Physical pharmacy
Experiment NO. 3
Surface Active Agents

Done by :
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introduction

Surface-active agent or *surfactant* are molecules and ions that are adsorbed at interfaces. Surfactants are materials that lower the surface tension (or interfacial tension) between two liquids or between a liquid and a solid. An alternative term is *amphiphile*, which suggests that the molecule or ion has a certain affinity for both polar and non-polar solvents. They are used in many pharmaceutical preparations as wetting agents, emulsifiers, solubilizing and antifoaming agents.

When such molecule is placed in an air-water or oil-water system, the polar groups are attached or oriented toward the water, and the non-polar groups are oriented toward the air At the air-water interface, or oriented toward the oil at the oil-water interface (Figure 1).

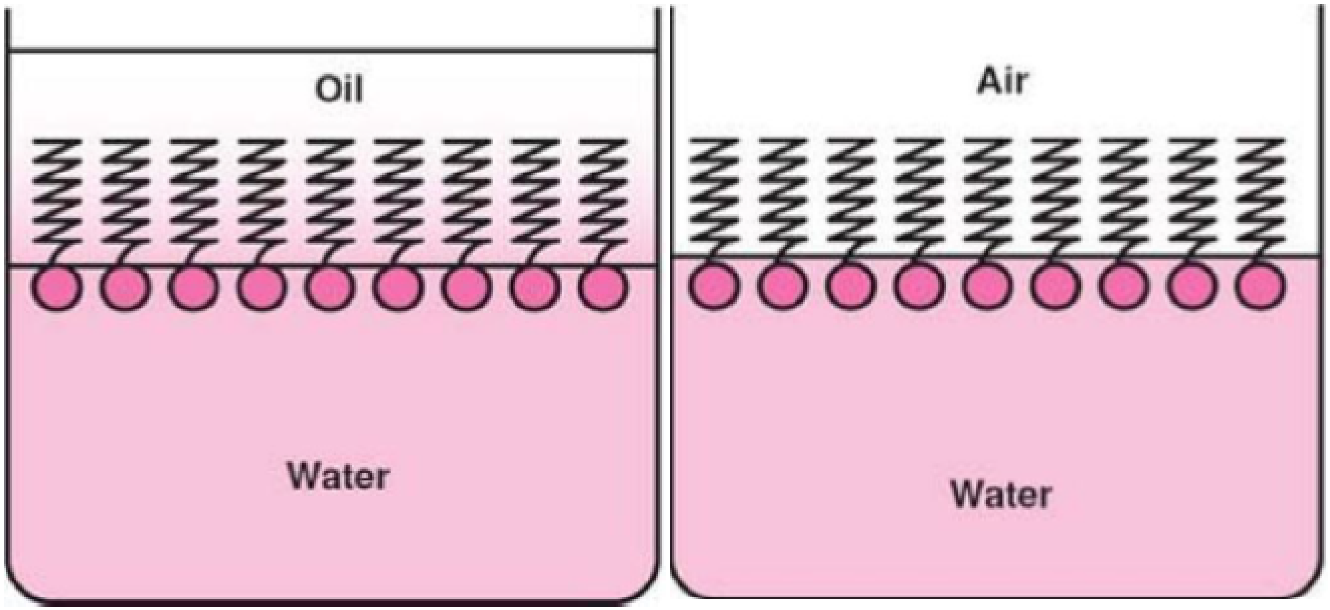
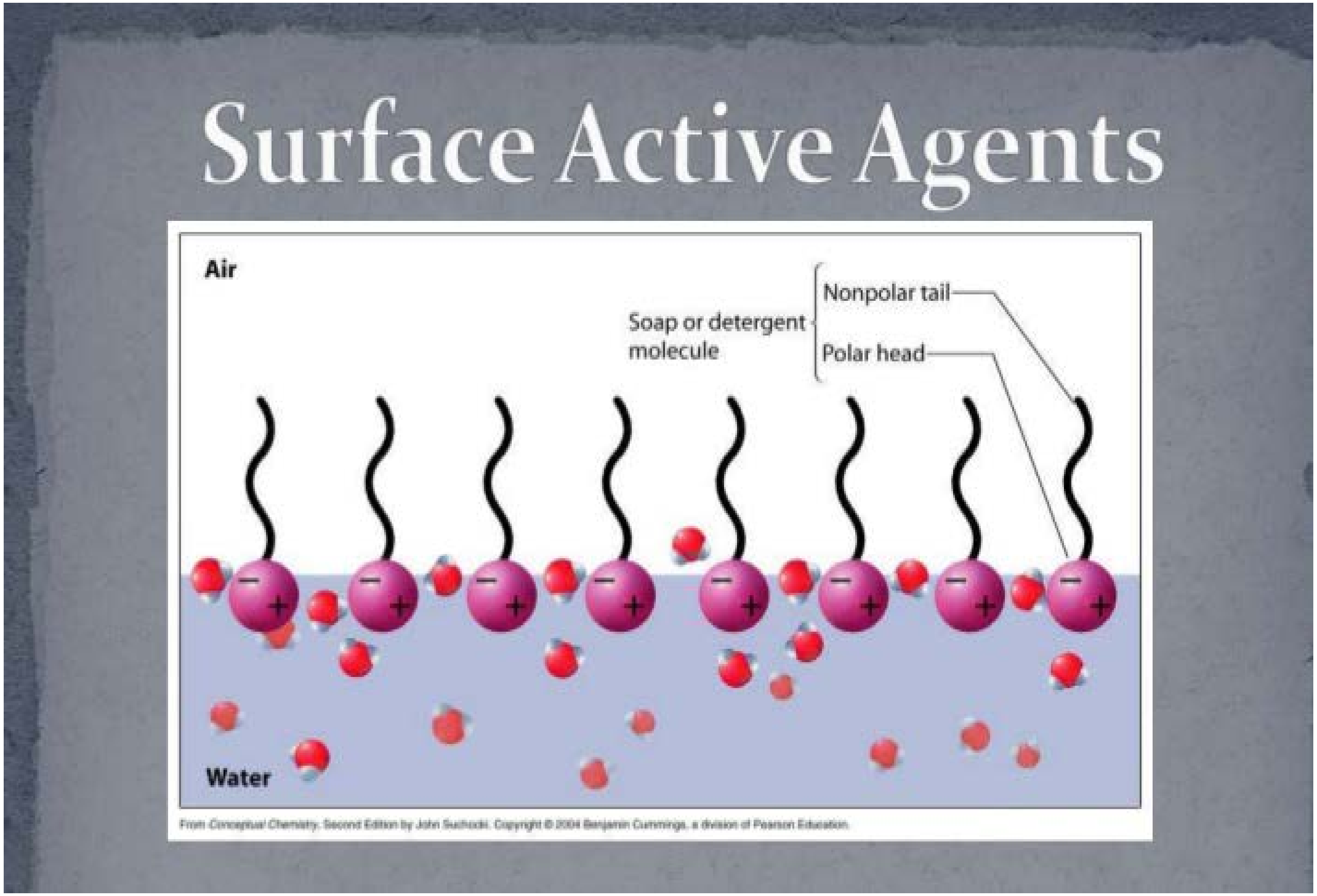


Figure 1: Adsorption of fatty acid molecule at a water-oil interface (left panel) and a water- air interface (right panel).

Surfactants are classified

According to their chemical structure and, more specifically, their polar group:

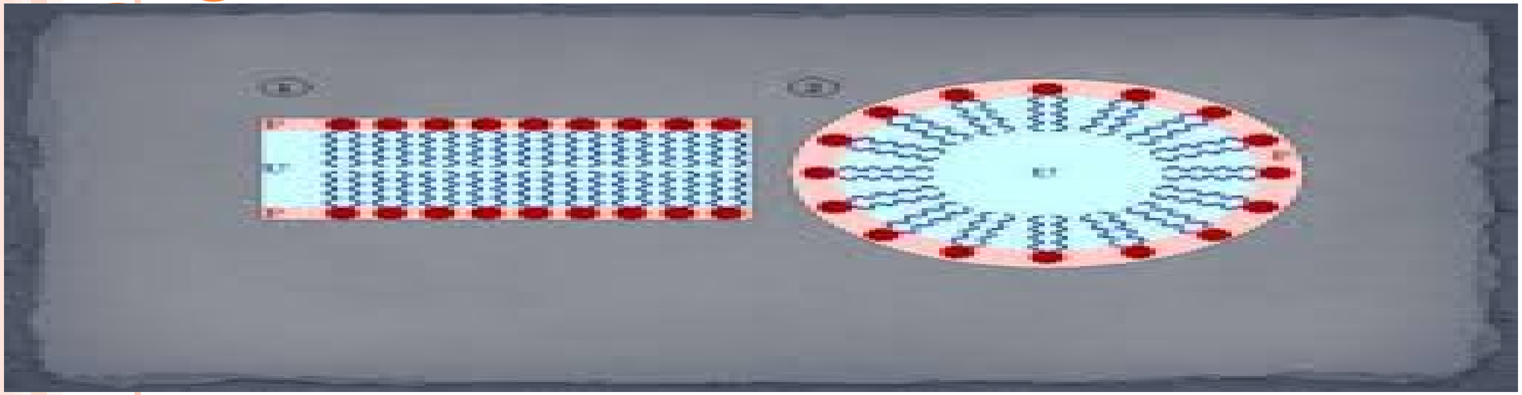
- Anionic surfactant such as sodium dodecyl sulfate (SDS®)
- Cationic surfactant such as cetyl trimethyl ammonium bromide (CTAB®)
- Ampholytic (Zwitterionic®) surfactant such as phospholipids
- Non-ionic surfactant such as poly oxy ethylene (Tween®)


Surface Active Agents
Air
Soap or detergent molecule
Nonpolar tail
Polar head
Water
From Conceptual Chemistry, Second Edition by John Suchocki. Copyright © 2004 Benjamin Cummings, a division of Pearson Education.

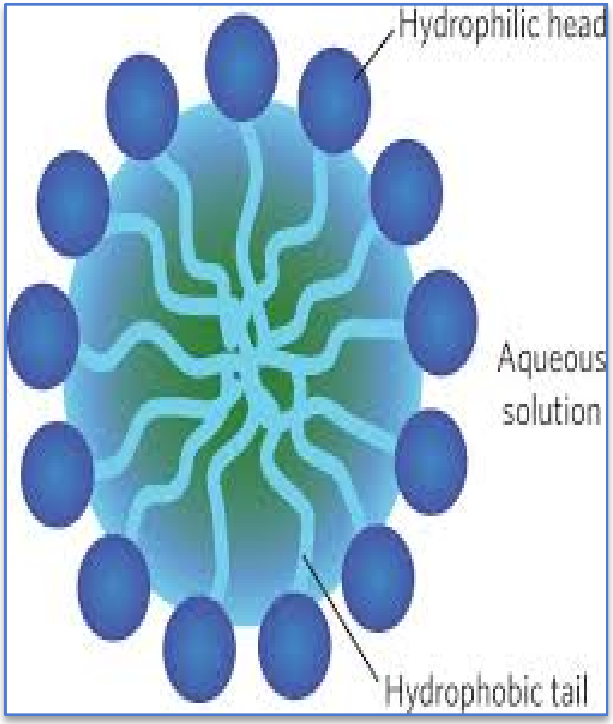
Micelles and the critical micelle concentration

Amphiphiles are characterised by having two regions of opposing solution affinities within the same molecule or ion. When Surface active agents present in a liquid medium at low concentration, the amphiphiles exist separately (a size as a sub-colloidal).

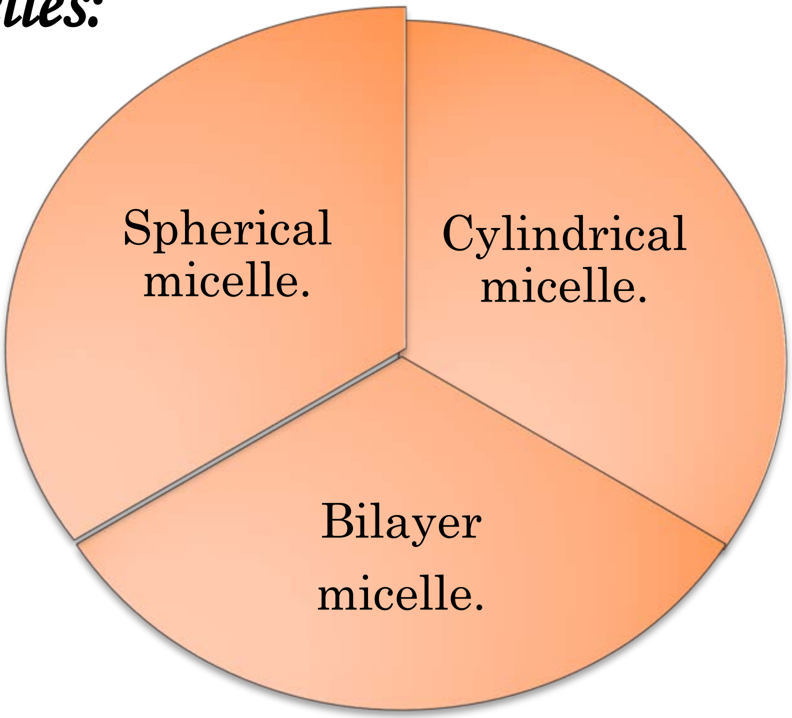
As the concentration is increased, aggregation occurs over a narrow range of concentration .These aggregates which may contain 50 or more monomers, are called micelles. Because the diameter of each micelle is of the order of 50 Å micelle lies within the size range designed as colloidal.

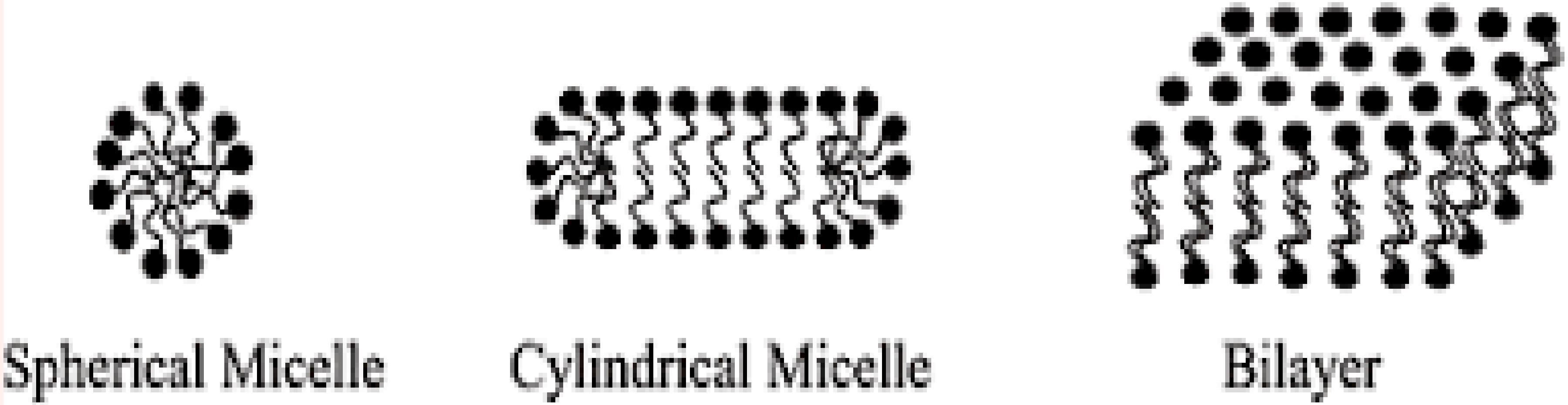


In general, Micelles are lipid molecules that arrange themselves in a spherical form in aqueous solutions. The formation of a micelle is a response to the amphipathic nature of fatty acids, meaning that they contain both hydrophilic regions (polar head groups) as well as hydrophobic regions (the long hydrophobic chain). The location of the molecule undergoing solubilisation in a micelle is related to the balance between the polar and non-polar properties of the molecule. The increase in solubility is due to adsorption or incorporation of the solute molecules into or in the colloidal particle (micelle).



Shapes of micelles:





Critical Micelle Concentration (C.M.C): The concentration of monomers at which micelles form. An important property of amphiphilic colloid in solution is the ability of the micelle to increase the solubility of materials that are normally insoluble or only slightly soluble in the dispersion medium used this phenomenon is known as solubilisation.

Experimental work

Part I: *bring Salicylic acid powder, Tween60, distilled water, phenol red indicator, volumetric flask (50ml), conical flask (50ml), graduated pipettes, burette, filter paper, funnel, and a balance. Prepare NaOH Solution (0.05N).*

Part II: *The aim of the experiment is to show the effect of increasing the concentration of Tween on the solubility of salicylic acid.*

Procedure:

1. Prepare different concentration of tween60 (0%, 0.05%, 0.5%, 1%, 2%, 3%), prepare 50 mL of each solution (use volumetric flask and pipette) from stock solution 5% (C1V1=C2V2).
2. Place 25ml of each concentration in a conical flask of (50mL) then add 0.25g salicylic acid to each flask.
3. Shake the flasks for 10 minutes.
4. Set to settle for another 10 minutes to permit the undissolved salicylic acid to settle down (filter if necessary).
5. Withdraw 10mL of filtrate solution and titrate with standardized NaOH solution (0.05N) using phenol red as indicator. The end point is a point when the colour changes from yellow to pink. Measure the end points.
6. Plot the total solubility (mg/mL) or (g/100ml) of salicylic acid against a concentration of tween 60.

Step no(1) of procedure

To prepare 50 ml of 0% tween60 that mean we will not use tween 60 ,just add 50 ml D.W in the volumetric flask

To prepare 50 ml of 0.05% tween60 from 5%stock solution by using dilution

$$C1V1 = C2\,V2$$

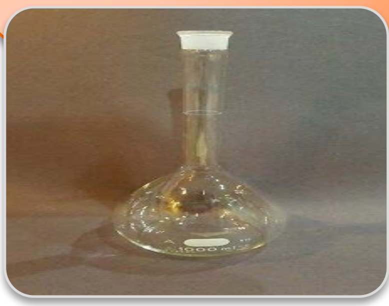
$$5\,\% * V1 = 0.05\% * 50$$

V1= 0.5ml take from stock solution 5%tween 60 (using pipette) put it in the volumetric flask then complete the volume to 50 ml by adding D.W

*The same procedure and calculation for preparation of the other concentration

Steps of experiment

prepare 50 mL of different concentration of tween 60 from stock solution 5%tween 60 (C1V1=C2V2).



Place 25ml of each concentration in a conical flask.

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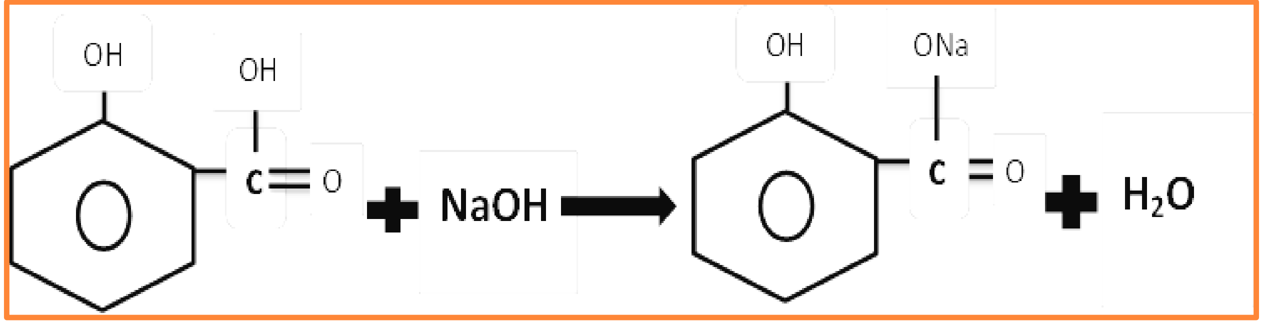
CALCULATION



1M.wt of salicylic acid= 1M.wt NaOH

1eq.wt of salicylic acid= 1eq.wt NaOH

138.1g = 1L of 1N NaOH

138.1g =1000ml of 1N NaOH

(138.1/1000) g =1ml of 1N NaOH

138.1/1000*0.05 =1ml of 0.05N NaOH

Therefore, 0.0069g of salicylic acid is the chemical factor.

Chemical factor* end point= g salicylic acid/10 ml.

If the end point for 0%tween 60 was 2.6ml

The calculation will be

End point *chemical factor = g of salicylic acid in 10ml (filtrate)

2.6 ml * 0.0069 =0.0179 g of salicylic acid in10 ml

The solubility of salicylic acid in (g\100ml)

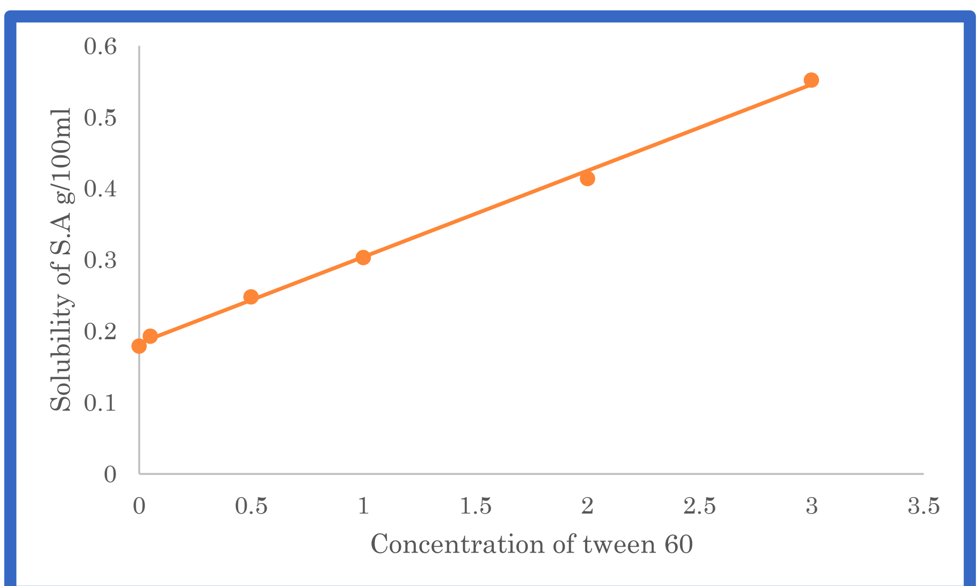
0.0179g 10ml

X 100ml

X= 0.179 g\100ml of salicylic acid

*The same calculation for other end points

Conc. of tween60	E.P (mls of NaOH)	Grams of S.A in 10 ml	Grams of S.A in 100 ml
0%			
0.05%			
0.5%			
1%			
2%			
3%			



THANK YOU FOR YOUR ATTENTION!

ANY QUESTIONS ?