"Comparative Study of Nano Emulsion & Microemulsion"

Mrs. Pooja Suresh Thorat*, Ritesh Shelke¹, Sumit Shelke², Mayuresh Vanarase

Assistant Professor, Shri Swami Samarth Institute of Pharmacy*,
Student of Final Year B. Pharmacy, Shri Swami Samarth Institute of Pharmacy, Malwadi.

Abstract – Emulsion is a biphasic liquid dosage form. These are of two types, oil in water and water in oil, it is a conventional method. Now-a-days novel dosage forms are used like microemulsions and Nano emulsions. This paper is an attempt to summarise comparative aspects like definition, theories, types, methods of preparations, limitations, advantages, disadvantages and methods of analysis of micro-emulsion and nano-emulsion. This paper aims at clarifying the problem, first by reviewing all the physical and physicochemical fundamentals regarding these two systems, using a quantitative thermodynamic approach for microemulsions and Nano emulsion.

Keywords – Microemulsion, Nanoemulsion, Surfactant, Interfacial theory, thermodynamics theory

Introduction –
The Word “Emulsion” Comes from the latin word “to milk”. An emulsion is mixture of two or more liquids that are normally immiscible or non-mixable.¹ Two immiscible liquid phases which are mixed using mechanical shear and surfactant. Surface active agent or molecule is known as surfactant. Choice of surfactants on the basis of hydrophilic lipophilic balance (HLB). HLB scale value or critical packaging parameter is help to develop desired emulsion. Microemulsion is thermodynamically stable. It is prepared by using oil, surfactant, water & co-surfactant.²,³ Nanoemulsions are a colloidal particulate system in the submicron size range acting as carriers of drug molecules. Their size varies from 10 to 1,000 nm. These carriers are solid spheres and their surface is amorphous and lipophilic with a negative charge. Magnetic nanoparticles can be used to enhance site specificity. As a drug delivery system they enhance the therapeutic efficacy of the drug and minimize adverse effect and toxic reactions. Major application includes treatment of infection of the reticular endothelial system (RES), enzyme replacement therapy in the liver, treatment of cancer, and vaccination.

An emulsion is a biphasic system in which one phase is intimately dispersed in the other phase in the form of minute droplets ranging in diameter from 0.1 to 100 μm. It is a thermodynamically unstable system, which can be stabilized by the presence of an emulsifying agent (emulgent or emulsifier).⁴,⁵

The dispersed phase is also known as internal phase or the discontinuous phase while the outer phase is called dispersion medium, external phase or continuous phase. The emulsifying agent is also known as intermediate or interphase. The term “nanoemulsion” also refers to a miniemulsion. which is fine oil/water or water/oil dispersion stabilized by an interfacial film of surfactant molecule having droplet size range 20-600 nm. Because of small size, nanoemulsions are transparent.

Nanoemulsion –
A ultra fine emulsion (nanoemulsion) is a particular type of emulsion. A ultra fine emulsion is obtained by shearing a mixture comprising two immiscible liquid phases, one or more surfactants and, possibly, one or more co-surfactants.⁶

Types (³): There are three types of nanoemulsion which can be formed:

a) oil in water (o/w) nanoemulsion
b) water in oil (w/o) nanoemulsion.
c) Bi-continuous nanoemulsions
Advantages [8,9] -
1. Reduction of globules as the potential to:
   - Increase surface area
   - Enhance solubility
   - More rapid onset of therapeutic action
   - Increase oral bioavailability
2. They do not show the problems of inherent creaming, flocculation, coalescence and sedimentation.
3. It is used to improve water solubility and ultimate bioavailability of lipophilic drugs.
4. It is preferred dosage form to incorporate GIT irritation causing active drugs.
5. It is preferred dosage form to incorporate first pass metabolism mediated Degradation prone drugs.

Disadvantages [10,11] -
1. The cost of fabrication of nano emulsion is expensive.
2. Excess concentration of surfactants can lead to mucosal toxicity

Composition [12] -
1. Oil phase
2. Surfactant (Primary surfactant)
3. Co-surfactant (Secondary surfactant)
4. Co-Solvent

Components -
Table 1: Commonly used components of Microemulsion and Nanoemulsion [13-14,15,16]

| 1. Oils | Saturated fatty acid-lauric acid, myristic acid, capric acid Unsaturated fatty acid-oleic acid, linoleic acid, Fatty acid ester-ethyl or methyl esters of Lauric, myristic |
| 2. Surfactant | Poly- oxy-ethylene /Polysorbate /Tweein 20,40,60,80; Sorbitan Monolaureate (Span), Soybean lecithin, egg lecithin, lysolecithin, Sodium dodecyl sulphate (SDS); Sodium bis (2-ethylhexyl) sulphosuccinate (Aerosol OT), Dioctyl sodium Sulphosuccinate, Sodium deoxycholate, Labrasol |
| 3. Co-surfactant | Ethanol, propanol, Isopropanol, butanol, pentanol, hexanol, sorbitol, n–pentanoic Acid, n–hexanoic acid, n–butylamine, sec, butylamine, 2–aminopentane, 1,2 Butanediol, Propylene glycol. Some newly evolved cosurfactants are as follows : Cremophor RH40 (polyoxyl 40 hydrogenated castrol oil), (polyglyceryl-6-dioleate), Plurisolostearique (isosteric acid of polyglycerol), Poloxamer Polyoxyethylene–10–oleyl ether (Brij 96V) Polysorbate 80 (Tween80) Span 20 Sodium mono hexyl phosphate Sodium mono octyl phosphate, N,N–Dimethyl dodecylamine–N–oxide (DDNO), Cinnamic alcohol, Cinnamic aldehyde. |
Limitations Of Nanoemulsion[17]

- The manufacturing of Nanoemulsion is an expensive process.
- Stability of nanoemulsion is an unacceptable and creates a big problem during the storage of formulation for the longer period time.
- Less availability of surfactant and cosurfactant required for the manufacturing of nanoemulsion

Methods Of Preparation-

1. High energy emulsification methods
2. High pressure homogenization
3. High shear stirring
4. Ultrasonic emulsification
5. Microfluidization
6. Phase inversion
7. Solvent evaporation
8. Low energy emulsification
9. Spontaneous Nano emulsification

1. High Energy Emulsification Methods - Nano emulsions are non-equilibrium systems which cannot be formed spontaneously. For this reason, mechanical or chemical energy input is necessary to form them. Nano emulsions are generally prepared by using high energy methods in which mechanical energy input is applied by high pressure homogenizers, high shear stirring, and ultrasound generators [20]. These mechanical devices provide strong forces that disrupt oil and water phases to form Nano emulsions. In high energy methods, input energy density is about 108–1010 W kg−1 [19]. Required energy is supplied in a shortest time to the system in order to obtain homogeneous small sized particles. High-pressure homogenizers are capable of doing this and therefore they are the most widely used devices for preparing Nano emulsions [21]. Moreover, producing emulsions using ultrasound is a cost-effective process which needs less surfactant use. Therefore, considering conventional mechanical processes more homogeneous batches are achieved [18].

2. High pressure Homogenization - This method specially designed high-pressure homogenization instrument which is used to produce nano sized particles. At very high pressure (500 to 5000 psi), oil phase and water phase are allowed to force through small inlet orifice. So extremely small size particles are created due to strong turbulence and hydraulic shear. But this method requires high temperature and energy. Pressure, homogenization cycles are directly responsible for particle size [22]. Higher the pressure and higher the homogenization cycles, smaller the particle size. This method is easy to scale up.

3. High Shear stirring - In this method, high-energy mixers and rotor-stator Systems are used for the preparation of Nano emulsions. Droplet sizes of the internal phase can be significantly Decreased by increasing the mixing intensity of these Devices. However, obtaining emulsions with the Average droplet size less than 200-300 nm is rather difficult [24].

4. Ultrasonic Emulsification - This method is based on the principle that when coarse emulsion is in ultrasonic field and external pressure is increased, cavitation’s threshold also increases to Limit where fine nano size particles is formed [25].

5. Microfluidization - It is most widely employed in the pharmaceutical industry in order to acquire fine emulsions. In this method, a device called microfluidizer is used which provides high pressures (Figure 2). During the process, high pressure forces the macro emulsion to go through to the interaction chamber and thus Nano emulsions with submicron ranged particles can be produced. Uniform nanoemulsion production can be achieved by repeating the process many times and varying the operating pressure in order to get desired particle size [26].

6. Phase Inversion - These methods utilize the chemical energy that is released because of the phase transitions during emulsification process. Required amount of phase transitions are achieved by changing the composition at constant temperature or by changing the temperature at constant composition [27].

7. Solvent Evaporation - In this technique, initially mix the drug with organic solvent using suitable surfactant and prepare o/w emulsion by mixing continuous phase. Then evaporate organic solvent under vacuum or heating or at atmospheric conditions to obtain microspheres loaded with drug followed by centrifugation or filtration [28].
8. Low Energy Emulsification - Nanomulsification can also be achieved with low energy methods which provides small size and more uniform droplets\cite{20,21}. These methods such as phase inversion temperature and phase inversion component provide smaller and more uniform droplets by using physicochemical properties of the system\cite{29}. Although low energy procedures are generally more effective to produce small droplet sizes than high energy procedures, there are some limitations for them about the using of some types of oils and emulsifiers like proteins and polysaccharides. In order to overcome this problem high level of synthetic surfactant concentrations are used to produce nanoemulsions in low energy techniques but this narrows down their application area, especially for many food process.

9. Spontaneous Nanoemulsification - This method is simple and uses volatile organic solvent composition of oil, water, lipophilic and hydrophilic surfactant. This composition is allowed to mix homogeneously by magnetic stirring. Then evaporate the water-miscible solvent under the vacuum to obtain nano-emulsion\cite{30}.

**Application Of Nanoemulsion**\cite{31}
- Parenteral delivery
- Oral drug delivery
- Topical drug delivery
- Ocular and pulmonary delivery
- Nanoemulsions in biotechnology

1. Parenteral Delivery: Parenteral administration (especially via the intravenous route) of drugs with limited solubility is a major problem in industry because of the extremely low amount of drug actually delivered to a targeted site. Nanoemulsion formulations have distinct advantages over macroemulsion systems when delivered parenterally because of the fine particle Nanoemulsion is cleared more slowly than the coarse particle emulsion and, therefore, have a longer residence time in the body. Both O/W and W/O Nanoemulsion can be used for parenteral delivery. The literature contains the details of the many Nanoemulsion systems, few of these can be used for the parenteral delivery because the toxicity of the surfactant and parenteral use. An alternative approach was taken by Von Corsewant and Thoren in which C3-C4 alcohols were replaced with parenterally acceptable co-surfactants, polyethylene glycol (400) / polyethylene glycol (660) 12 hydroxystearate / ethanol, while maintaining a flexible surfactant film and spontaneous curvature near zero to obtain and almost balanced middle phase Nanoemulsion. The middle phase structure was preferred in this application, because it has been able to incorporate large volumes of oil and water with a minimal concentration of surfactant.

2. Oral Drug Delivery - Nanoemulsion formulations offer the several benefits over conventional oral formulation for oral administration including increased absorption, improved clinical potency, and decreased drug toxicity. Therefore, Nanoemulsion have been reported to be ideal delivery of drugs such as steroids, hormones, diuretic and antibiotics. Pharmaceutical drugs of peptides and proteins are highly potent and specific in their physiological functions. However, most are difficult to administer orally. With on oral bioavailability in conventional (i.e. non-Nanoemulsion based) formulation of less than 10\%, they are usually not therapeutically active by oral administration. Because of their low oral bioavailability, most protein drugs are only available as parenteral formulations. However, peptide drugs have an extremely short biological half life when administered parenterally, so require multiple dosing. A Nanoemulsion formulation of cyclosporine, named NeoralR has been introduced to replace SandimmuneR, a crude oil-in-water emulsion of cyclosporine formulation. NeoralR is formulated with a finer giving, division it a more rapid and predictable absorption and less inter and intra patient variability.

3. Topical Drug Delivery - Topical administration of drugs can have advantages over other methods for several reasons, one of which is the avoidance of hepatic first pass metabolism of the drug and related toxicity effects. Another is the direct delivery and targetability of the drug to affected area of the skin or eyes. Both O/W and W/O Nanoemulsions have been evaluated in a hairless mouse model for the delivery of prostaaglandin E1. The Nanoemulsions were based on oleic acid or Gelucire 44/14 as the oil phase and were stabilized by a mixture of Labrasol (C8 and C10 polyglycolysed glycerides) and Plurol Oleique CC 497 as surfactant. Although enhanced delivery rates were observed in the case of the O/W Nanoemulsion, the authors concluded that the penetration rates were inadequate for practical use from either system. The use of lecithin/IPP/water Nanoemulsion for the transdermal transport of indomethacin and diclofenac has also been reported. Fourier transform infra red (FTIR) spectroscopy and differential scanning calorimetry (DSC) showed the IPP organ gel had disrupted the lipid organisation in human stratum corneum after a 1 day incubation. The transdermal delivery of the hydrophilic drug diphenhydramine hydrochloride from a W/O Nanoemulsion into excised human skin have also been investigated. The formulation was based on combinations of Tween 80 and Span 20 with IPPM. However two additional formulations were tested containing cholesterol and oleic acid, respectively. Cholesterol increased drug penetration whereas oleic acid had no measurable effect, but the authors clearly demonstrated that penetration characteristics can be modulated by compositional selection.

4. Ocular and Pulmonary Delivery - For the treatment of eye diseases, drugs are essentially delivered topically. O/W Nanoemulsions have been investigated for ocular administration, to dissolve poorlysoluble drugs, to increase absorption and to attain prolong release profile. The Nanoemulsions containing pilocarpine were formulated using lecithin, propylene glycol and PEG 200 as co-surfactant and IPPM as the oil phase. The formulations were of low viscosity with a refractive index lending to ophthalmologic applications. The formation of a water-in-HFA propellant Nanoemulsion stabilized by fluorocarbon non-ionic surfactant and intended for pulmonary delivery has been described.

**Micro emulsion**
A micro emulsion is a thermodynamically stable fluid that differs from kinetically stable emulsions, which will separate into oil and water over time. The particle size of micro emulsions ranges from about 10–300 nm. Because of this small particle size, micro emulsions appear as clear or translucent solutions\cite{32}. 
Advantages\[33,34,38,39\] –
- It is very easy to prepare and scale up due to spontaneous formation ability.
- It is very good system to raise the rate of absorption as well as bioavailability by eliminating interfering variations.
- It able to improve solubility of lipophilic drugs.
- It is thermodynamically more stable system as compared to conventional system and hence suitable for long term use.
- It can be preferred to develop sustained and controlled release drug system.
- It is the best system to minimize first pass metabolism.
- Having the ability to carry both lipophilic and hydrophilic drugs.
- Microemulsions have low viscosity compared to primary and Multiple emulsions.
- The formation of microemulsion is reversible. They may become unstable at low or high temperature but when the temperature returns to the stability range, the microemulsion reforms.

Disadvantages\[35,36,37\] –
- Additional use of excess amount of surfactant and co-surfactant increases the cost.
- Excess concentration of surfactants can lead to mucosal toxicity.
- Limited solubilizing capacity for high-melting substances used in the system.

Limitation\[37,38,39\] –
- The concentration of surfactants and co-surfactants used must be kept low for toxicological reasons.
- Microemulsion also suffers from limitations of phase separation.
- For intravenous use, the demand of toxicity on the formulation is rigorous and very few studies have been reported so far.
- Use of those surfactants which are included in “generally regarded As safe” (GRAS) category can reduce toxicity.

Theories
1. Interfacial theory- It is also called as mixed film or dual film theory. Surfactant and co-surfactant together forms complex film (Figure 3) at the oil water interface and thus creates generation of micro emulsion droplets\[14,40\].
2. Solubilization theory - This theory assumes that swollen micellar system forms in the form of micro emulsion. Oil solubilised due to normal micelle formation and water solubilised by reverse micelle formation\[41,42\].
3. Thermodynamic theory- When interfacial tension between two immiscible phases reduces to zero, causes spontaneous formation of micro emulsions and formed negative free energy helps to make emulsion thermodynamically stable. Microemulsions are also called as transparent emulsion, swollen micelle and micellar solution. self-microemulsifying drug delivery system (SMEDDS) is also one of the popular term for microemulsion mediated delivery of drugs.\[43\] The term microemulsion is coined by T. P. Hoar and J. H. Shulman when they used this term to describe multiphase system consisting of water, oil, surfactant and alcohol which forms a transparent solution in 1953. But discovery of microemulsions confirms well before use in the form white spirit and or liquid waxes.

Types- According to Winsor, there are four types of micro emulsion phases exists in equilibrium, these phases are referred as Winsor phases\[43,44\] they are:
1. Winsor I (two phase system): Upper oil layer exists in equilibrium with lower (o/w) micro emulsion phase.
2. Winsor II (two phase system): The upper (w/o) micro emulsion exists in equilibrium with lower excess water.
3. Winsor III (three phase system): The middle bi-continuous phase of o/w and w/o exists in equilibrium with upper phase oil and lower phase water.
4. Winsor IV (single phase system): It forms homogenous mixture of oil, water and surfactant.

Methods Of Preparation –
1. Phase Titration Method - Microemulsions are prepared by the spontaneous emulsification method (phase titration method) and can be depicted with the help of phase diagrams. Construction of phase diagram is a useful approach to study the complex series of interactions that can occur when different components are mixed. Microemulsions are formed along with various association structures (including emulsion, micelles, lamellar, hexagonal, cubic, and various gels and oily dispersion) depending on the chemical composition and concentration of each component. The understanding of their phase equilibrium and demarcation of the phase boundaries are essential aspects of the study. As quaternary phase diagram (four component system) is time consuming and difficult to interpret, pseudo ternary phase diagram is often constructed to find the different zones including microemulsion zone, in which each corner of the diagram represents 100\% of the particular component Fig. (3) The region can be separated into w/o or o/w microemulsion by simply considering the composition that is whether it is oil rich or water rich. Observations should be made carefully so that the metastable systems are not included.\[45,46\]
2. Phase inversion temperature method (PIT) - Phase inversion of micro emulsions means conversion of O/W to W/O system by adding excess of the dispersed phase or by rising the temperature when non-ionic surfactant is used to change spontaneous curvature of the surfactant which brings system near to minimal surface tension and to form fine dispersed oil droplets [47, 48]. This method shows extreme changes in particle size which further leads to changes in in-vivo and in-vitro drug release pattern [49, 50].

Composition –

The major components of micro emulsion system are [51]:
- Oil phase
- Surfactant (Primary surfactant)
- Co-surfactant (Secondary surfactant)
- Co-Solvent

Oil phase - Oil phase is the second most important vehicle after water, due to its properties to solubilise the lipophilic drug molecules and improve absorption through lipid layer present in body [52]. Oil has unique property of penetrating cell wall and hence very useful for lipophilic active drug delivery. Swelling of tail group region of the surfactant is influenced by oil phase. Such penetration is to greater extent in case of short chain alkanes compared to long chain alkanes [53]. The oil being one of the most important excipients in the formulation not only because it can solubilise the required dose of microemulsion to be formed (transient) negative value was required, it is recognized that while value of A is positive at all times, it is very small and it is offset by the entropic component. The dominant favourable entropic contribution is very large dispersion entropy arising from the mixing of one phase in the other in the form of large number of small droplets. However there are also expected to be favourable entropy contributions arising from other dynamic processes such as surfactant diffusion in the interfacial layer and monomer-micelle surfactant exchange. Thus a negative free energy of formation is achieved when large reductions in surface tension are accompanied by significant favourable entropic change. In such cases, microemulsion is spontaneous and the resulting dispersion is thermodynamically stable [54, 55].

Example - Saturated fatty acids: lauric, myristic and capric acid

Unsaturated fatty acids: oleic acid, linoleic acid

Fatty acid esters: ethyl or methyl esters of lauric, myristic and oleic acid.

Surfactant - During the preparation of microemulsion, surfactant must be able to Reduce the interfacial tension nearest to zero to facilitate dispersion of all components. These surfactants can be:
- Non-ionic
- Anionic
- Cationic
- Zwitterionic

Nature of surfactants helps in deciding the stability of microemulsion. Dipole and hydrogen bond interactions stabilizes non-ionic surfactant and electrical double layer stabilizes ionic surfactants. Ionic surfactants are also affected by salt concentration. Hence ionic surfactants being sensitive in stability issues and due to toxicity concern, are generally non preferable. But non-ionic surfactants can produce nontoxic pharmaceutical dosage forms and hence more popular [56].

Surfactants with HLB values 3-6 are useful in preparation of W/O micro emulsion and surfactants with higher HLB values 8-18 are useful in the preparation of O/W micro emulsion. Surfactants with more than 20 HLB values acts as co-surfactants to reduce.

Examples of non-ionic surfactants:
- Polyoxyxyl 35 castor oil (Cremophor EL)
- Poly-oxyl 40 hydrogenated castor oil (Cremophor RH 40)
- Polysorbate 20 (Tween20)
- Polysorbate 80 (Tween80)
- d-α-tocopherol polyethylene glycol 1000 succinate (TPGS)
- Solutol HS-15
- Sorbitan monooleate (Span80)

Co-surfactants –
It is studied that high concentrations of single-chain surfactants are required to reduce the o/w interfacial tension to a level to enable a spontaneous formation of a microemulsion. However, if co-surfactants are added then with minimum concentration of surfactants different curvatures of interfacial film can be formed to generate the stable microemulsion composition.\textsuperscript{57,58} Co-surfactants raise the fluidity of the interface due to presence of fluidizing groups like unsaturated bonds, then demolishes liquid crystalline or gel structure and alters the HLB value in such way to cause spontaneous formation of microemulsion.\textsuperscript{59,60}

Example-
- Short chain alcohols like ethanol to butanol.
- Short chain glycols like propylene glycol.
- Medium chain alcohols like amines or acids

Co-solvents –
Co-solvents are organic solvents like ethanol, propylene glycol (PG), and polyethylene glycol (PEG) which helps to dissolve relatively high concentrations of surfactants as well as lipid soluble drugs. Hence cosolvents are also considered as co-surfactants.

Applications -

![Applications of microemulsion](image)

**Fig.4 Represent Application Of Microemulsion**

**Oral delivery**\textsuperscript{61}
The development of effective oral delivery systems has always been challenging to researchers because drug efficacy can be restricted by instability or poor solubility in the gastrointestinal fluid. Microemulsions have the potential to enhance the solubilization of poorly soluble drugs (particularly BCS class II or class IV) and overcome the dissolution related bioavailability problems. Due to the presence of polar, nonpolar and interfacial domains, hydrophilic drugs including macromolecules can be encapsulated with varying solubility. These systems have been protecting the incorporated drugs against oxidation, enzymatic degradation and enhance membrane permeability. Presently, Sandimmune Neoral(R) (Cyclosporine A), Fortovase(R) (Saquinavir), Norvir(R) (Ritonavir) etc. are the commercially available microemulsion formulations. Microemulsion formulation can be potentially useful to improve the oral bioavailability of poorly water soluble drugs by enhancing their solubility in gastrointestinal fluid.

**Parenteral delivery**\textsuperscript{62}
The formulation of parenteral dosage form of lipophilic and hydrophilic drugs has proven to be difficult. O/w microemulsions are beneficial in the parenteral delivery of sparingly soluble drugs where the administration of suspension is not required. They
provide a means of obtaining relatively high concentration of these drugs which usually requires frequent administration. Other advantages are that they exhibit a higher physical stability in plasma than liposome’s or other vehicles and the internal oil phase is more resistant against drug leaching. Several sparingly soluble drugs have been formulated into o/w microemulsion for parenteral delivery.

**Topical delivery**[63]
Topical administration of drugs can have advantages over other methods for several reasons, one of which is the avoidance of hepatic first-pass metabolism, salivary and degradation of the drug in stomach and related toxicity effects.

**Ophthalmic delivery**[64,65]
In conventional ophthalmic dosage forms, water soluble drugs are delivered in aqueous solution while water insoluble drugs are formulated as suspension or ointments. Low corneal bioavailability and lack of efficiency in the posterior segment of ocular tissue are some of the serious problem of these systems. Recent research has been focused on the development of new and more effective delivery systems. Microemulsions have emerged as a promising dosage form for ocular use.

<table>
<thead>
<tr>
<th>Table.2 Various Parameters Of Nanoemulsion and Microemulsion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parameters</strong></td>
</tr>
<tr>
<td>Appearance</td>
</tr>
<tr>
<td>Particle size</td>
</tr>
<tr>
<td>Formation</td>
</tr>
<tr>
<td>Stability</td>
</tr>
<tr>
<td>Phases</td>
</tr>
<tr>
<td>Viscosity</td>
</tr>
<tr>
<td>Preparation Cost</td>
</tr>
<tr>
<td>Interfacial tension</td>
</tr>
<tr>
<td>Optical Isotropy</td>
</tr>
<tr>
<td>Types</td>
</tr>
<tr>
<td>Formulation Methods</td>
</tr>
<tr>
<td>Theories</td>
</tr>
</tbody>
</table>

**Conclusion**
Oil-in-water nanoemulsions and microemulsions are two common forms of colloidal dispersions that are used to encapsulate the lipophilic components. This article has emphasized their key distinctions and similarities. Similarities between microemulsion and nanoemulsion. These two systems’ composition, dimensions, architectures, and construction techniques, which Has caused a great deal of uncertainty on the exact nature of the colloidal in the literature. Being researched is dispersion. The definitions that follow are suggested to demonstrate similarities and Distinctions between nanoemulsions and microemulsions; An emulsion of oil and water.A thermodynamically stable colloidal dispersion known as a microemulsion is described as Small, distributed spherical particles made of oil, surfactant, and cosurfactant Inside a liquid medium. Oil-in-water nanoemulsions are known as nanoemulsions. Two immiscible liquids are combined to form a colloidal dispersion that is thermodynamically unstable tiny, spherical droplets (r 100 nm) of one liquid are spread across the other liquid. The distinction between microemulsions and nanoemulsions must be made precisely because it affects how they are made, how stable they are over time, and how well they function. We also suggest a number of practical techniques.Longterm storage, shelf life, adjusting sample history, particle size distribution measurements, or particle shape measurements, which may be helpful for identifying whether a specific colloidal dispersion is a microemulsion or a nanoemulsion.
REFERENCES –

1. Emulsions, group no-2 course physical Pharmacy course code 311, Sara 27sara SlideShare page .2
17. Nanoemulsion slide share by mr. sagar kishor savale department of pharmaceutical.
32. Johannes Karl Fink in petroleum engineer guide to oil field chemicals and fluids 2012
61. Hsu-O Ho, Chih-Chuan Hsiao, Ming-Thau Sheu; Preparation of microemulsions using polyglycerol fatty acid esters as surfactant for the delivery of protein drugs; J Pharm Sci., 85 (1996) 138-143.