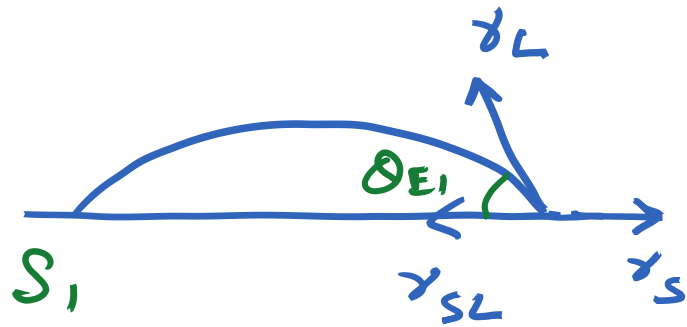


Water



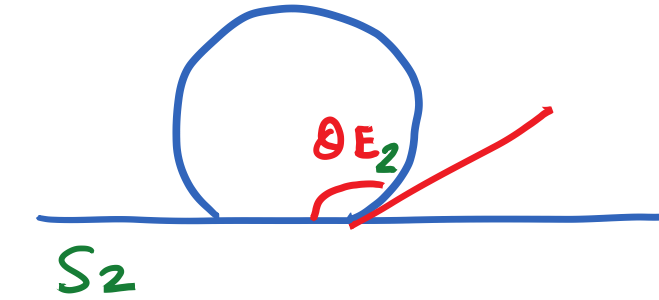
$$\gamma_S = \gamma_{SL} + \gamma_L \cos \theta_E$$

$S_1 \rightarrow$ Hydrophilic, $S_2 \rightarrow$ Hydrophobic

Likes water to
spread over it

$\gamma_{S1} \rightarrow$ Higher

$\gamma_{S2} \rightarrow$ Lower



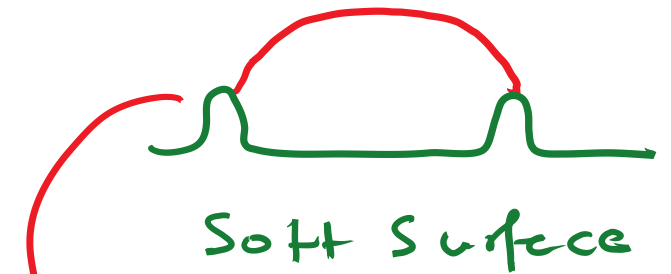
Does not like
Water to spread over
it.

Hydrophilic Surface
Has higher γ , lower
 θ_E .

07th Feb 2022

Lecture 12

Surfactants



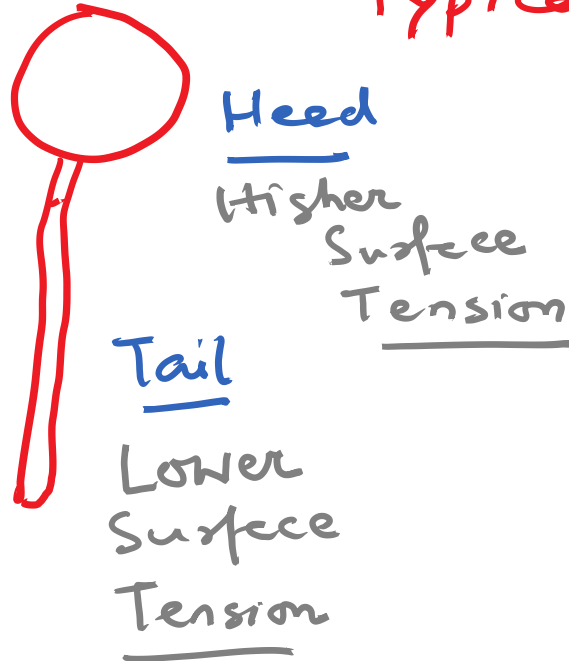
Visible
deformation.
Wetting ridge
formation
(Clear signature of
the vertical component
of Surface Tension)

Surfactant Molecules → What is special about them?

↳ Synthetic molecule → Where they have spatial variation w their wetting property.

Typically → Inorganic Head Part → Hydrophilic

→ organic (Hydrocarbon) → Hydrophobic
Tail



4 - types

Classification of Surfactant is done by the nature of the Head Group.

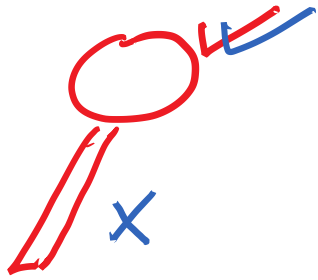
- (1) Anionic Surfactant
- (2) Cationic Surfactant

(4) Non ionic Surfactant

(No Charge)

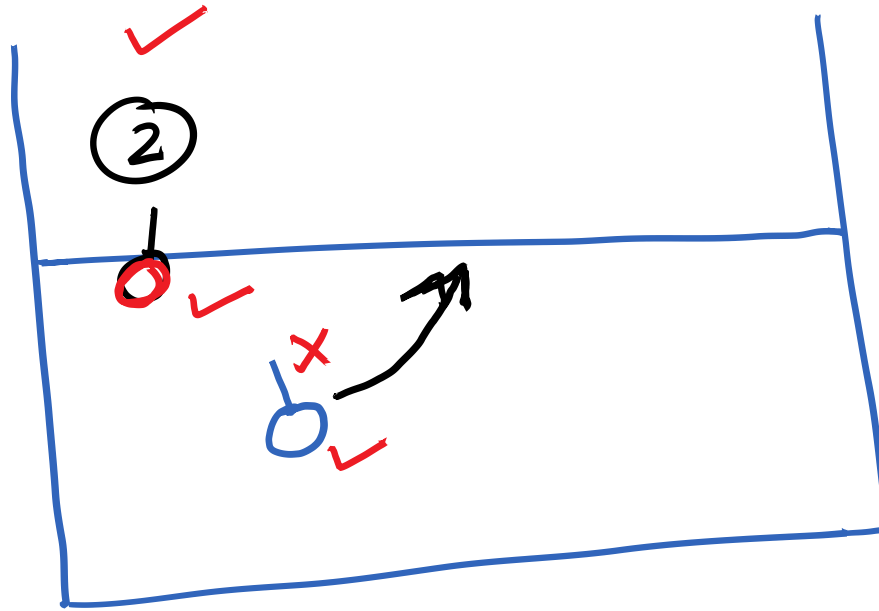
Both Charges

← (3) Zwitterionic Surfactant



⇒ The molecule migrates to the free surface.

Surface Active



The molecule moves to the surface and attains a very specific configuration.

$$\frac{\gamma_s}{\gamma_{SL}}$$

$$\Delta_{SL} = \gamma_s - (\gamma_L + \gamma_{SL})$$

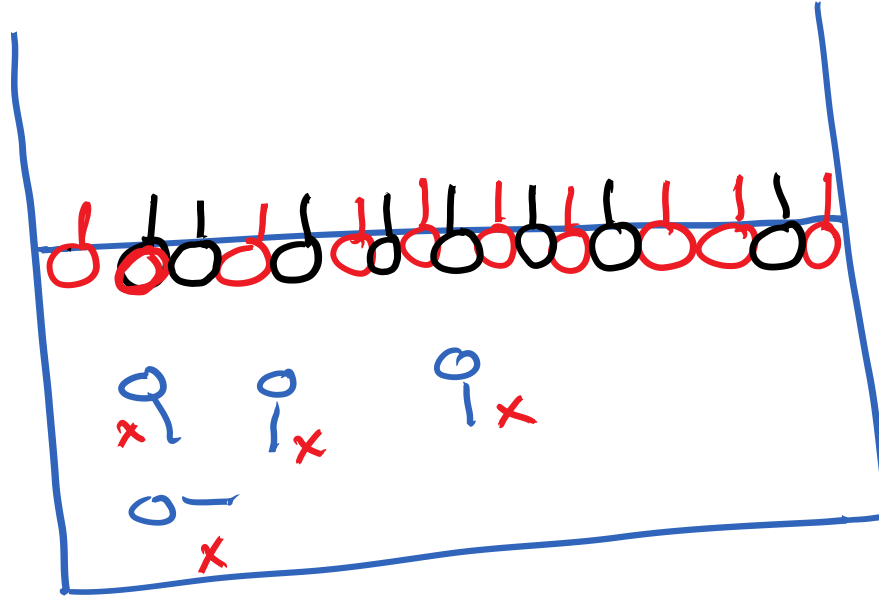
For the tail part, Spreading Coefficient is Negative → it is not favored.

Add more number of
Surfactant molecules



more molecules
will go to the surface.

(Free Surface Has
Finite Area)



(1) Stage 1 : Few molecules

(2) Stage 2 : More molecules → so the surface finally gets covered
with a SINGLE layer of surfactant molecules.

(3) Stage 3 : Add more → molecules now don't have the surface
to migrate → so they have to be in water.
Every molecule level the tail is unfavorable.

Add more number of
Surfactant molecules

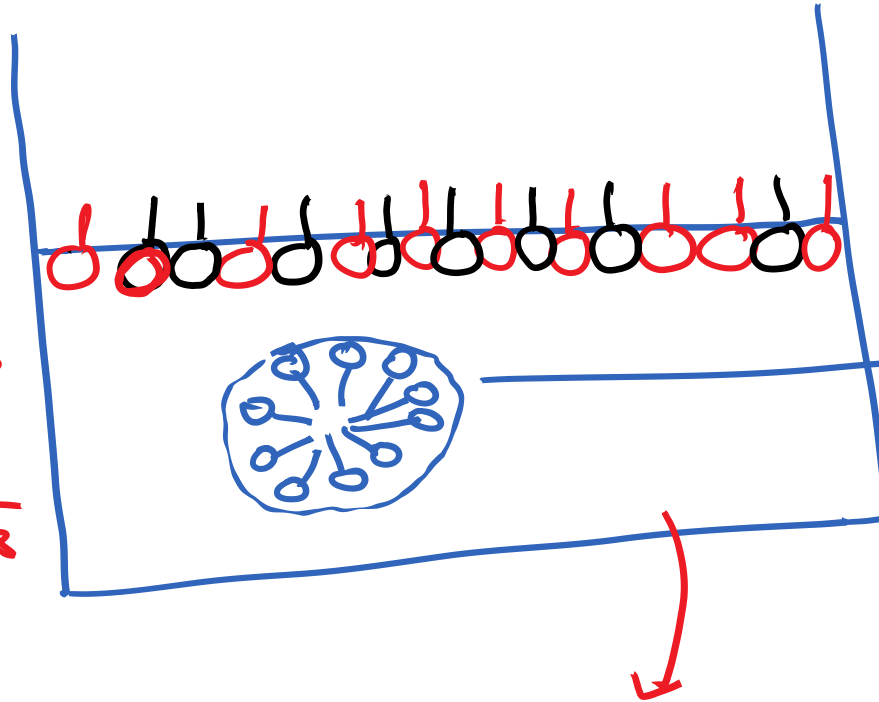


And the Concentration
of Surfactant for
which micelle forms
is CMC.

Critical Micelle Concentration.

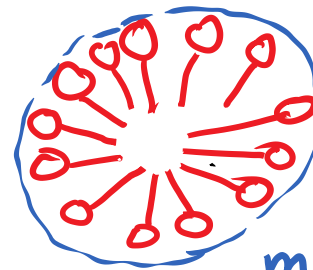
Self assembled
Structure

→ The tails remain
embedded/ hidden.



Water now
sees/ Comes in
Contact with
only the head
groups =

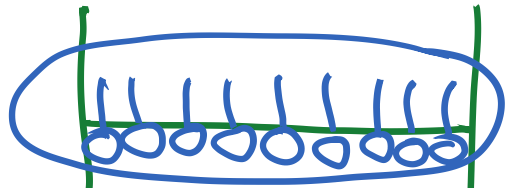
Micelle as a
whole is thermodynamic
favored.



micelle

Tails are hidden inside
and outer surface is only
the head group.

No. of molecules reqd to cover the surface
is less.



CMC₁



CMC₂

CMC

Critical Micelle
Concentration

→ more molecules
are consumed in
covering the surface

Same Volume

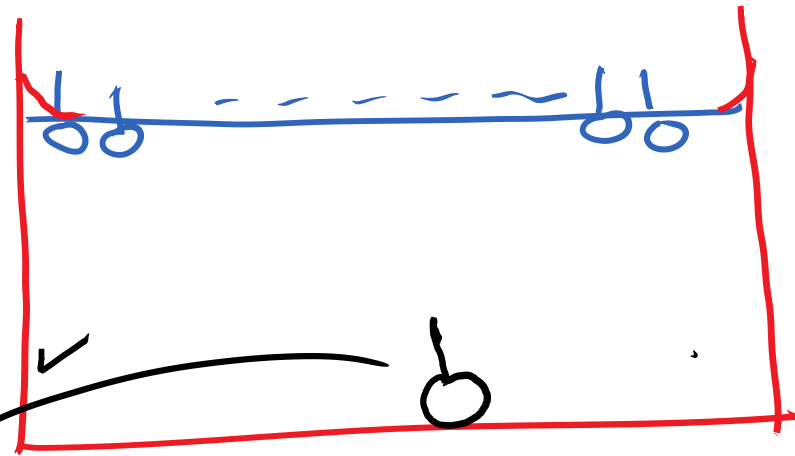
Vessel shape is different :

Comments on CMC

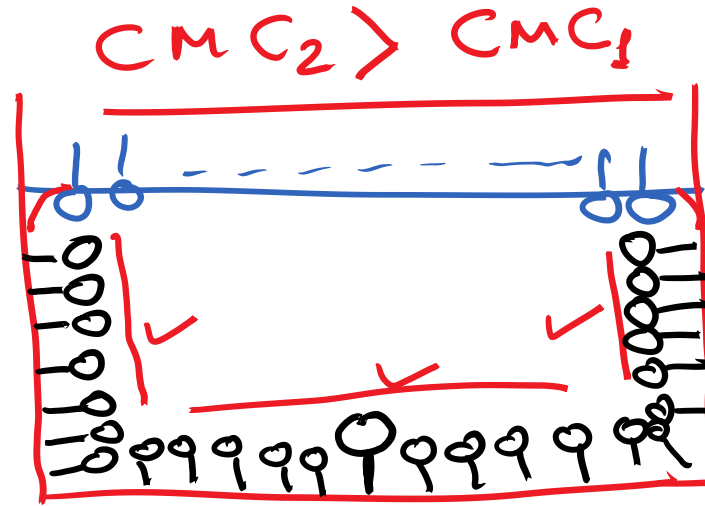
CMC₂ > CMC₁

CMC depends on the shape of the
vessel.

All meniscus effects neglected



Hydrophilic (Glass surface)



Hydrophobic
(Perspex beaker)

Micelle
formation
Starts after
inner surface
also gets
covered.

Same Size + Geometry vessel: →

In both cases → first molecules will decorate the free surface

→ If a surfactant molecule
goes to the surface, then
the hydrophilic head will be in
contact with the hydrophilic surface

→ Tail will be exposed to
water?

Does not lead to any
thermodynamically favorable
state.