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A REVIEW ARTICLE OF FORMULATION AND EVALUATION OF MICROEMULSIONS

Tejaswini J.Taware [1], Sharda K. Lokade[2],Vinayak A. Katekar[3], Dr. Swati P. Deshmukh[4]

[1,2]Department of Pharmacy, Shraddha Institute of Pharmacy, Washim, Maharashtra, India

[3]Department of Quality Assurance, Shraddha Institute of Pharmacy, Washim, Maharashtra, India

[4]Department of Pharmacology, Shraddha Institute of Pharmacy, Washim, Maharashtra, India

Abstract:

Microemulsions are have appear as novel vehicles for drug delivery system, microemulsions clear, stable, isotropic mixtures of oil, water, and surfactants, frequently in combination with co-surfactants. Microemulsions acts as potential drug carrier systems for oral, topical, and parenteral administration. Micro emulsion can be easily distinguished from normal emulsions by their low viscosity transparency and more accurately and their thermodynamic stability . Micro emulsion have a great range of applications and uses such as in pharmaceutical, agro chemicals, cutting oils, biotechnology, food, cosmetic, and analytical application etc.

KEYWORDS -: *Parental, Transparency, co- surfactants Thermodynamic.*

Corresponding author:

Tejaswini J.Taware,

Department of Pharmacy,
Shraddha Institute of Pharmacy,
Washim, Maharashtra, India

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INTRODUCTION:

Microemulsions are introduced by Hoar and Schulman [4].Micro emulsion are defined as a transparent solution obtained by titrating a normal coarse emulsion with a medium chain alcohols micro emulsion are thermodynamically stable isotropic system in which two immiscible liquids (water and oil) are mixed to for a single phase by means of an appropriate surfactants and co- surfactant .

The particles size of micro emulsion range about 10 nm to 300 nm . Because of the small particles sizes of micro emulsion appears as a clear or transcalent solutions.

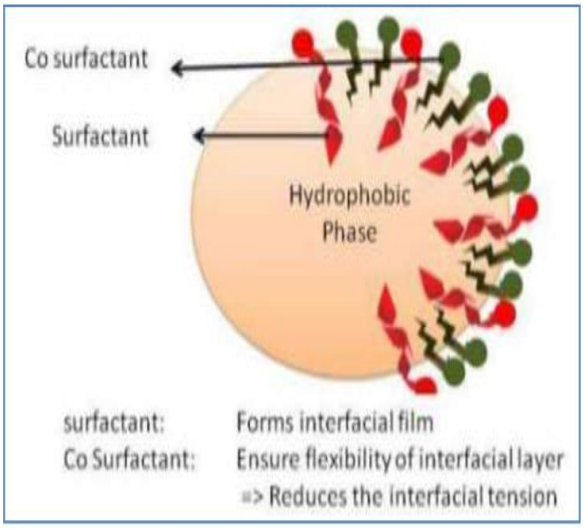


Figure 1: Structure of Microemulsion

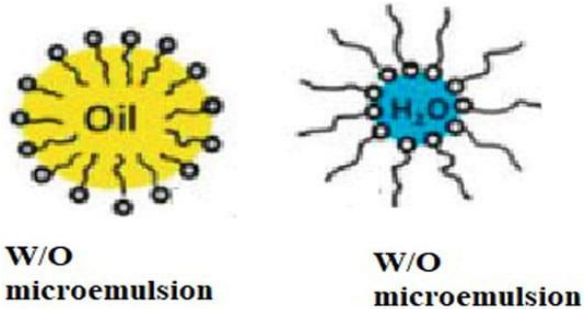
Types of microemulsion -: According to Winsor, there are four types of equilibrium microemulsion phases, these phases are called Winsor phases and are:

A.Winsor I (two-phase system): The upper oil layer is in equilibrium with the lower (o/w) Micro emulsion phase .

B.Winsor II (two-phase system): The upper microemulsion (w/o) is in equilibrium with the lower excess water.

C.Winsor III (triphasic system): The middle bicontinuous phase of o/w (called W/O) is in equilibrium with the upper oil phase and the lower water phase.

D.Winsor IV (single phase system): Forms a homogeneous mixture of oil, water and surfactant.



Formulation of micro emulsion: - The main components of the microemulsion system are:

1) Oil phase
2) Surfactant (primary surfactant)
3) Co-surfactant (secondary surfactant)
4) Co-solvent

1. Oil Phase: The oil phase is the second most important vehicle after water due to its properties to solubilize lipophilic drug molecules and enhance absorption through the lipid layer present in the body.

2. Surfactants: During preparation of the microemulsion, the surfactant must be able to reduce the interfacial tension as close to zero as possible to facilitate the dispersion of all components. These surfactants can be: • Nonionic• Anionic• Cationic• Zwitterionic Example • Polyoxyl 35 castor oil (Cremophor EL) • Polyoxyl 40 hydrogenated castor oil (Cremophor RHCo surfactants).

3.Co-surfactants: It was investigated that high concentrations of single-chain surfactants are required to lower the o/w interfacial tension to a level which allows spontaneous formation of a microemulsion.

4. Co-Solvents: Co-solvents are organic solvents such as ethanol, propylene glycol (PG) and polyethylene glycol (PEG) that help dissolve relatively high concentrations.

Component Example Oil

1)-saturated fatty acid- lauric acid, carpic acid.

2)unsaturated fatty acid-oleic acid, linolic acid, linolenic acid .

3)fatty acid ester-ethyl or methyl ester of lauric, oleic acid and myristic acid.

Prepration of micro emulsion:-

Oil surfactants, cosurfactant and bioactive i.e (drugs) Bioactives are solubilize completely at an ambient temperature with constant stirring.

Addition of water ater drop wise .

Development of clear liquid micro emulsion.

Preparation method of micro emulsions:-

phase titration
phase inversion

Difference between Macroemulsions and Microemulsions: -

S. No.	Macro-emulsion	Micro-emulsion
		
1.	Macro-emulsions are thermodynamically unstable.	Micro emulsions are Thermo dynamically stable.
2.	They may remain stable for long periods of time, will ultimately undergo phase separation on standing to attain a minimum in free energy.	It can have basically infinite lifetime assuming no change in composition, temperature and pressure, and do not tend to separate.
3.	They are lyophobic.	They are on the borderline between lyophobic and lipophilic colloids.
4.	Most macro-emulsions are opaque (white) because bulk of their droplets is greater than wavelength of light and most oils have higher refractive indices than water.	Microemulsion are transparent or translucent as their droplet diameter are less than ¼ of the wavelength of light, they scatter little light.
5.	Droplet diameter 1–20mm.	Droplet diameter 10–100nm.
6.	Macro Emulsions consist of roughly spherical droplets of one phase dispersed into the other.	They constantly evolve between various structures ranging from droplet like swollen micelles to bi-continuous structure.
7.	Inefficient molecular packing.	Efficient molecular packing.
8.	Direct oil/water contact at the interface.	No direct oil/water contact at the interface.

Advantages of Microemulsion: -

1. Microemulsions are easily prepared and require no energy contribution during preparation this is due to better thermodynamic stability.
2. Microemulsions have low viscosity compared to primary and multiple emulsions.
3.The formation of micro-emulsion is reversible. They may become unstable at low or high temperature but when the temperature returns to the stability range, the micro-emulsion reforms.

Disadvantages of Microemulsions:-

1. Thermodynamically unstable
2. Short life span
3. Leads to creaming and cracking
4. Leads to phase inversion

Evaluation parameters of Microemulsions :-

1)Physical appearances:-Visual examination of the physical characteristics of the microemulsion can reveal its homogeneity, fluidity, and optical clarity .

2)Scattering Techniques [36]:- Studies of the structure of microemulsions have used scattering techniques like small angle neutron scattering, small angle X-ray scattering, and light scattering, particularly in the case of dilute monodispersed spheres in polydisperse or concentrated systems like those frequently found in microemulsions.

3)Limpidity Test (Percent Transmittance) [37]:- A spectrophotometer can be used to spectrophotometrically determine the microemulsion's limpidity.

4)Drug stability [38]:- The ideal microemulsion was stored at low temperature (4–8 °C), room temperature, and high temperature (50–2 °C). The microemulsion can be examined for phase separation, percent

transmittance, globule size, and assay every two months.

4)Globule size and zeta potential measurements [39]:- Using a Zetasizer HSA 3000, dynamic light scattering can be used to measure the microemulsion's globule size and zeta potential.

5)Assessment of the Rheological Properties (viscosity measurement) [40]:- The stability is significantly influenced by the rheological characteristics. The Brookfield digital viscometer can ascertain it. Rheological properties that change can be used to distinguish the microemulsion zone from other regions. The bicontinuous structure, the swelling reverse micelle, and the swollen micelles all fluctuate continuously in bicontinuous microemulsions.

6)Electrical conductivity [41]:-A mixture of oil, surfactant, and co-surfactant was given a dropwise addition of the water phase. The electrical conductivity of the created samples was then evaluated using a conductometer at room temperature and at a constant frequency of 1 Hz.

7)Drug solubility [42]:-The improved microemulsion formulation and every component within received an excessive addition of drug. After 24 hours of nonstop stirring at room temperature, samples were taken out and centrifuged for 10 minutes at 6000 rpm. By deducting the drug contained in the sediment from the total amount of drug added, the amount of soluble drug in the optimised formulation as well as each individual ingredient of the formulation were estimated. Comparing the drug's solubility in microemulsions based on each of its component parts.

8)In-vitro drug release [43, 44] :- In a 20mL volume, a modified Franz diffusion cell can be used to conduct the diffusion investigation. With buffer, the receptor compartment was filled. The microemulsion formulation and the pure drug solution were contained separately in the donor compartment, which was fixed with a cellophane membrane. Samples were taken out of the receptor compartment at specified intervals and put through a UV spectrophotometer at a certain wavelength to be tested for drug.

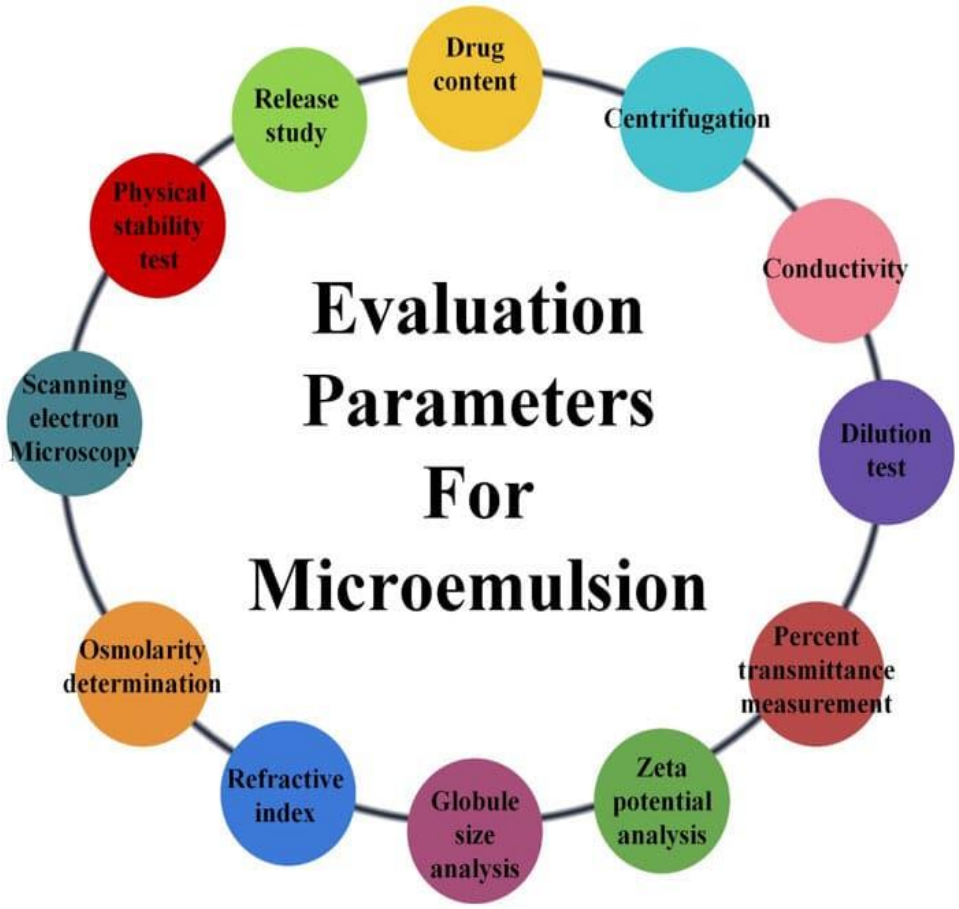


Figure 4: Evaluation Parameters For Microemulsion

CONCLUSION:

Micro-emulsion is drug delivery systems for the delivery of more than one medicament simultaneously. Micro-emulsion protects labile drug, control drug release, increase drug solubility, increase bioavailability, and reduce patient variability also it has proven possible to formulate preparations suitable for most routes of administration. The role of microemulsion in providing novel solutions to overcome the problems of poor aqueous solubility of highly lipophilic drug compounds and provide high, more consistent, and reproducible bioavailability. The drug delivery through the micro-emulsion is a promising area for the continued research with the aim of achieving the controlled release with enhanced bioavailability and for drug targeting to various sites of the body.

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[7]. 1*Khyati College of Pharmacy, Gujarat Technological University, Ahmedabad, Gujarat, India. Email: kamlesh779131@gmail.com2Department of Quality Assurance, Khyati College of Pharmacy, Gujarat Technological University, Ahmedabad, Gujarat, India.3Department of Pharmacology, Khyati College of Pharmacy, Gujarat Technological University, Ahmedabad, Gujarat, India.*Correspondence Author: Kamlesh Solanki

[8].Microemulsions-A reviewBysu Sujatha*1, E. Himabindu2, Dr. Sowjanya Bttu3 Dr. Konde Abbulu41,2,3,4 Department of Pharmaceutics, CMR College of pharmacy,Kandlakoya Village, Medchal, Hyderabad-501401.

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