut oil, caustic potash (24%) borax, glycerine, sugar and water.

8. Floating soaps: -

These soaps are made by bubbling air through the melted neat soap until the amount of air incorporated increases its volume to such an extent that the solid soap becomes lighter than water. It contains about 30% water.

9. Other soaps (Non-alkali metal soaps): -

Instead of alkali metals (Na and K) these contain either Ca, Al, Pb, Zn, Mg, Co, etc. to form soaps with fatty acids. Their solubility in water is very low. Similarly, NH_3 and alkanolamine are used to neutralize fatty acids to form such soaps. These soaps are not used as a cleaning agent but used for other purposes like water proofing agent, lubricants, in paints, printing ink, furniture, automobiles, floor polishes, ointments etc.

INDUSTRIAL CHEMISTRY

CHAPTER- SOAPS AND DETERGENTS

ONLINE LECTURE

NO. 5

DATE:- 15, APRIL 2021

TIME: (10.00A.M.)

•Detergents: -

A detergent is a cleansing agent. Soaps are made from natural ingredients, such as plant oils (coconut, vegetable, palm, pine) or acids derived from animal fat. But, detergents, on the other hand, are synthetic, man-made derivatives. In general, the term synthetic detergents (or syndets or tensides) is used to indicate a synthetic material which are used for cleaning and usually does not include soap. Hence detergents are synthetic cleaning compounds. Detergents are soap substitute products used to fulfill short supply of soap. The shortage of oil and fat for the manufacture of soap was controlled by producing detergents. A large amount of edible oils and fats, which is being consumed in the manufacture of soap, has now become available for human consumption by the introduction of soapless detergents.

The most important advantages of the synthetic detergents are their power to lower surface tension of water, property of emulsifying oils and fats, better wetting and cleansing action and no consumption of hard water. Because of higher solubility of their Ca^{+2} and Mg^{+2} ions, they are soluble in hard water. This solubility is attributed to the fact that the sulphonate group does not attach itself to the ions present in hard water.

The cleaning property of soaps much depends on the hardness of the water which contains harmful minerals. Hence we make use of surfactants. The detergent surfactants are much better solutions for the cleaning purpose as the hardness of water does not affect them.

A detergent may be regarded as a chemical formulation which essentially consists of surface active agents or surfactants and subsidiary constituents such as fillers, boosters, builders etc. Detergents are the potassium or sodium salts of a long alkyl chain ending with a sulphonate group. The detergent may be in the form of solid, liquid, paste or powder. Hence, surfactants, suds regulators and additives make up the basic detergent formulation. Detergents are not used for bathing because they contain abrasives. Repeatedly bathing with detergent will cause the skin to dry up and crack.

Detergents find extensive use, not only as detergent substitutes for soaps, but also as wetting agents in dyeing to increase the effectiveness of insecticide spray and for many other purposes.

Principal groups of synthetic detergents: -

Detergents have two distinct groupings in their molecular structure:

1. A hydrophilic or water loving group that makes the compound soluble in water.
2. A hydrophobic or water hating group that makes the compound soluble in oil.

When detergent is added to water containing some non-aqueous material, such as oil, the molecule of the surface active agent orient themselves in such a manner that the hydrophilic or water loving groups project in water while the hydrophobic or water hating groups dissolves in the oil. As a result, interfacial tension between water and oil is reduced and an emulsion is produced, when such a mixture is shaken.

In many cases, the hydrophilic group is generally introduced synthetically to a hydrophobic material, so as to produce a compound that is soluble in water e.g. Lauryl alcohol (dodecanol, $C_{11}H_{23}CH_2OH$) is practically insoluble in water, but, when it is sulphonated, the resulting product $C_{11}H_{23}CH_2O{\cdot}SO_3$ is soluble in water in all proportions. The alkali salt $C_{11}H_{23}CH_2O{\cdot}SO_3Na$ of it is a good detergent.

It should however, be noted that the formation of detergent does not depend upon the solubility, but on the ratio of the molecular weight of the hydrophobic to that of hydrophilic part of the molecule. e.g. Detergent formed by the action of 10 molecules of ethylene oxide on lauryl alcohol is soluble in water and is a good detergent, but the same compound formed by the action of 5 molecules of ethylene oxide on lauryl alcohol is neither soluble in water nor a good detergent.

Surfactants and its importance: -

"Substances which lower the surface tension of water or affects interfacial tension between two liquids are known as surfactants or surface active substances".

The cleaning action of surfactant depends upon its surface activity. It is a property which decreases the tension at the boundary surface between two phases of matter which may be liquid–gas or liquid-liquid. Surface active substances, when dissolved in water or dispersed in liquid, wash a surface clean by removing oil, in which dust particles are dispersed. The modern concept of surfactants includes soaps, detergents, emulsifiers, wetting agents and penetrants.

Surfactants have allowed the investigation of molecular properties of membrane proteins and lipoproteins acting as solubilizing agents and as probes for hydrophobic binding sites, contribution in purification of receptors in their active forms in biochemistry, such as the neuropeptide receptors and opiate receptors, in electrophoresis, in HPLC and in analytical chemistry.

•Detergent builders: -

Detergents are never used in pure form. Several other substances are added before the detergents are marketed. Builders are basically water softeners; they prevent the redeposition of soil, provide desirable level of alkalinity and improve the wetting and emulsification characteristics. Hence, these substances improve the qualities of detergents and boost the detergent power. These substances are called “builders” which may be inorganic or organic. The surfactants are very expensive as compared to builders. Hence, the addition of these inorganic builders into synthetic detergent lowers the cost of the resulting product without affecting its wetting and detergent activities. By adding these builders, it is possible to obtain free flowing powder from liquid or low melting surfactants.

1. Sodium sulphate: - It is used to improve the surface activity of the detergent. It also dehydrates the synthetic detergent to give dry free flowing powders. The surfactants prepared by sulphonation or sulphitation processes always contain with it Na_2SO_4 and Na_2SO_3 to less or more extent.

2. Sodium silicate: - It is generally used as filler (diluents). The presence of silicate is quite helpful in softening hard water by forming precipitates which do not deposit on the fiber but are readily washed away. It has also wetting and emulsifying properties and is generally added to the dish-washing detergent powders. It also functions as corrosive inhibitors.

3. Sodium phosphates: - These include sodium tripolyphosphates ($Na_5P_3O_{10}$) and tetra sodium pyrophosphate. Their functions are water softening, adjustment of pH, suspending of soil and removal of water from the detergent and accepting it as water of crystallization to yield a free flowing powder.

$$Na_5P_3O_{10} + 6H_2O \longrightarrow Na_5P_3O_{10}\cdot 6H_2O$$

Sodium tripolyphosphate

Sodium tripolyphosphate hexahydrate

The polyphosphates, sequester the water hardening Ca^{+2} and Mg^{+2} ions as-

$$(Na_2)^{+2}(Na_2P_2O_7)^{-2} + Mg^{+2} \longrightarrow (Na_2)^{+2}(MgP_2O_7)^{-2} + Na^{+}$$

They prevent redeposition of soil from the wash water on fabrics. The growth of algae and eutrophication in lakes is due to the presence of phosphates in detergents. So, there is restriction to use phosphates in detergents. Again due to increased growth of algae, there is decrease in dissolved oxygen content in water, which is harmful to aquatic life.

4. Carbonates: - Soda ash (Na_2CO_3), $NaHCO_3$, sodium sequi-carbonate (Na_2CO_3, $NaHCO_3\cdot 2H_2O$) and K_2CO_3 are used. The most used is soda ash which provides high alkalinity and softens hard water by precipitating Ca and Mg carbonates.

5. Other builders: - NTA (Nitrolo-triacetic acid), citrate and zeolite are the substitutes for phosphates.

•Detergent additives: - Additives improve the detergent power by –

i) Wetting and emulsifying.

ii) Abrasive.

iii) Alter or decompose the composition of soil and render the particles more easily removable.

iv) Antiredeposition agency.

•Additives are: -

1. CMC (Carboxy Methyl Cellulose): - It is used as an antiredeposition agent. It has the ability to suspend and prevent redeposition of soil on the washed garments. PVP (Polyvinyl pyrrolidine) is also used for similar purpose.

2. Benzotriazole: - Tarnish inhibitor, carry on the work of the corrosion inhibitor and extend protection to metals such as German silver.

3. Bluings (ultramarine blue): - Improve the whiteness of fabrics by counter-acting the natural yellowish tendency.

4. Enzymes: - These are useful in removing stains, particularly those of a protein nature. Enzymes added are generally proteolytic and amolytic enzymes. The enzymes decompose or alter the composition of soil and separate the particles more easily removable.

5. Opacifying agents: - Shelf stable creamy liquid detergents can be prepared by adding water stable compounds. They opacifies and increases viscosity. e.g NH_3 or other water soluble salts of hydrolyzed copolymer of styrene and maleic anhydride.

6. Hydrotopes: - These are added to liquid detergents. Their function is to "drive" the detergents and builders into solution to effect a solubilising action. e.g. Methyl ethyl or propyl benzene sulphonates.

7. Optical brighteners: - These are added to all washing powders. These are not bleachers but are dyestuffs which are absorbed by textile fibres from solution and are not removed on rinsing. These are fabric brighteners, which make fabrics look brighter because of their ability to convert uv light to visible light by absorbing light on the washed garments. These are derivatives of stilbene or coumarin.

8. Sodium perborate ($NaBO_3 \cdot 4H_2O$): - It is added to bring about slow bleaching because it releases oxygen.

$$NaBO_3 \cdot 4H_2O + H_2O \longrightarrow NaBO_2 + H_2O_2 + 4H_2O$$

$$2H_2O_2 \longrightarrow 2H_2O + O_2$$

9. Antimicrobial agents: - These includes carbanilides, salicylanilides etc.

10. Miscellaneous compounds: - Many other inorganic substances like borax, NaCl, $MgSO_4$ certain insoluble inorganic fillers like silica, quartz, marble dust, kieselguhr etc. are used purely as an abrasive in some detergent soaps.

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ONLINE LECTURE

NO. 6

DATE:- 17, APRIL 2021

TIME: (10.00A.M.)

•Comparison between soaps and detergents: -

Deference between soap and detergents:

1. Detergents differ from soap in their action in hard water. Soaps form insoluble compounds with the Ca and Mg ions present in hard water. These insoluble compounds precipitate out and reduce foaming and cleaning action. Thus, soap gets wasted in hard water.

Detergent may react with the hard water ions, but the resulting products are either soluble or remain colloidally dispersed in the water.

2. Soap-making involves the use of oils and fats which have potential food values. While, the surfactants required for synthetic detergents are made from petroleum products.

3. Soap is biodegradable, so do not cause appreciable water pollution. While, the biohard detergents and phosphates from the detergents, causes considerable water pollution problems.

Distinguish between soaps and detergents: -

Soaps	Detergents
1) These consists of a '-COONa' group attached to a fatty acid having a long alkyl chain.	1) These consists of a 'SO_3Na' group attached to a long alkyl chain.
2) These are derived from natural sources such as vegetable oils and animal fats.	2) These are synthetic derivatives.
3) These are completely biodegradable.	3) These are non-biodegradable.
4) These are not effective in hard water.	4) These are effective in hard water also.
5) These forms scum in hard water.	5) These do not forms scum in hard water.
6) Soaps are eco-friendly products.	6) Detergents can form thick foam which is harmful to aquatic life.

•Advantages of soaps over detergents: -

1. It has negligible toxic effects.

2. It is biodegradable and does not cause pollution.

3. It can be partially recovered, if large amounts are used.

4. It makes antibacterial agents effective.

5. It does not require addition of soil suspending agents.

•Advantages of detergents over soaps: -

1. It is more active than soap in comparatively low concentration.

2. Detergents can be used in hard water and in textile processing industry. But soaps dissolve in water and get hydrolyzed, giving an alkaline solution. Thus soaps are unsuitable for washing fabrics dyed with alkali sensitive dyes.

3. Detergents can be used for washing delicate fibres like knitted wool or silk.

4. It is excellent foaming agent.

5. It has germicidal and bactericidal properties.

6. A large amount of edible oils and fats are consumed in the manufacture of soaps, but these are now available for human consumption by the introduction of detergents.

7. The most important advantage of the synthetic detergent is better wetting and cleansing action and no consumption by hard water, because of higher solubility of their Ca^{+2} and Mg^{+2} ions.

Thank You.

STAY HOME,
STAY SAFE