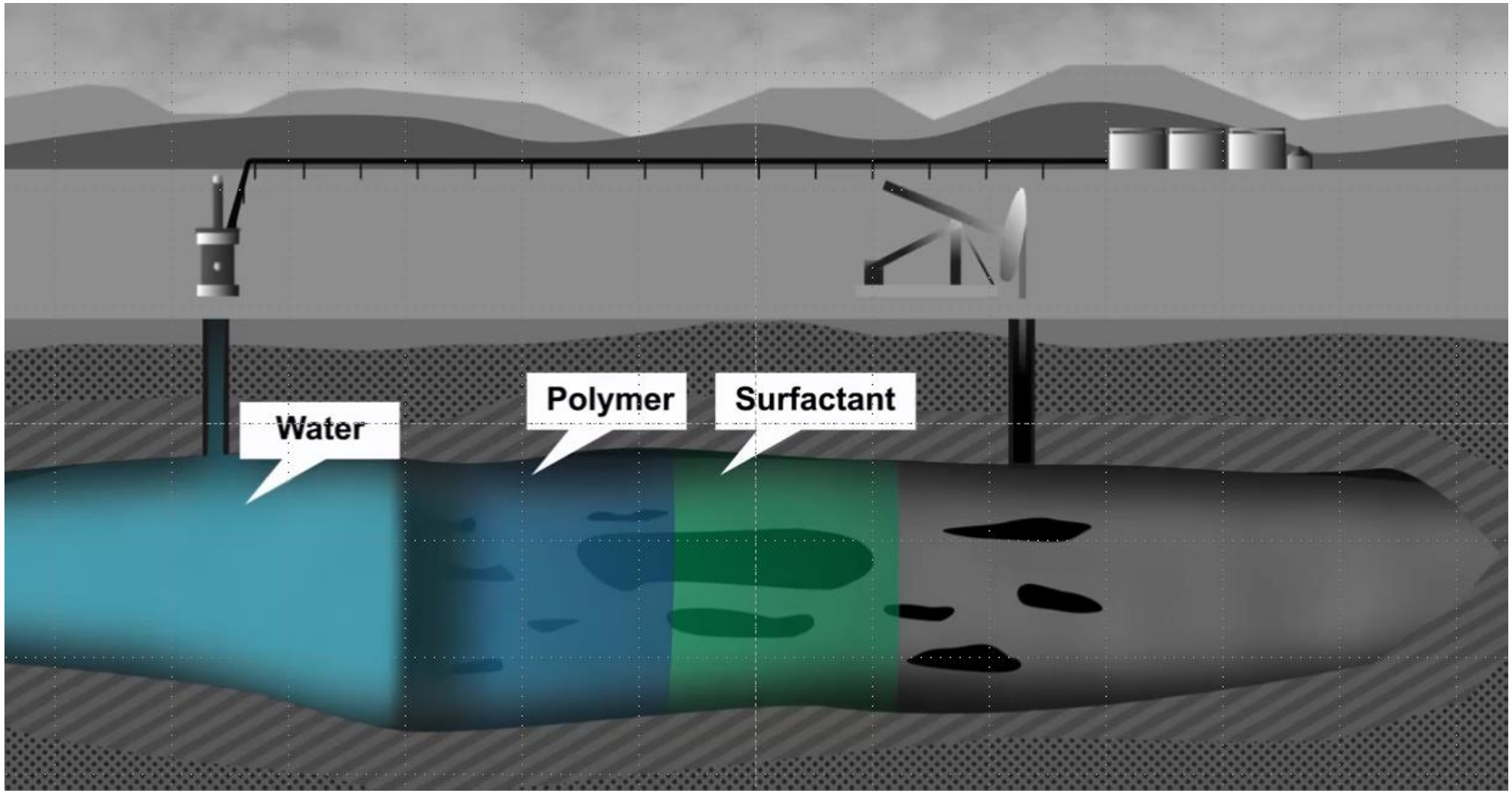
SURFACTANTS FLOODING



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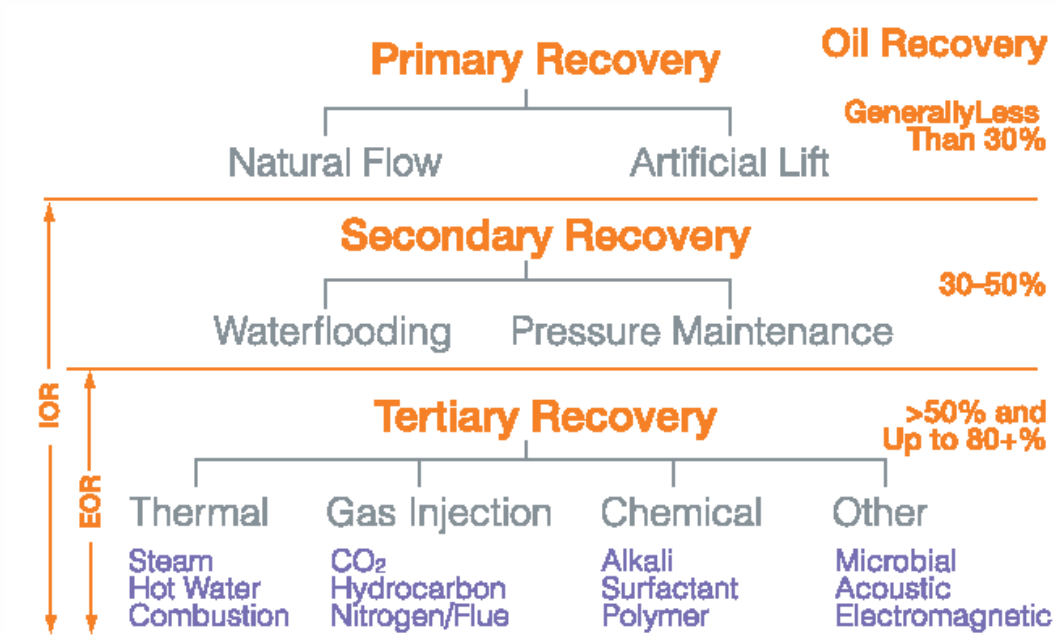
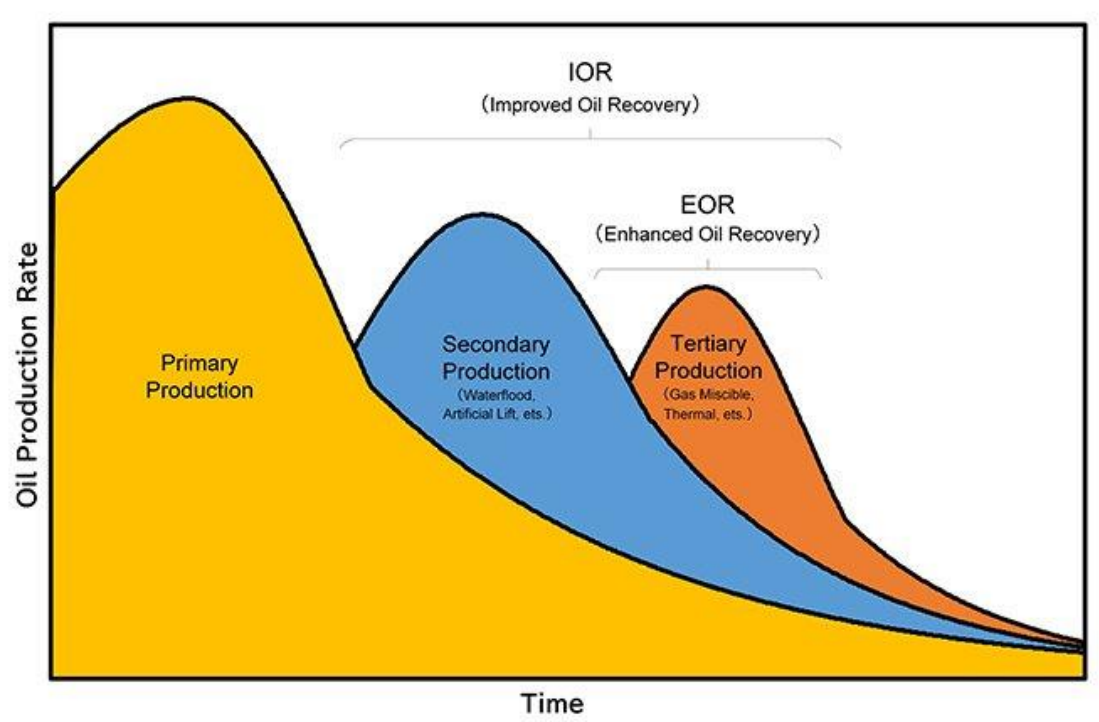
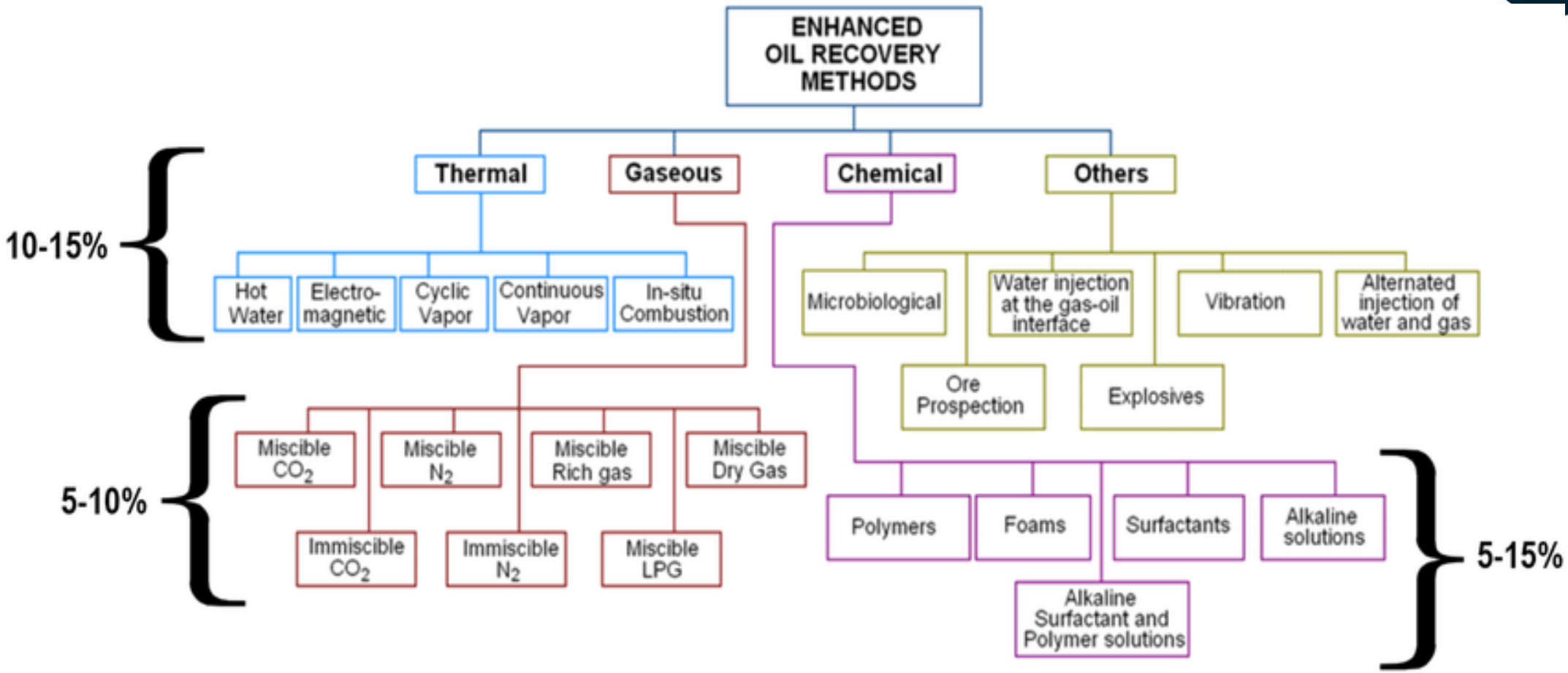
Oil Recovery






ENHANCED OIL RECOVERY METHODS
Thermal
Gaseous
Chemical
Others
10-15%
Hot Water
Electro-magnetic
Cyclic Vapor
Continuous Vapor
In-situ Combustion
Microbiological
Water injection at the gas-oil interface
Vibration
Alternated injection of water and gas
Ore Prospection
Explosives
5-10%
Miscible CO_2
Miscible N_2
Miscible Rich gas
Miscible Dry Gas
Immiscible CO_2
Immiscible N_2
Miscible LPG
Polymers
Foams
Surfactants
Alkaline solutions
Alkaline Surfactant and Polymer solutions
5-15%

EOR Processes

$$N_C = \frac{F_v}{F_c} = \frac{v\mu}{\sigma \cos\theta}$$

1- Mobility-control

2- Chemical processes

3- Miscible processes

4- Thermal Processes

Screening Criteria for Chemical EOR Processes

1- Formation

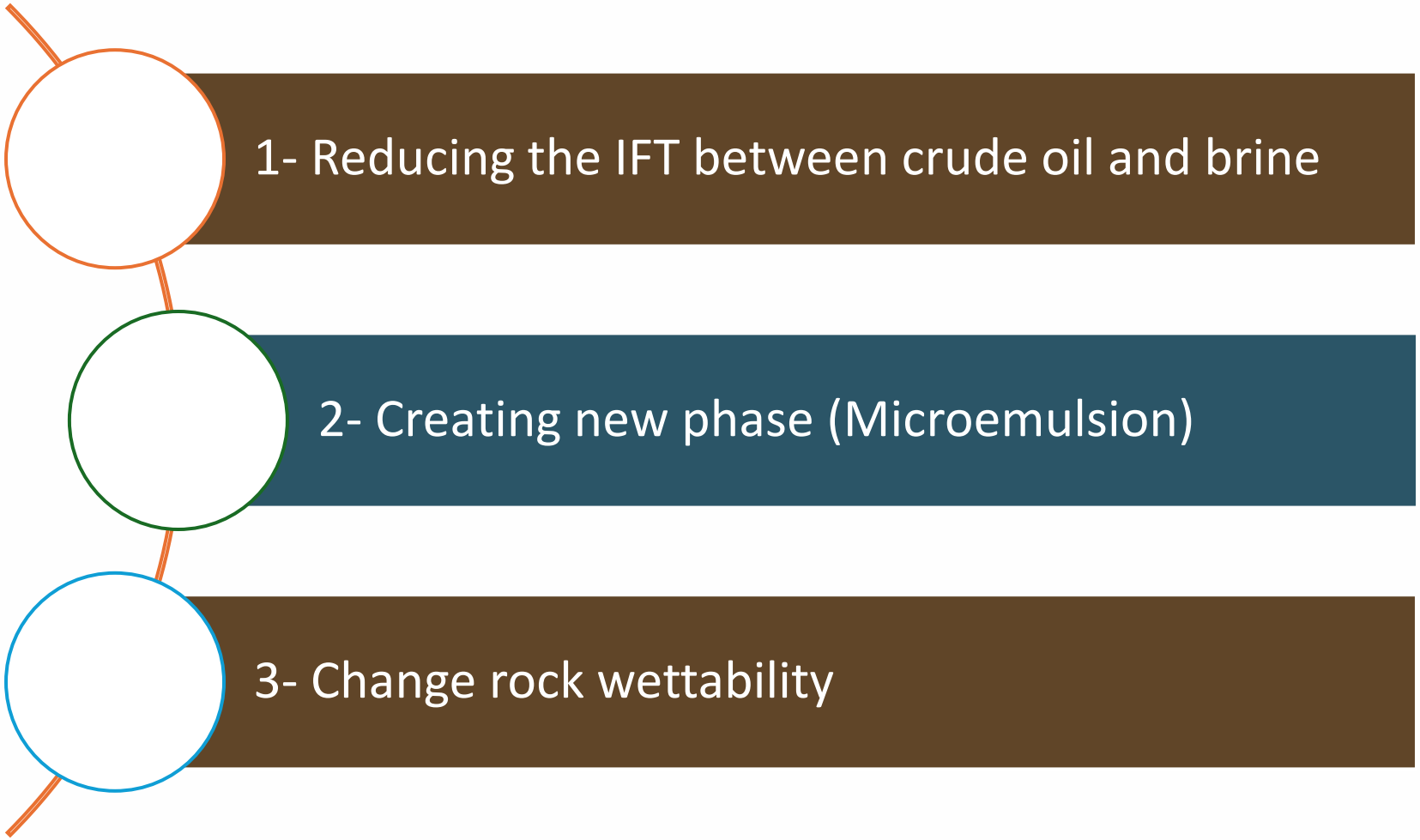
2- Oil Composition and Oil Viscosity

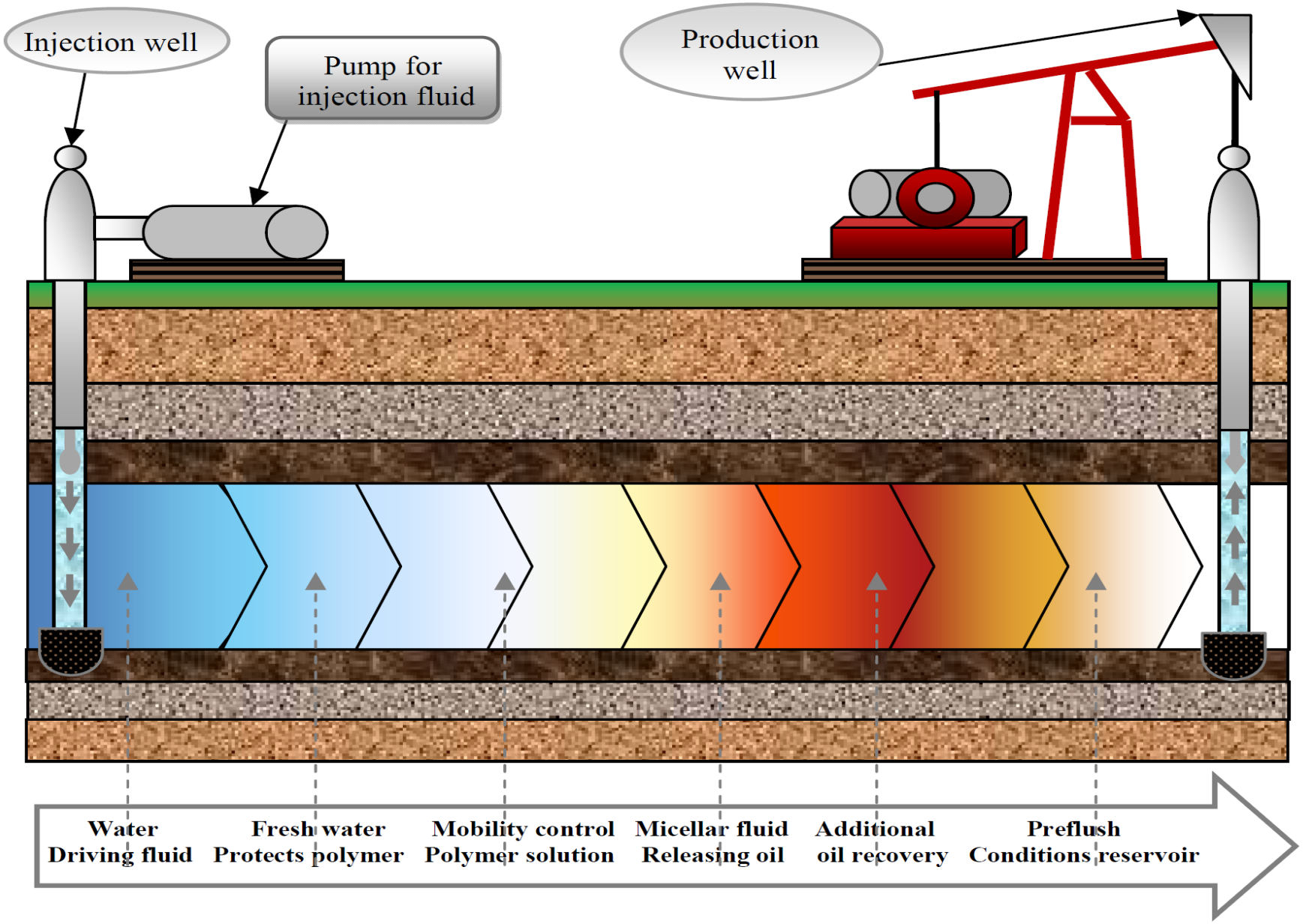
3- Formation Water Salinity

4- Reservoir Temperature

5- Formation Permeability

Mechanism of Surfactant Flooding





Types of Surfactant Flooding

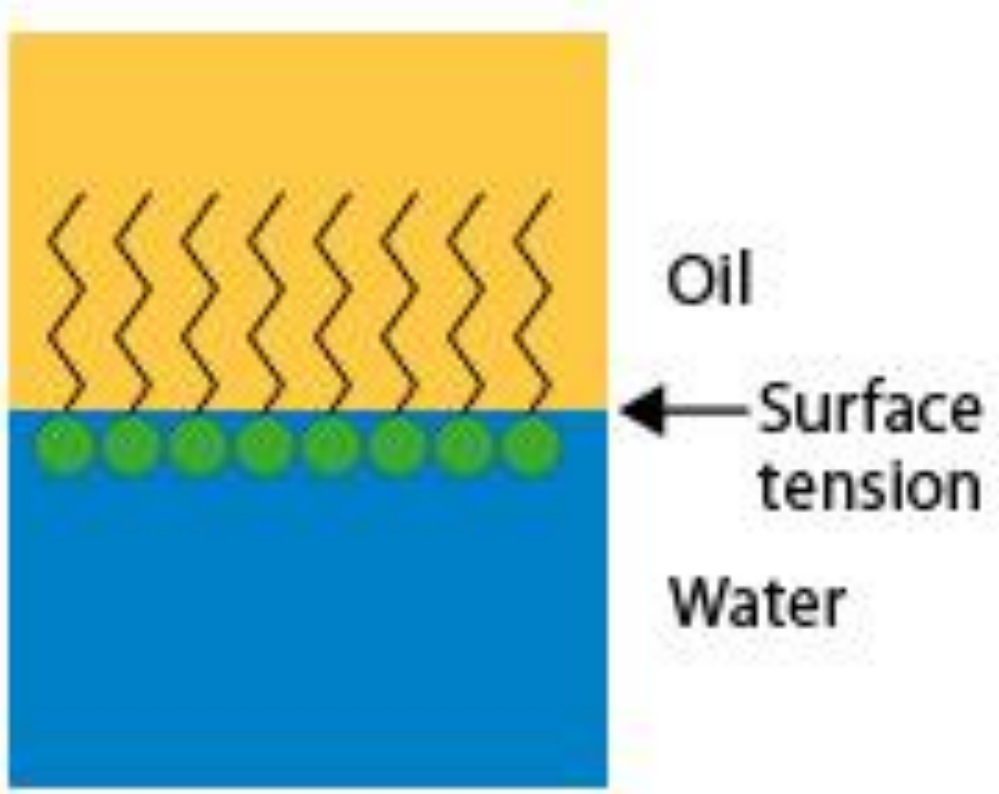
1- Micelle/polymer flooding

2- Microemulsion flooding

3- Alkaline/surfactant/polymer

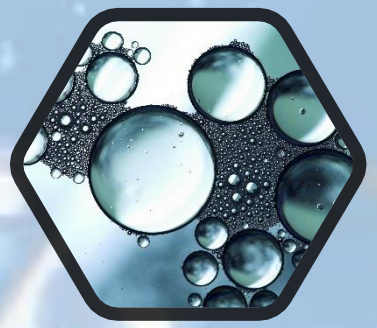
SURFACTANTS

Surface Active Agents



Polar hydrophilic
(water-loving) head

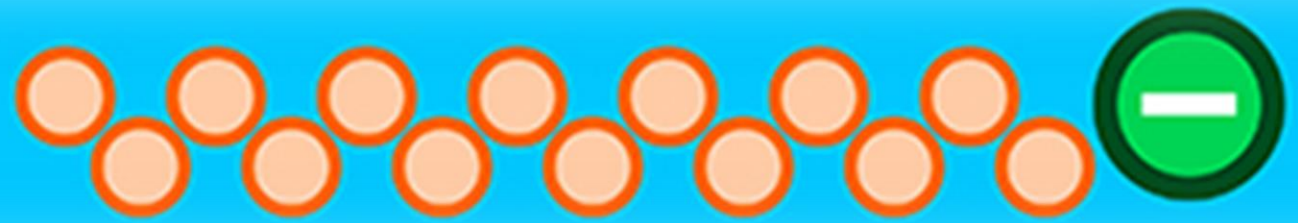
Non-polar hydrophobic
(water-hating) tail



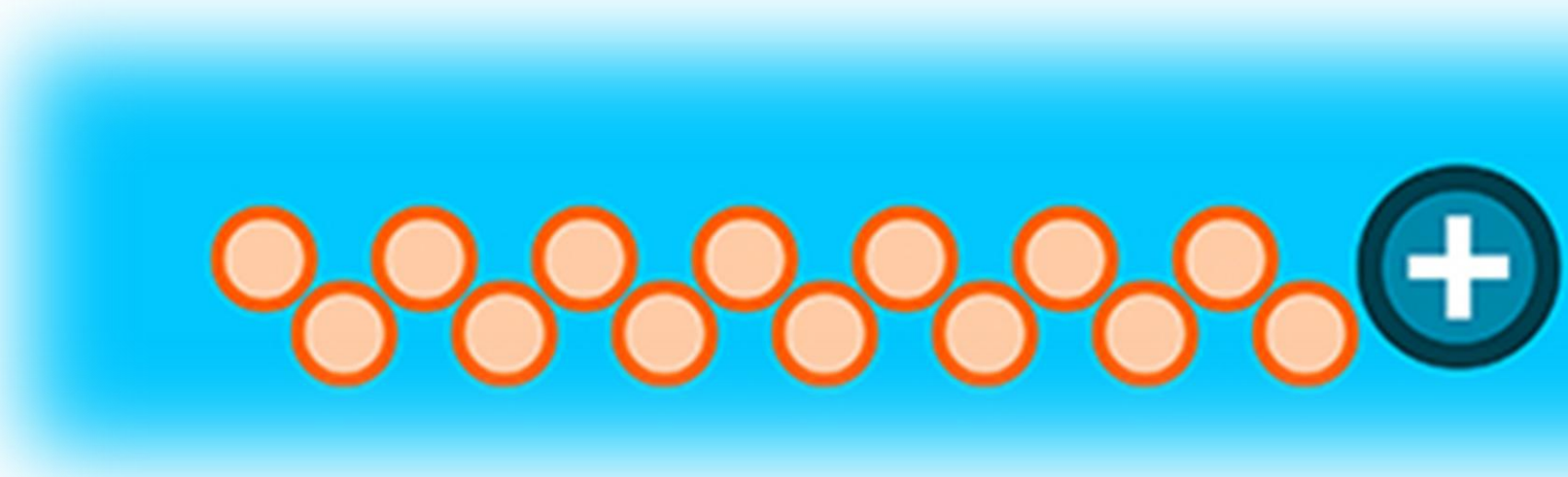
Types

- Anionic
- Cationic
- Nonionic
- zwitterionic

Anionic Surfactant

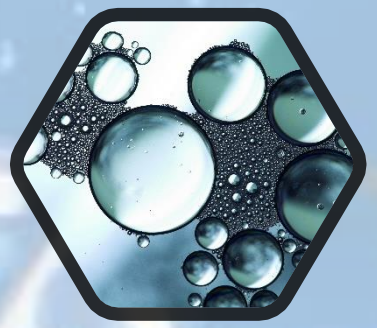


Cationic Surfactant



Nonionic Surfactant

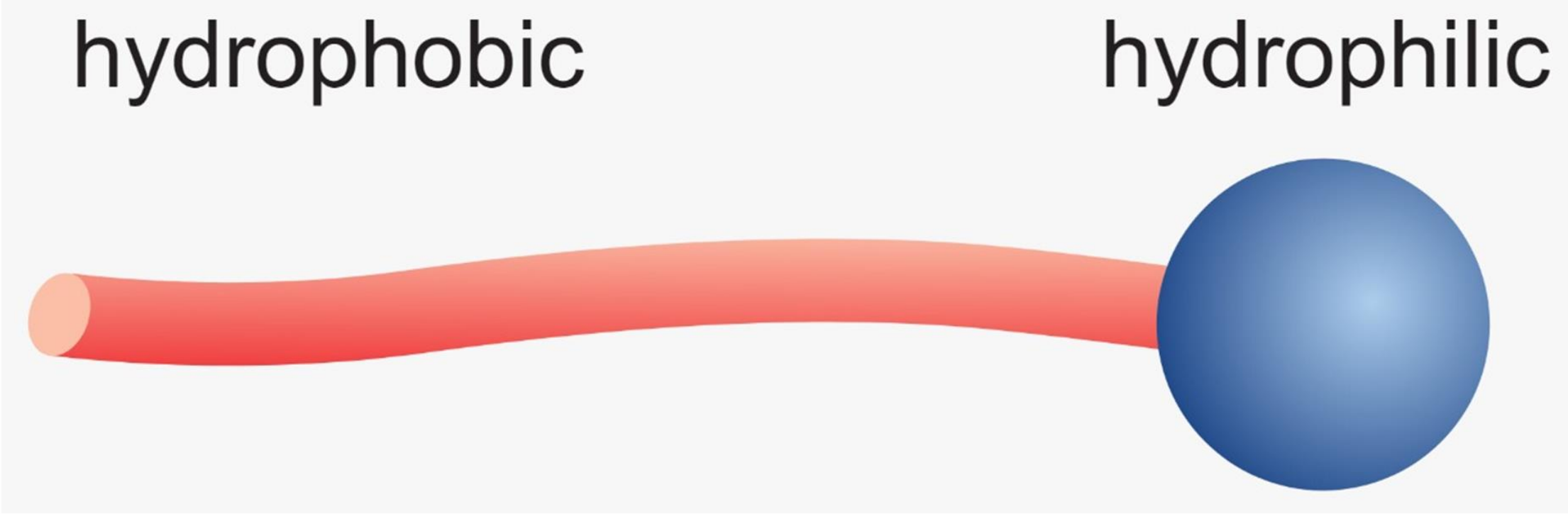
Zwitterionic Surfactant



Surfactant Characterization

HLB **CMC** **SR** **CPP**

HLB Hydrophile–Lipophile Balance



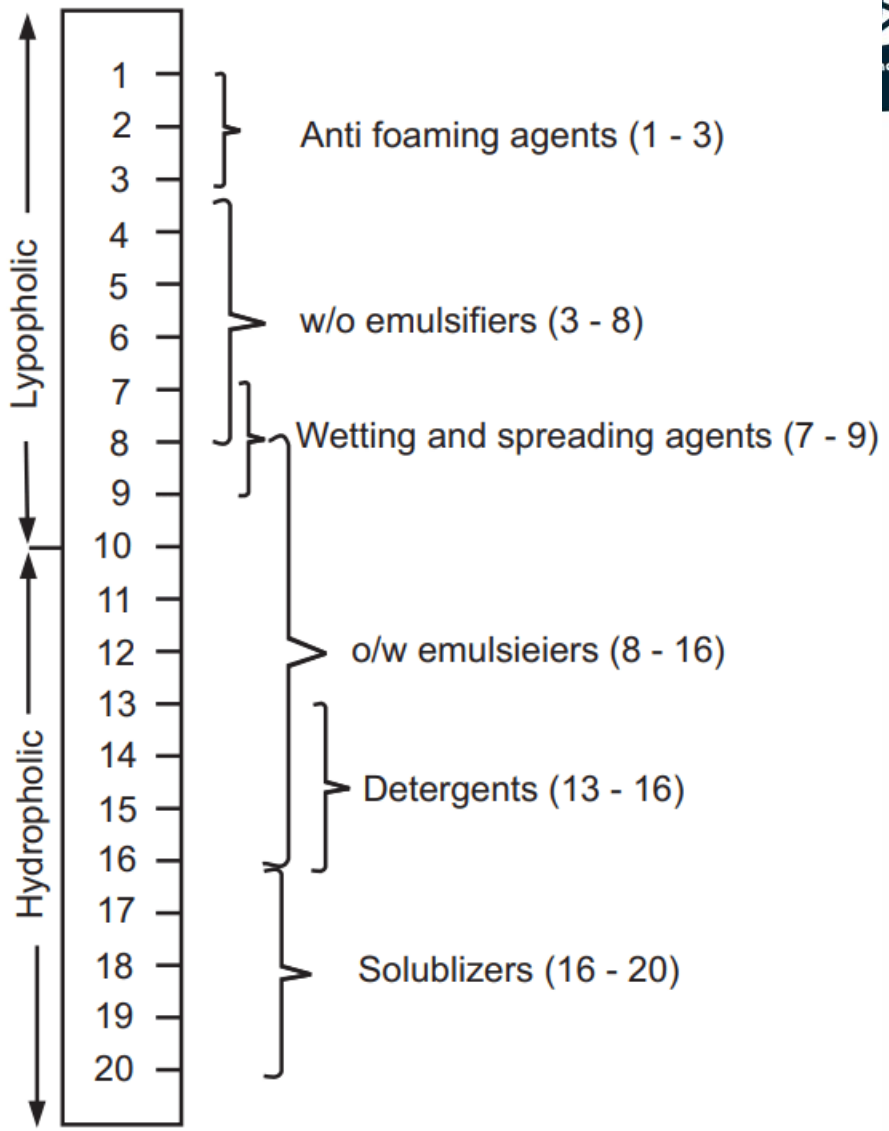
Hydrophile–Lipophile Balance (HLB)

- calculating values for the different regions of the molecule.

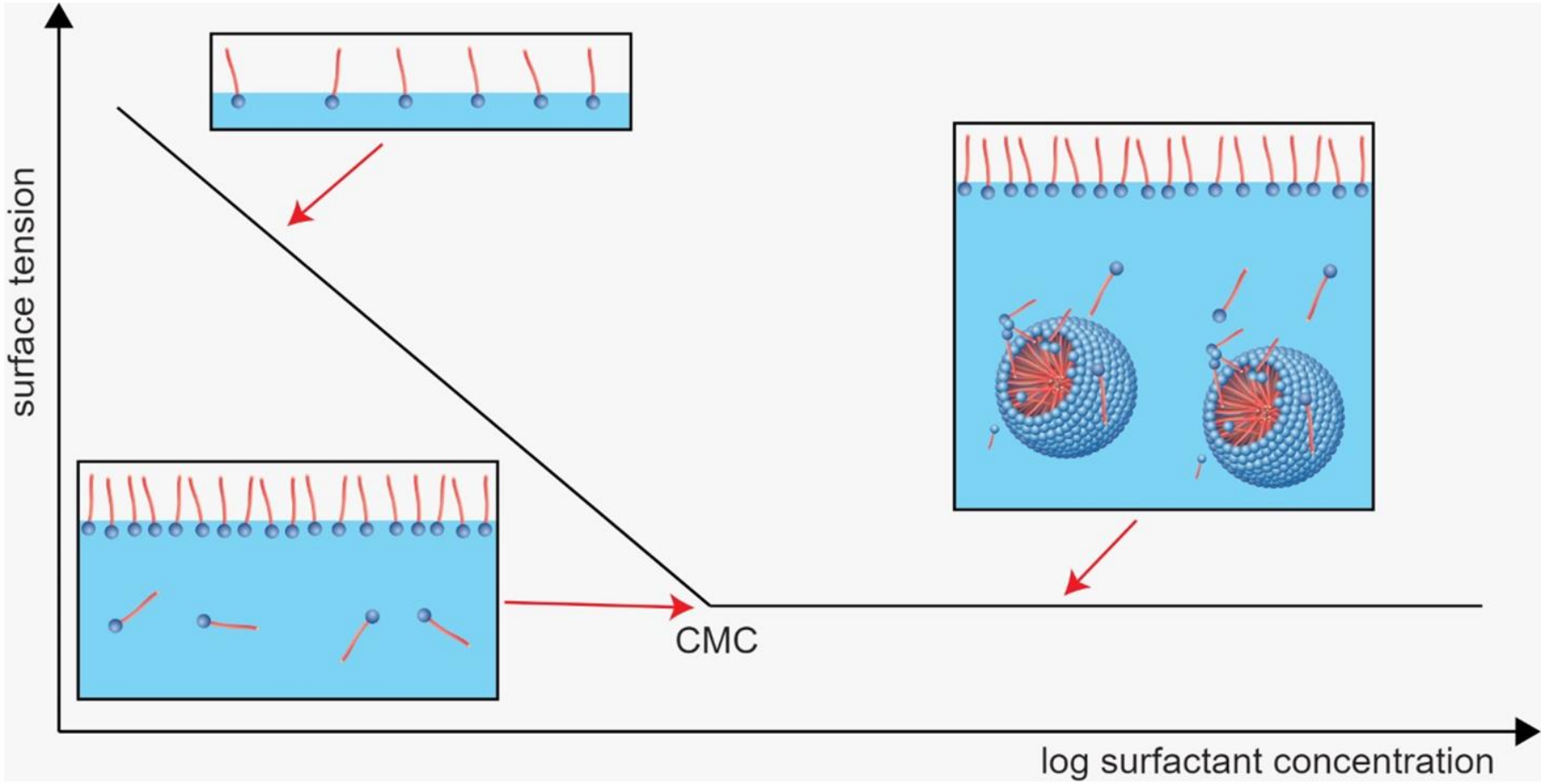
- $$HLB = \frac{20\ MW_h}{MW}$$

  - MW_h : The molecular mass of the hydrophilic portion of the molecule.

  - MW : The molecular mass of the whole molecule



CMC Critical Micelle Concentration



Solubilization Ratio

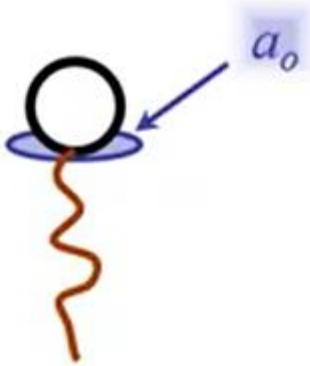
The ratio of the solubilized oil (water) volume to the surfactant volume in the microemulsion phase.

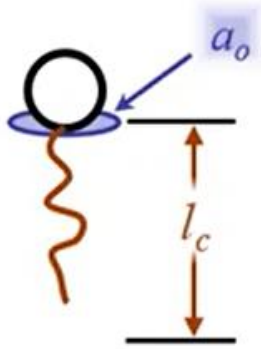
Related to IFT

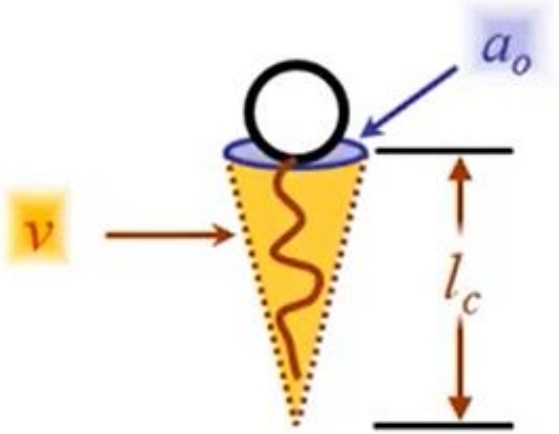
The IFT reaches its minimum

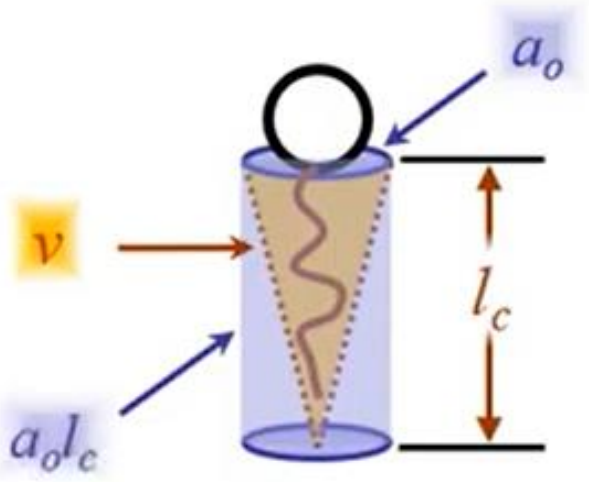
the solubilization ratio for oil is equal to that for water.

CPP Critical Packing Parameter

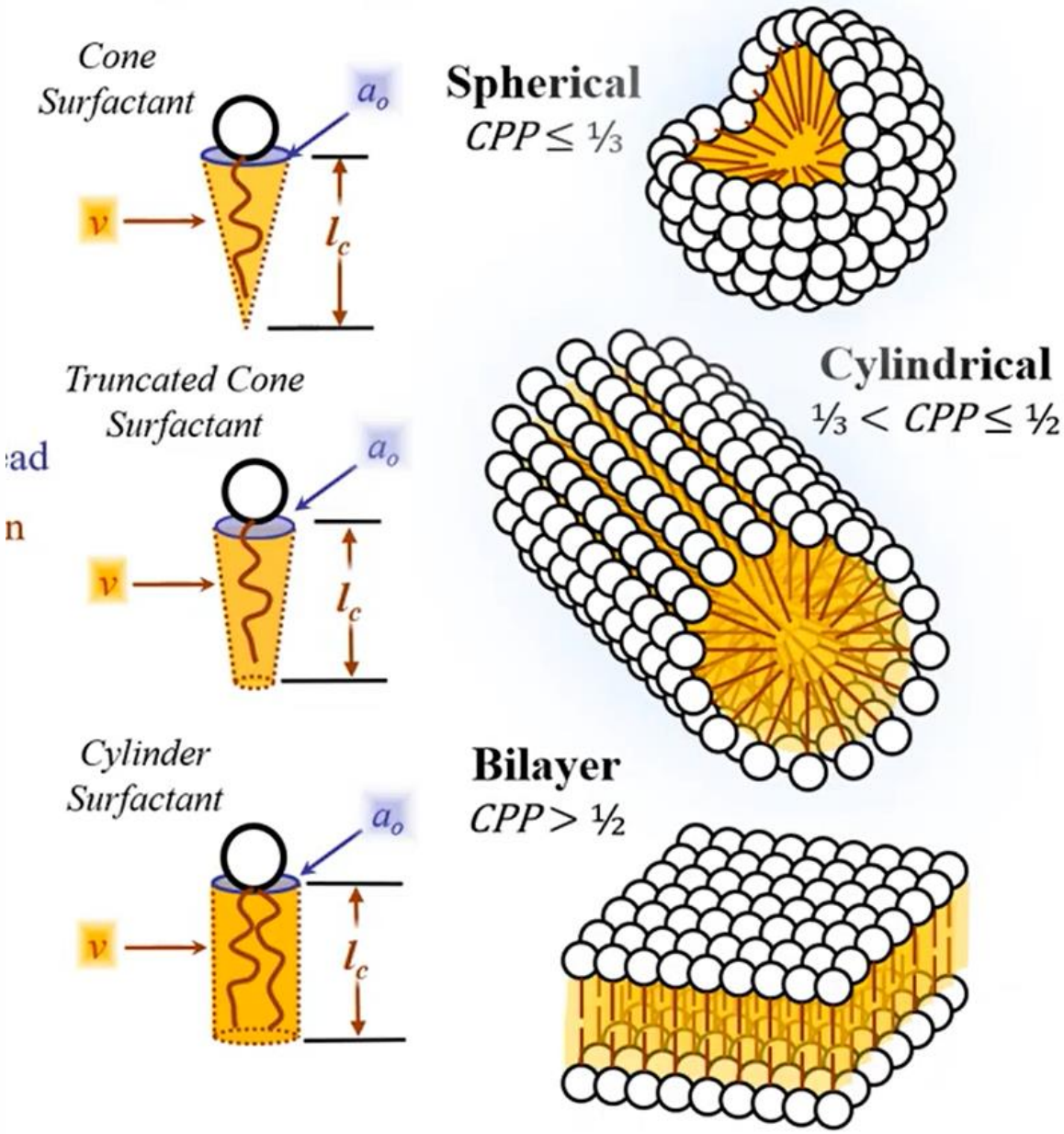








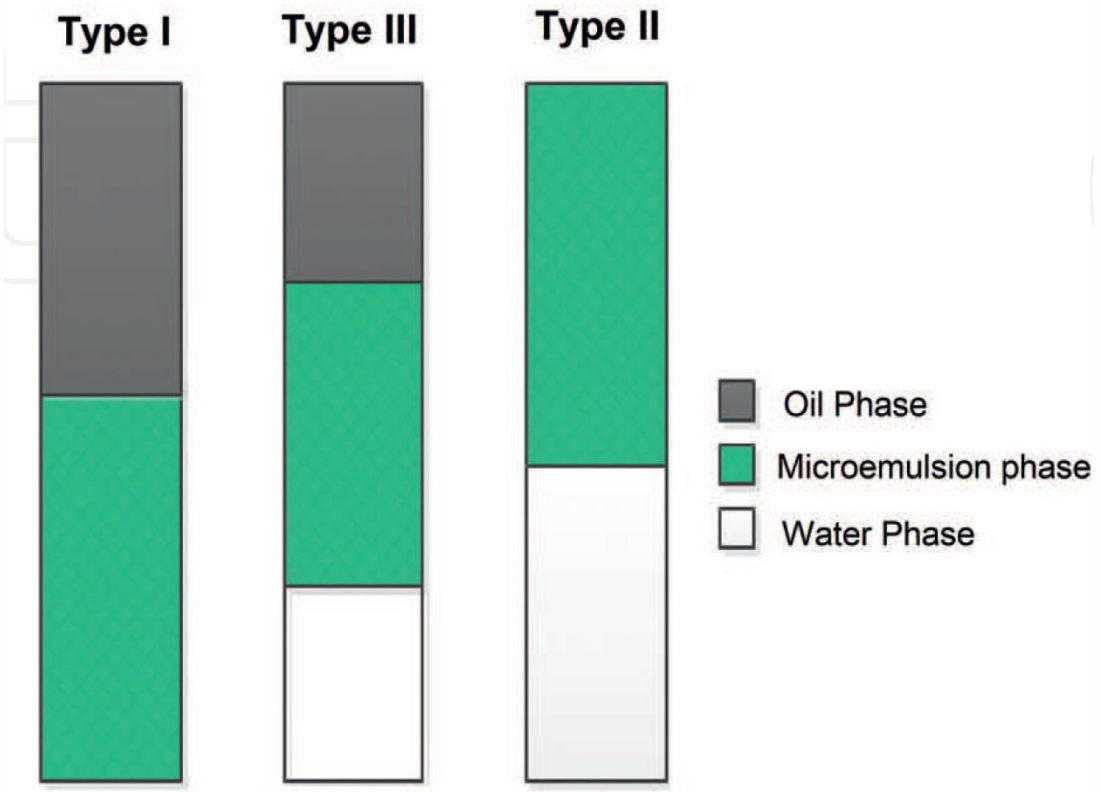
Critical Packing



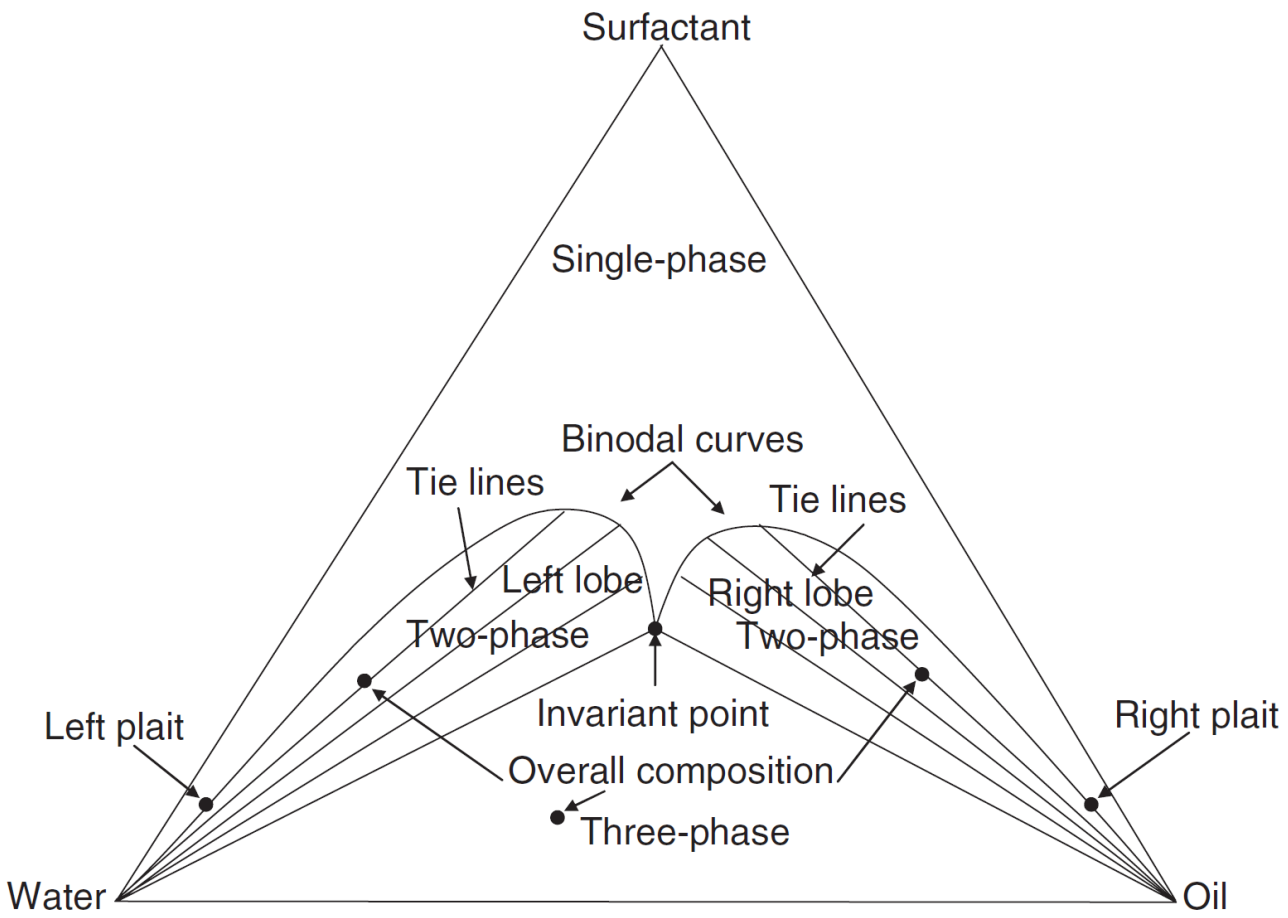
MICROEMULSION

Types of Microemulsion

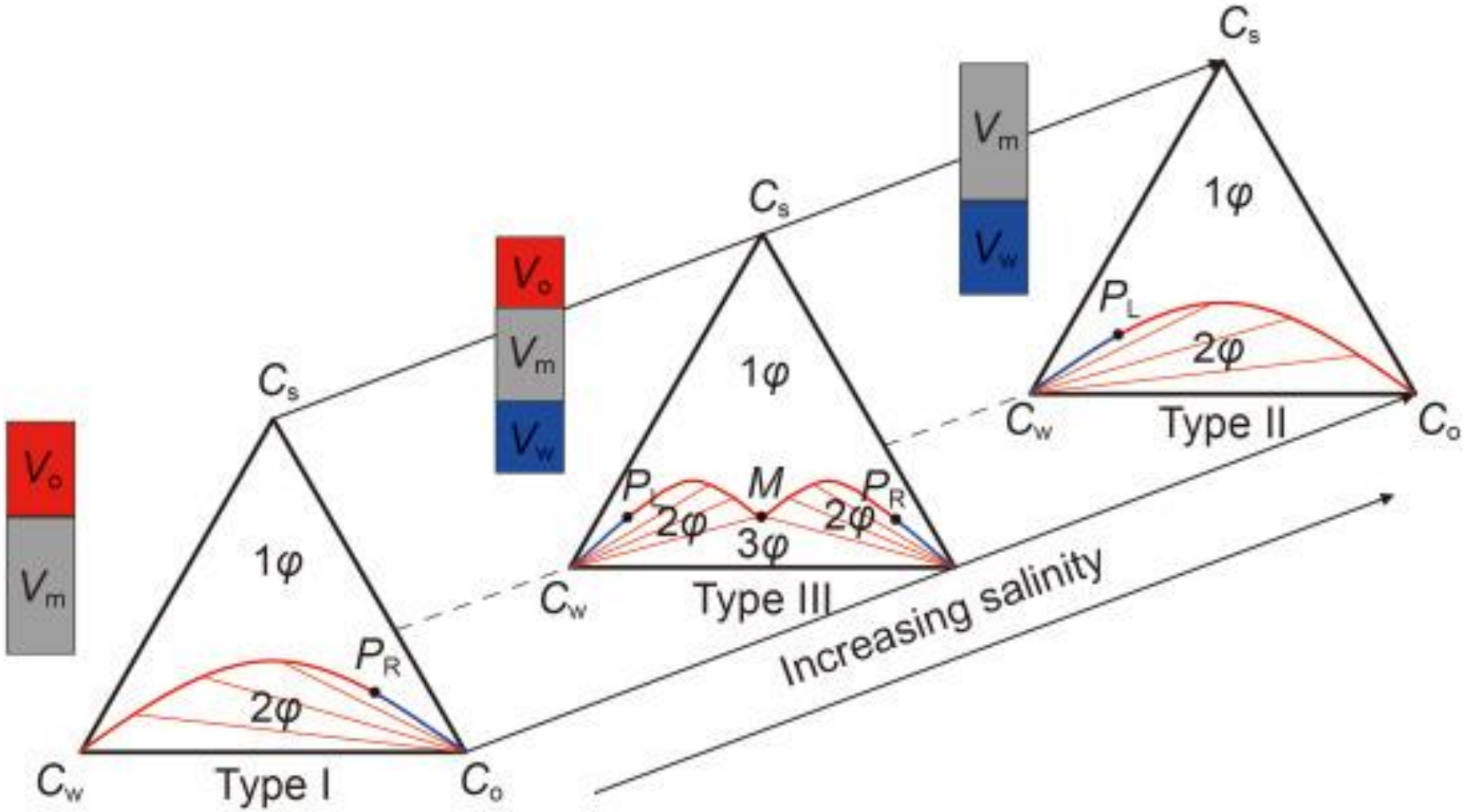
1. Type I (II –)
2. Type II
3. Type III



Schematic of a Ternary Diagram

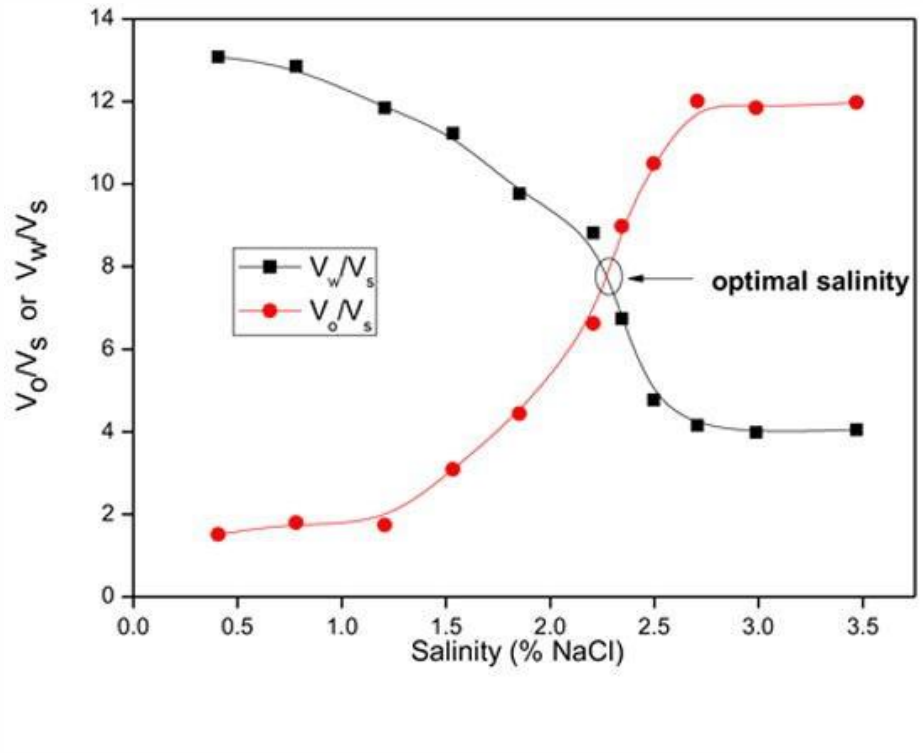


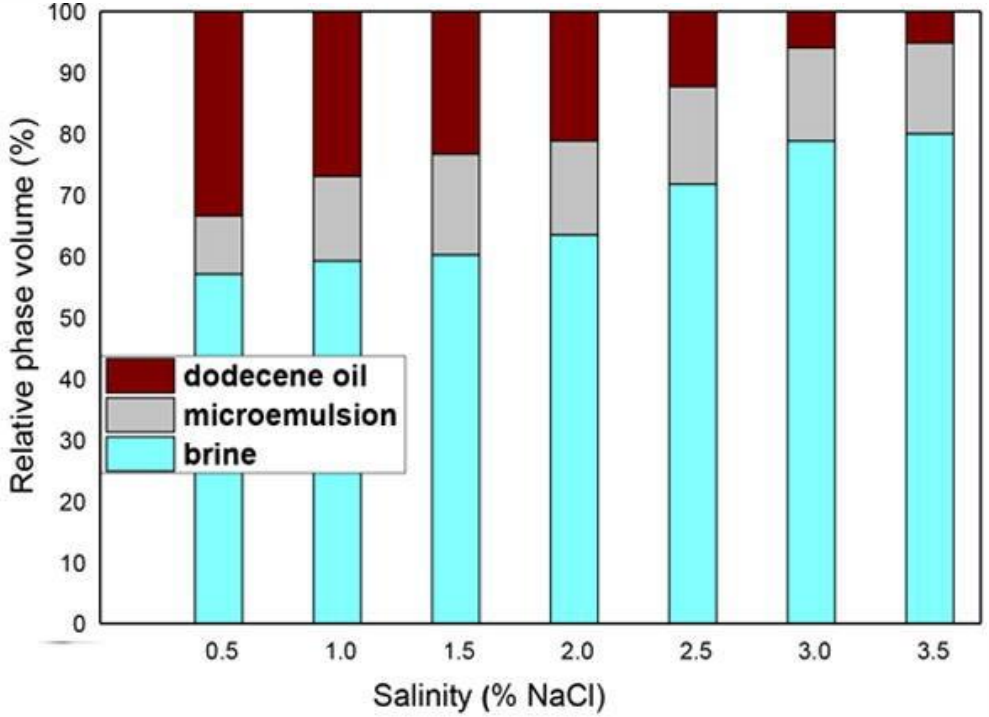
Phase Behavior of Microemulsion



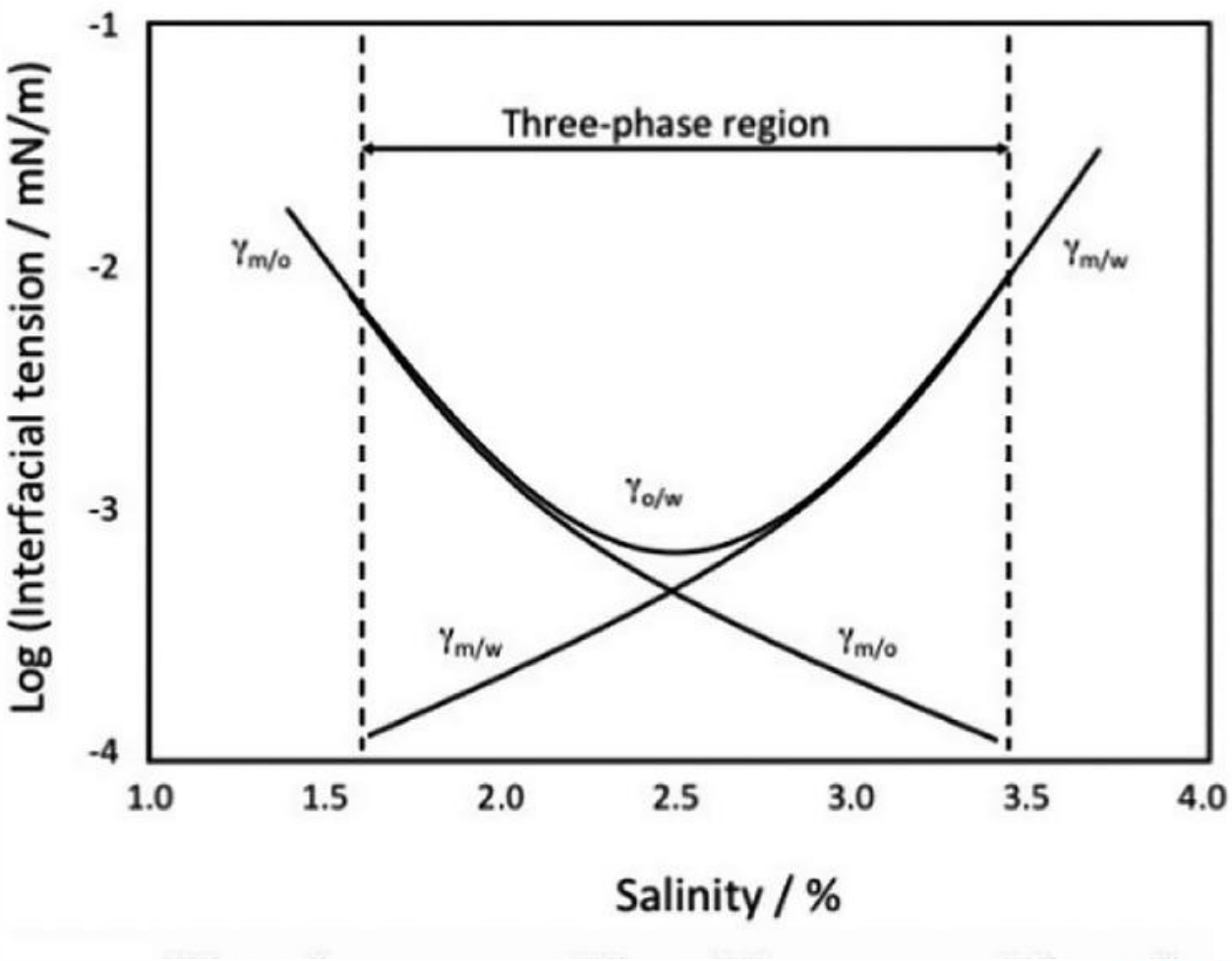
Characteristics of Microemulsion

1 Solubilization Capacity

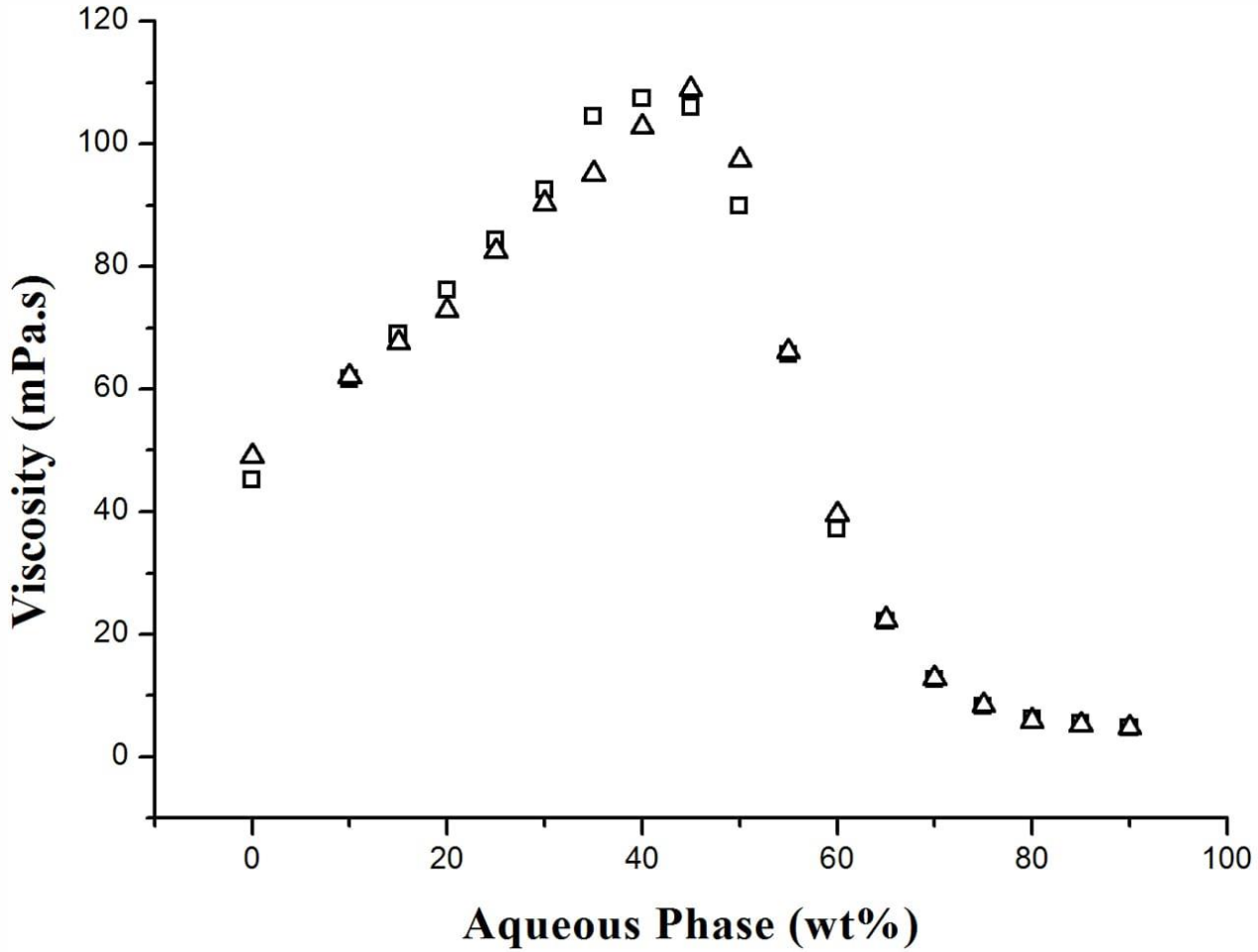




2 IFT Reduction



3 Viscosity and Density



Effect of Chemicals Used

- **Effect of surfactant**
  - Carbon chain length
  - HLB (Hydrophile–Lipophile Balance)
- **Effect of co-surfactant**
  - KM Value