

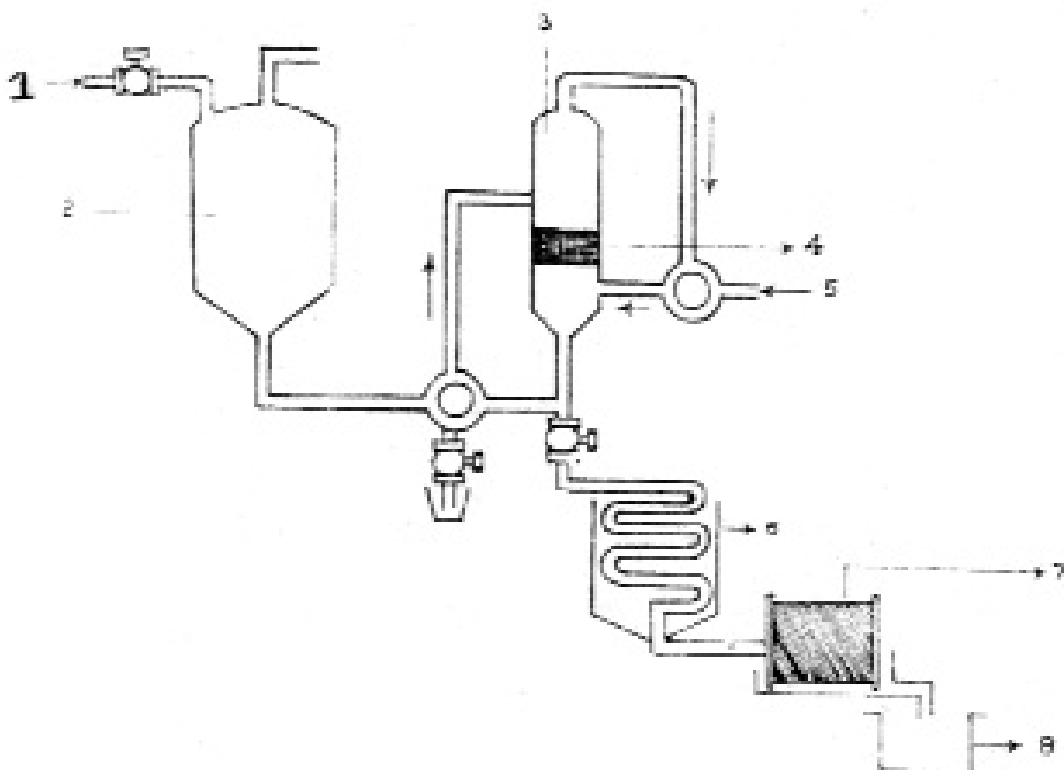
# OILS AND FATS

## Important points to keep remember:

1. Oils and Fats are tri esters of glycerol and fatty acids.
2. Lauric and stearic acids are the saturated fatty acids. Lauric acid  $\rightarrow C_{11}H_{23}COOH$ .  
Stearic acid  $\rightarrow C_{17}H_{35}COOH$ .  
Sources of Lauric acid  $\rightarrow$  coconut oil and Butter  
sources of stearic acid  $\rightarrow$  Animals fat and Butter.
3. Oleic acid ( $C_{17}H_{33}COOH$ ) and Linoleic acid ( $C_{17}H_{29}COOH$ ) are the unsaturated fatty acids.  
Sources of oleic acid  $\rightarrow$  Butter, cotton seed oil, soya beans  
sources of Linoleic acid  $\rightarrow$  Lin seed.
4. Fats are prepared by the hydrogenation of oils in the presence of 'nickel' catalyst  
$$H_2O + \underset{\text{unsaturated}}{\text{Oil}} \xrightarrow{\text{Ni}} \underset{\text{(saturated)}}{\text{Fat}}$$
5. Soaps are salts of fatty acids.
6. Chemically detergents are sodium salts of alkyl benzene sulphonates or fatty alcohol sulphates.

## 5 Marks Questions

1. Draw the neat sketch of hydrogenation of oils and label the parts.



1. Unhydrogenated Oils; 2. Bioler; 3. Convector;
4. Catalyst; 5. Hydrogen;
6. Coolant; 7. Filter; 8. Hydrogenated Oil.

## 4 Marks Questions

### 1. How is soap industrially manufactured?

(June 2008)

- Soap is manufactured from coconut, palm cotton seed, soya bean oils or animal fats. This process includes three steps.
  - a) Hydrolysis of fat into fatty acids.
  - b) Separation of fatty acids and
  - c) Neutralization of fatty acids by bases.

#### a. Hydrolysis of fat into fatty acids:

1. Oil or Fat is taken on a stainless steel trough.
2. Catalyst like zinc oxide or calcium oxide or magnesium oxide is added to Oil or Fat. The mixture is heated to 240-250°C and a pressure of 4.1 mpa is applied. The mixture is blended by steam.
3. The hydrolysis carried for 2-3 hours by passing water stream. Mixture of fatty acids and glycerol are obtained. Glycerol is removed by distillation.

#### b. Separation of Fatty acids:

1. Mixture of fatty acids are dried and subjected to fractional distillation so as to separate the mixture. The quality of a soap depends upon the composition of fatty acids in the mixture.
2. The soap maker chooses the required fatty acids and then mixes in the required proportion according to the properties designed.
3. Neutralization of fatty acids by bases.  
The soap is then prepared by continuous neutralization of fatty acids with bases like KOH,  $Mg(OH)_2$ ,  $Ca(OH)_2$ , triethanolamine etc.

### 2. How is detergent industrially manufactured?

(March 06, 02, 00)

- Chemically detergents are sodium salts of alkyl benzene sulphonates or fatty alcohol sulphates. Preparation of detergents is carried out by three steps.

**Step 1:** Oleum is reacted with either Alkyl benzene or fatty alcohol to get ABS or FAS.

Alkyl benzene + Oleic acid  $\rightarrow$  Alkyl benzene sulphonate (ABS)

(or)

Fatty alcohol + Oleic acid - fatty alcohol sulphate (FAS)

**Step 2:** ABS or FAS is treated with NaOH to get their respective salts.

ABS (or) FAS + NaOH  $\rightarrow$  Sodium salt of ABS or FAS

**Step 3:** Sodium salts of ABS or FAS is made to react with builders to produce detergents.

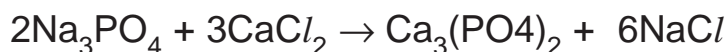
Sodium salts of ABS or FAS + builders  $\rightarrow$  Detergents.

### 3. How do you test the quality of a soap?

(April 08, June 07, 06, March 07, 05, 02, 01, Oct 99)

1. Dissolve 1.5 grams of soap in 100 ml of distilled or soft water. Take 10 ml of this soap solution in a boiling tube.
2. Close the boiling tube with a rubber stopper and shake it vigorously for 15 seconds. Allow the solution to stand for 30 seconds observe the level of foam.

3. perform the same kind of experiment on different kinds of soaps available in the market.
4. A good soap is that which gives the largest lather or of greatest height.
5. Add 4 drops of 40%  $\text{CaCl}_2$  solution and observe the foam level after shaking for 15 seconds and allowing it to settle for 30 seconds. Add one gram of  $\text{Na}_3\text{PO}_4$  to this solution.
6. Shake for 15 seconds and allow it to stand for 30 seconds. Observe the foam level.
7. Upon addition of  $\text{CaCl}_2$  the foam level decreases because  $\text{Ca}^{2+}$  is hard water ion.
8. Addition of  $\text{Na}_3\text{PO}_4$  again increases the foam level because  $\text{Na}_3\text{PO}_4$  removes the  $\text{Ca}^{2+}$  ions.



#### 4. Write the uses of soaps?

- a. A soap of  $\text{K}^+$  salt of fatty acid is used as a toilet soap.
- b. A soap of  $\text{Na}^+$  salt of fatty acid is used as laundry soap.
- c. A soap of  $\text{Ca}^{2+}$  or  $\text{Al}^{3+}$  fatty acids is used in water proof texture.
- d. A soap of  $\text{Mg}^{2+}$  fatty acid is used as face powder.
- e. A soap of  $\text{Li}^+$  salt is used as grease.
- f. A soap of Triethanol ammonium salt of fatty acids is used in dry-cleaning and cosmetics.

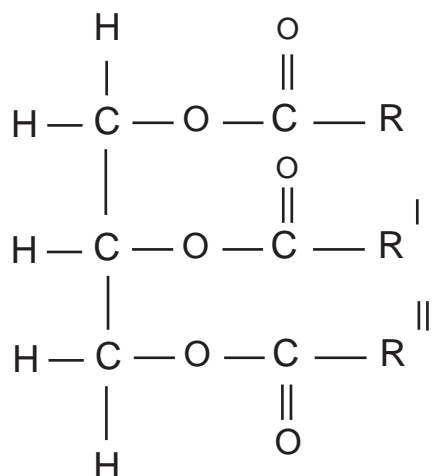
#### 5. Write the comparison of steps involved in the manufacture of soap and detergents (or)

What are the differences in the manufacturing of soap and detergent  
(March 08, 99)

SOAP	DETERGENT
1. Fat + $\text{H}_2\text{O}$ → Fatty acid (FA) + Glycerol	1. Alkyl Benzene + Oleum → alkyl benzene sulphonate (ABS)  Fatty alcohol + Oleum → fatty alcohol sulphate (FAS).
2. FA + NaOH → Sodium Salt of FA	2. ABS or FAS + NaOH → Sodium Salt of ABS or FAS
3. Sodium salt at FA + builders → Soap	3. Sodium salt of ABS or FAS + builders etc → detergent

## 2 Marks Questions

### 1. Write the chemical formula of Oil / Fat?



- R, R', R'' = Long chain alkyl or alkenyl groups

### 2. Name four fatty acids. (March 2009 Under match the following)

1. Lauric Acid -  $\text{C}_{11}\text{H}_{23}\text{COOH}$  (Saturated)
2. Stearic Acid -  $\text{C}_{17}\text{H}_{35}\text{COOH}$  (Saturated)
3. Oleic Acid -  $\text{C}_{17}\text{H}_{33}\text{COOH}$  (unsaturated)
4. Linoleic Acid -  $\text{C}_{17}\text{H}_{31}\text{COOH}$  (unsaturated)

### 3. Write the industrial uses of oils

(June 2001)

- industrial uses of oils

Fat or Oil	Industrial Oil
1. Animal Fat	1. Soaps, Paints, varnishes and fatty acids
2. Coconut Oil	2. Fatty alcohols, soaps and detergents
3. Linseed Oil	3. Paints, Varnishes and floor coverings
4. Soya bean Oil	4. Pains, varnishes and floor coverings
5. Castor Oil	5. Protective coating and plastics
6. Tall Oil	6. Soaps, leather, paints, and ink

#### 4. Distinguish between a soap and a detergent

(March 1999)

Soap	Detergent
1. Chemically soap is a sodium or potassium salt of fatty acids.	1. Chemically detergents are sodium salts of alkyl benzene sulphates or fatty alcohol sulphates.
2. It doesn't give lather with hard water	2. It gives lather with hard water also.
3. Cleaning action is less	3. Cleaning action is more
4. $C_{17}H_{33}COONa$	4. $C_{11}H_{23}SO_3Na$

#### 1 Marks Questions

##### 1. Why do shaving soaps give slow drying lather?

(March 2000)

- Shaving soap contains considerable proportion of potassium soap and excess of stearic acid giving slow drying lather soap.

##### 2. Name the catalyst used in the hydrogenation of oils?

- Nickel

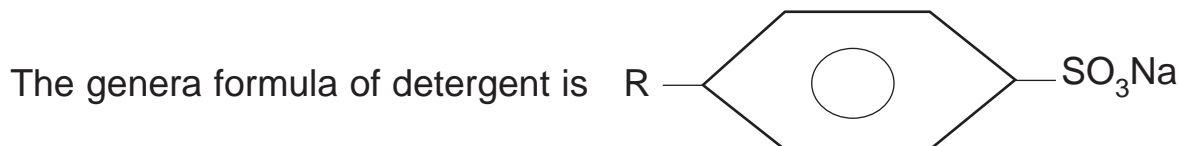
##### 3. What is saponification?

(June 2005, March 2002)

- Soaps can be directly obtained from oils or fats by hydrolysis in the presence of a base. This process is called saponification of oils.

##### 4. Write the general formula of soap and detergent?

- The general formula of soap is  $RCOONa$  (or)  $RCOOK$   
Where R = long chain alkyl or alkenyl.  
Where R = long chain alkyl or alkenyl.



##### 5. What is soap?

(March 2007, 2002)

- Chemically soap is sodium or potassium salt of fatty acids of long carbon chains.

##### 6. What are the advantages of hydrogenation of Oil?

(March 09, 04, June 2003)

- Hydrogenation of Oils improves preservation, taste and Odour of many oils.

### 7. What is detergent?

(March 2002, June 2000)

- Chemically detergents are sodium salts of alkyl benzene sulphonates or fatty alcohol sulphates .

### 8. Why is the cleaning action of detergent's not affected with hard water?

- Detergent react with  $\text{Ca}^{2+}$  or  $\text{Mg}^{2+}$  ions but they dont form precipitate but form lather hence they are useful in the presence of hard water also.

### 9. Why do shaving soaps give slow drying lather?

(March 2000)

- Shaving soaps contain considerable proportion of potassium soap and excess of stearic acid giving drying lather soap.

### 10.What is the main content of Deodorant soap (or) antimicrobial soap?

- 3, 4, 5 tribromosalicylanilide.

### 11.What is the main content of transparent soap?

- Some Glycerol

### Fill in the blanks

1.  $2\text{Na}_3\text{PO}_4 + 3\text{CaCl}_2 \rightarrow 6\text{NaCl} + \underline{\hspace{2cm}}$  (March 2000)
2. Detergents are used in hard water because  $\underline{\hspace{2cm}}$  (June 04, 02)
3. Catalyst used in (hydrogenation of Oils) the preparation of vanaspati  $\underline{\hspace{2cm}}$   
(june 05, March 04, 02)
4. Deodorant soaps contain  $\underline{\hspace{2cm}}$  (March 2010, June 2006)
5.  $\underline{\hspace{2cm}}$  and  $\underline{\hspace{2cm}}$  are examples of seed which give oil (March 2007)
6. Shaving soap contain excess of  $\underline{\hspace{2cm}}$  (March 03, 01, June 2004)

### Answers

1.  $\text{Ca}_3(\text{PO}_4)_2$
2. They react with  $\text{Ca}^{2+}$  or  $\text{Mg}^{2+}$  but do not form precipitate
3. Nickel
4. 3, 4, 5 tribromo salicylanilide
5. Sun flower and ground nut
6. Stearic acid

**I. Match the following.**

**(2 1/2 Marks)  
(March 2009)**

**Group A**

1. Lauric acid ( )
2. Stearic acid ( )
3. Oleic Acid ( )
4. Linoleinic ( )
5. Acetic Asia ( )

**Group B**

- A)  $C_{17}H_{33}COOH$
- B)  $CH_3COOH$
- C)  $C_{17}H_{29}COOH$
- D)  $C_{11}H_{23}COOH$
- E)  $C_{17}H_{35}COOH$

**KEY**

1. D; 2. E ; 3. A ; 4. C; 5. B

**II. Match the following.**

**Group A**

1.  $K^+$  Salt ( )
2. Salt of  $Na^+$  ( )
3. Salt of  $Ca^{2+}$   $Al^{3+}$  ( )
4. Salt of  $Mg^{2+}$  ( )
5. Salt of tri Ethanol Ammonium ( )

**Group B**

- A) Dry Cleaning
- B) Face Powder
- C) Cloths Cleaning Soap
- D) Toilet Soap
- E) Cloth which is hot wet with water
- F) Greece

**KEY**

1. D; 2. C ; 3. E ; 4. B; 5. A