



# Microemulsions

**A Concise Presentation**

**By**

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# HISTORICAL BACKGROUND :

- The microemulsion concept was introduced as early as 1940's by Hoar and Schulman who generated a clear single-phase solution by titrating a milky emulsion by hexanol.
- Schulman and co-worker(1959)subsequently coined the term microemulsion.

# DEFINITION :

“ Micro-emulsions is homogenous, transparent, thermodynamically stable dispersions of water and oil, stabilized by a surfactant, usually in combination with a co-surfactant.”

# ALTERNATIVE NAMES :

Microemulsions are also called as,

- Transparent emulsion
- Swollen micelle
- Micellar solution
- Solubilized oil

# COMPOSITION OF MICRO-EMULSION :

Microemulsions is defined as transparent dispersion consisting of,

1. Oil
2. Surfactant
3. Co-surfactant
4. Water

# MAJOR GOALS :

- To delivery of Hydrophilic as well as Lipophilic drug as drug carriers because of it's
  - 1) Improved drug solubilization capacity
  - 2) Long shelf life
  - 3) Easy of preparation and
  - 4) Improvement of bio-availability

# ADVANTAGES :

- Increase the rate of absorption
- Increase bio-availability
- Helpful in taste masking
- Eliminates variability in absorption
- Helps in solubilizing lipophilic drugs

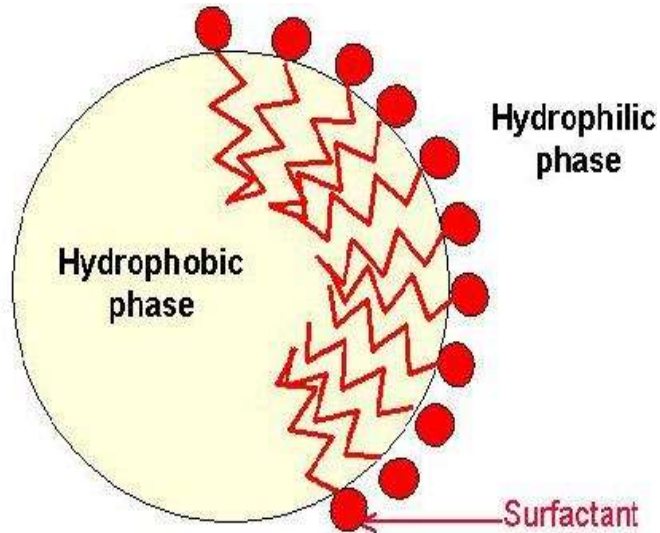


## DISADVANTAGES :

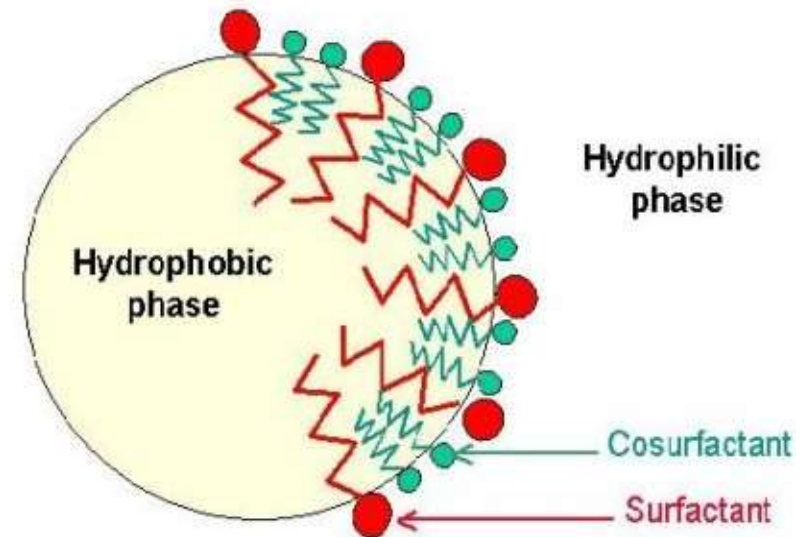
- Use of large concentration of surfactant and co-surfactant necessary for the stabilizing micro droplets.
- Limited solubilizing capacity for high melting substances.
- Microemulsion stability is influenced by environmental parameters such as, temperature & pH. These parameters change upon microemulsion delivery to the patients.

# EMULSIONS Vs MICROEMULSIONS :

## Shape :



**Surfactant:** Forms the interfacial film



**Surfactant:** Forms the interfacial film

**CoSurfactant:** Ensures flexibility of interfacial layer  
=> reduces the interfacial tension

# MACROEMULSIONS Vs MICROEMULSIONS :

FEATURES	MACROEMULSIONS	MICROEMULSIONS
Droplet diameter	1-20mm.	10-100nm.
Appearance	Most of the emulsions are opaque(white).	Microemulsions are transparent.
Stability	They are stable but coalesce finally.	More thermodynamically stable than macro emulsions.
Preparation	Require intense agitation for their formation.	Generally obtained by gentle mixing of ingredients.
Surfactant concentration	2-3% by weight.	6-8% by weight.
Interface contact	Direct oil/water contact at the interface.	No direct oil/water contact at the interface.

# TYPES OF MICROEMULSIONS :

Microemulsions are of 3 types.They are :

- 1) O/W Microemulsion
- 2) W/O Microemulsion
- 3) Bi-continuous microemulsion

- O/W Microemulsion where in droplets are dispersed in the continuous aqueous phase.
- W/O Microemulsion where in water droplets are dispersed in the continuous oil phase.
- Bi-continuous microemulsion where in micro domains of oil & water are inter dispersed within the system.
- In all the three types of microemulsions, the interface is stabilized by an appropriate combination of surfactants and/or co-surfactants.

## PREPARATION METHODS OF MICROEMULSIONS :

Following are the different methods used for the preparation of the microemulsions :

- 1) Phase titration method
- 2) Phase inversion method

# PHASE-TITRATION METHOD :

1. Dilution of an oil-surfactant mixture with water.[W/O]
2. Dilution of a water surfactant mixture with oil.[O/W]
3. Mixing of all components at once, in some systems, the order of ingredients addition may determine whether a microemulsion forms or not.

# PHASE-INVERSION METHOD :

Temperature range in which an o/w microemulsions inverts to a w/o type.

- Using non-surfactants: polyoxyethylene are very susceptible to temperature.

with increasing the temperature, the polyoxyethylene group becomes dehydrated, altering critical packing parameter which results in the phase inversion.

- For ionic surfactants: increasing temperature, increase the electrostatic repulsion between the surfactant headgroups thus causing reversal of film curvature.

Hence, the effect of temperature is opposite to the effect seen with non-ionic surfactants.



# EQUIPMENTS USED FOR THE PREPARATION OF MICROEMULSIONS :

- Colloidal mill



- Rotorstator



- Homogenizer



# FORMATION OF MICROEMULSION :

Microemulsion is formed when

- The interfacial tension at the o/w inter phase are brought at very low level.
- The interfacial tension is kept at highly flexible and fluid.

# FACTORS AFFECTING MICROEMULSION FORMATION :

1. PACKING RATIO
2. PROPERTY OF SURFACTANT
3. PROPERTY OF OIL PHASE
4. TEMPERATURE
5. CHAIN LENGTH
6. NATURE OF CO-SURFACTANT

# EVALUATION PARAMETERS STUDIES :

1. Phase behaviour
2. Size and shape
3. Rheology
4. Conductivity
5. Zeta potential
6. pH
7. Drug release studies
8. Physical stability study

# APPLICATIONS :

- 1) Oral delivery system
- 2) Parenteral delivery system
- 3) Ophthalmic delivery system
- 4) Microemulsions in detergency
- 5) Microemulsions in cosmetics
- 6) Microemulsions in foods

# MARKETED PREPARATIONS :

BRAND NAME	DRUG	COMPANY	DOSAGE FORM	CATEGORY
Douxo seborrhea	Phyto sphingosine	Sogeval	Spray	Emollient
Retamax	Retinol	Skin health inc.,	Cream	Emollient
White glow	SPF25	Lotus herbal	Cream	Emollient
Tray bell	Cocoa extract	Alcantra	Shampoo	Cleansing

# CONCLUSION :

- Microemulsions are potentially quite powerful alternative carrier system for delivery because of high solubilization capacity, transparency, thermodynamic stability, ease of preparation, and high diffusion and absorption rates through skin, when compared to solvent without the surfactant system.
- A number of factors must be considered when using microemulsions as drug delivery system such as surfactant, co-surfactant, oils, pH, HLB, temperature etc.

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