Advancement in Nanoemulgel Formulations: A Comprehensive Review

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Abstract: Conventional dosage forms like creams, ointment, emulsions, gels are restricted because poor drug penetration to address this nanoemulgel was developed. Currently 40% marketed drug and 90% of those in development pipeline are lipophilic in nature. Nanoemulgel demonstrated remarkable advantages for lipophilic drugs compared to other formulations. It is innovative technique that is formulated by incorporating nano-emulsion into hydrogel by using high energy or low energy methods. Nano-emulgel is extensively researched to treat a range of dermatological problems such as skin infections. Furthermore, it is regarded as superior and unique topical formulation because it has no stability issues such as destabilization issue with traditional emulgels, cake formation issue with suspension, moisture entrapment issue with powder, coalescence with oil globules and poor adherence and spreadability with nanoemulsion. The objective of review provides component details, characterized several nanoemulgel formation techniques (based on energy, phase inversion type, self-emulsification), advantages and disadvantages of nanoemulgel with schematic representation, characterization of nanoemulgel and focus on how it is better as a topical drug delivery system. Because of its safety profile, ease of use, and potential to achieve targeted administration without gastrointestinal degradation or first-pass metabolism, nanoemulgel has drawn interest. Disadvantages involves it is costly, formulation complexity and low drug entrapment, the formulation of nanoemulgel may eventually be acknowledged as a crucial and efficient target for the topical distribution of lipophilic medications, despite its limited disadvantages.

Keywords: Nano-emulgel, Nano-emulsion, Topical drug delivery system, High energy methods, Low energy methods

1. Introduction:

The therapeutic uses of conventional dosage forms, such as ointments, creams, gels, emulsions, and emulgels are restricted because of their large particle size and poor drug penetration through the skin. To address the permeability problem, the nanoemulgel concept was developed [1]. The emerging transdermal delivery system, nanoemulgel, has demonstrated remarkable advantages for lipophilic drugs compared to other formulations. Recent lipophilic medication that are developed in new era leads to poor bioavailability, uneven absorption, pharmacokinetic variances and low oral bioavailability [2]. Nowadays, nearly 40% of the medications on the market and 90% of those in the development pipeline are lipophilic in nature [3]. Nanoemulgel drawn interest due to its potential to achieve targeted delivery without first pass metabolism. It is innovative technique created by incorporating nano-emulsion into gel by which drug distribution for both instant and regulated release is made possible [4]. Nano-emulgels is being extensively researched to treat a range of dermatological problems, including skin infections. They are appropriate delivery system for both lipophilic and hydrophilic medications [5, 6]. Nano-emulgels consist of two different systems: first one is gelling system another one is an emulsion with nano-scale droplets. The emulsion may be either oil-in-water (o/w) or water-in-oil (w/o). Emulsion act as the drug delivery vehicles while

emulsifier stabilizes the emulsion. The gels are composed of polymers that expand when liquid is absorbed [7]

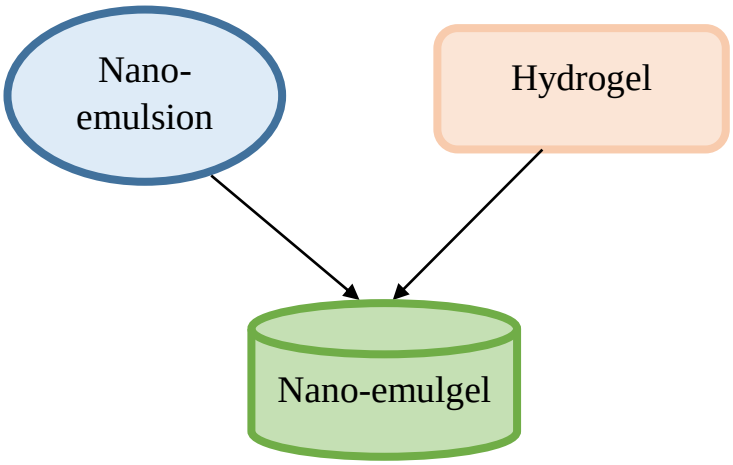

Fig.1 General Representation of Nanoemulgel

Nano-emulsion: A colloidal dispersion of two immiscible liquids that is thermodynamically unstable is called a nanoemulsion, where one is dispersed and another one is continuous phase [8]. The emulsifier, surfactant play a crucial role in maintaining nanoemulsion stability and preventing phase separation over time. By adsorption at the water-oil interface the interfacial tension between the two phases was decreased. This reduction encourages the capillary forces inside the reservoir to decrease, which will improve the mobilization and recovery of residual oil [9, 10].

2. Topical Drug Delivery System: In recent decades, medications have been administered to the human body by variety of ways, including oral, sublingual, rectal, parental, topical, inhalation, etc., in order to treat illness. For treatment of skin diseases like acne and psoriasis topical drug delivery system plays important role [11]. The topical mode of administration has several advantages, including eliminating the hepatic first-pass metabolism, reduce side effects due to local site of action, improving absorption, and increasing bioavailability with a prolonged deposition [12].

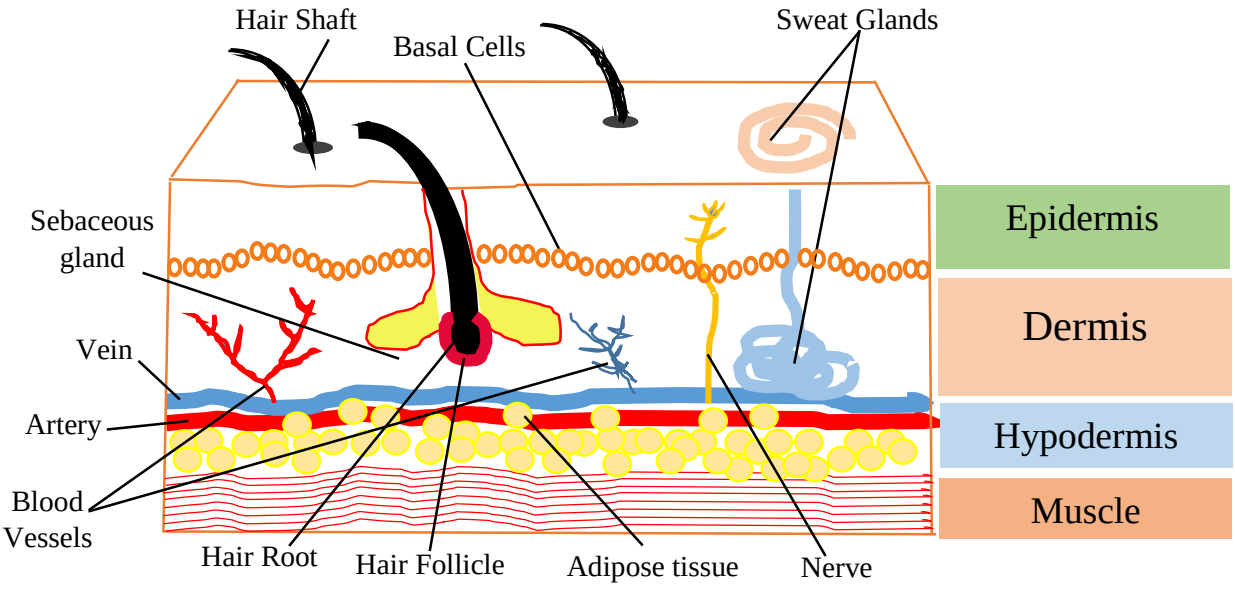

Fig 2: Shows Morphology of Skin

2.1 Skin: Skin is the largest organ of body, performs a multitude of tasks such as controlling body temperature, limiting fluid and salt loss and blocking the entry of pathogens like bacteria, virus, toxic chemicals and allergens [13]. Additionally, it provides defence against UV rays and environmental particles by functioning as sophisticated physical barrier [14]. The three main layers of skin are: the epidermis, the dermis and the hypodermis or subcutaneous tissue (shows in Fig. 2). The stratum basale, stratum spinosum, stratum granulosum, stratum corneum these are the subparts of outer most layer i.e. epidermis. In order to replace the cells that are lost from skin surface stratum basale which contain basal cells divide rapidly and undergo mitosis. As these basale cells divide, they gradually move upwards through skin surface [15, 16]. The stratum spinosum have spiny projections that strengthen tissue, hence it provide stability as well as strength to the epidermis [17, 18]. The stratum granulosum, where the cells start to make a lot of proteins, including keratin, when these cells develop, they create granular, flattened layers that will eventually serve as the skin's outermost barrier of defence [19]. The outermost layer of the epidermis i.e. stratum corneum work as obstacle for molecules which are larger than 500 Dalton. It is composed of horny cells with lipophilic lipid layers (about 10–20μm thick) [20]. The dermis is the largest layer of skin which is approximately 0.1-0.4cm thick and lies underneath the epidermis. This layer consist of hair follicle, sensory nerve, lymphatic vessels, collagen, elastin, sebaceous gland and it provide structural support to the skin as well as nutritional support to the viable epidermis [21]. Finally the hypodermis which is also called subcutaneous tissue is primary made up of fat or adipose tissue which perform as a cushion, controlling body temperature and shielding beneath organs and systems [22, 23]. Lipid-soluble molecules can pass through the SC barrier more readily than water-soluble ones, although water-soluble compounds are mostly absorbed through the sweat glands and hair follicles, which make up 0.1% and 0.01% of the skin's surface, respectively [20].

3. Nanoemulgel Drug Delivery System: By integrating the nano-emulsion into a hydrogel matrix, nano-emulgel is created, which lessens the emulsion's thermodynamic instability. Due to the greater uniformity of the external medium, the non-aqueous phase's mobility is reduced, which leads to improve thermodynamic stability. Because of prolong retention time and also thermodynamic stability nanoemulgel enable to release drug gradually and helps drugs with a short half-life. Nano-emulgel is a controlled release dosage form for topical administration that benefits medications with a short half-life because of its longer retention time and thermodynamic stability, which allow the formulation to release the drug gradually [24, 25].

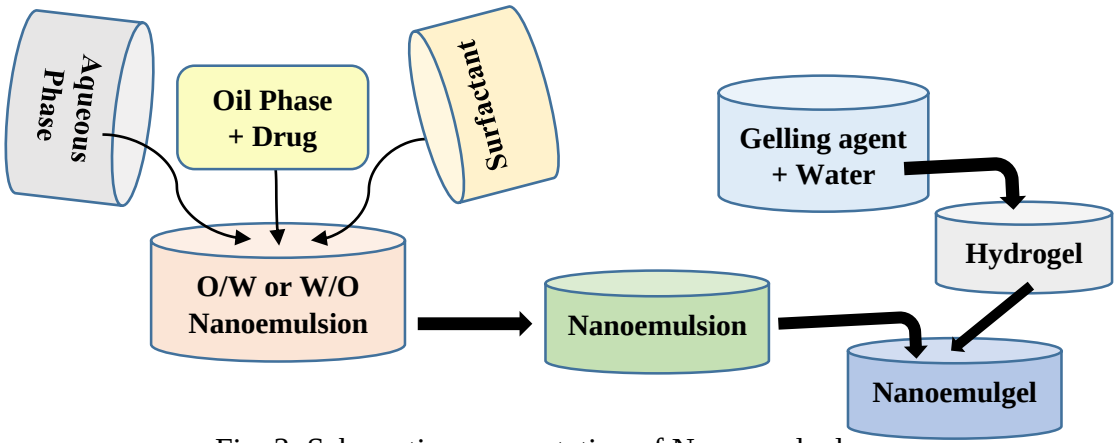

Fig. 3: Schematic representation of Nanoemulgel

Table 1: Researchers on Nanoemulgel Formulations

Authors	Year	Formulation	References
Eid *et al.*	2014	*Swietenia macrophylla* Nanoemulgel	[26]
Srivastava *et al.*	2016	In situ nanoemulgel of ketoprofen for periodontitis	[27]
Bhattacharya *et al.*	2017	Celecoxib nanoemulgel	[28]
Elmataeeshy *et al.*	2018	Terbinafine nanoemulgel	[29]
Morsy *et al.*	2019	Atorvastatin loaded nanoemulgel	[30]
Vartak *et al.*	2020	Ebselen nanoemulgel	[31]
Eid *et al.*	2021	*Coriandrum sativum* oil nanoemulgel	[32]
Almostafa *et al.*	2022	Fusidic acid incorporated into a myrrh oil-based nanoemulgel	[33]
Alhasso et al.	2023	Mupirocin nanoemulgel	[34]
Kaur et al.	2023	Luliconazole nanoemulgel	[35]
Giri *et al.*	2024	Turmeric and neem based nanoemulgel	[36]
Dilip et al.	2024	Vitex Negundo nanoemulgel	[37]

Table 2: List of Nanoemulgel Marketed Products

Product Name	Brand Name	Manufacturer	Formulation
Clindamycin Nanoemulgel	Cleocin Lotion	Pfizer Inc.	Clindamycin phosphate
Adapalene Nanoemulgel	Differin Gel	Galderma Laboratories, LP	Adapalene
Ketoconazole Nanoemulgel	Nizoral A-D	Galderma Laboratories, LP	Ketoconazole
Mupirocin Nanoemulgel	Bactroban	GlaxoSmithKline	Mupirocin
Sunscreen Nanoemulgel	Neutrogena Ultra Sheer Dry-Touch SPF 100^{+}	Johnson $ Johnson	Avobenzone and Octinoxate
Timolol Nanoemulgel	Timoptic	Merck $ Co.	Timolol maleate
Metronidazole Nanoemulgel	Metro Gel	Galderma Laboratories, LP	Metronidazole
Fluticasone Nanoemulgel	Flonase	Novartis	Diclofenac sodium
Hydrating nanoemulgel	CeraVe Moisturizing Cream	La Roche-Posay	Ceramides, hyaluronic acid, niacinamide

Table 3: Pre-Clinical Studies on Nanoemulgel dosage form

Active Ingredient	Animal model	Delivery Route	Pre-clinical outcome	References
Terbinafine	Mice	Topical	Terbinafine nanoemulgel treating dermatophytosis, improve drug and sustained release.	[38]

Eucalyptol	Rabbits	Topical	Study revealed that a Eucalyptol-loaded nanoemulgel is promising approach for wound healing.	[39]
Thymoquinone	Wistar Rats	Topical	Deeper penetrability of Thymoquinone through nanoemulgel improve therapeutic efficacy, help in wound healing.	[40]
Pirfenidone	Sparague Dawley Rats	Topical	The Pirfenidone nanoemulgel showed higher skin permeation and treated rheumatoid arthritis.	[41]
Curcumin and Myrrh oil	Male Witsar Rats	Topical	Curcumin loaded nanoemulgel exhibited good anti-inflammatory effect. Further, Myrrh oil boosted in vivo activity of Cur-loaded formulation.	[42]
Celastrol	Male Rats	Topical	Nanoemulgel containing Celastrol produced better penetration than control preparation containing Celastrol+0.1%DMSO gel.	[43]
Cinnamon oil	Male Wistar Rats	Topical (fore, hind limbs)	Formulation of cinnamon oil nanoemulgel beneficial for oral microbiota.	[44]
Thymoquinone and fulvic acid	Mice	Topical	Fulvic acid based thymoquinone nanoemulgel improve penetration and provide long term stability.	[45]

Mupirocin	Porcine ear skin	Topical	Topical antibacterial agent (Mupirocin) can use for skin lesions where high skin deposition and low permeability.	[46]

Moreover, nanoemulgel is regarded as foremost and unique topical formulation because it has no stability issues such as destabilization issue with traditional emulgels, cake formation issue with suspension, moisture entrapment issue with powder, coalescence with oil globules and poor adherence and spreadability with nanoemulsion [47].
Due to these considerations, nano-emulgel is frequently use as topical medication delivery method in comparison to the commonly used commercial dosage forms. Research on a variety of skin conditions and diseases is encouraged by this innovative formulation. As a beneficial alternative to traditional forms, nano-emulgel will soon dominate the topical delivery market. Some of these products are already being marketed as shows in Table 2. Many researcher on nanoemulgel formulation (Table 1) and Pre-clinical studies are being conducted and evaluated shows in Table 3.

4. Formulation Components:

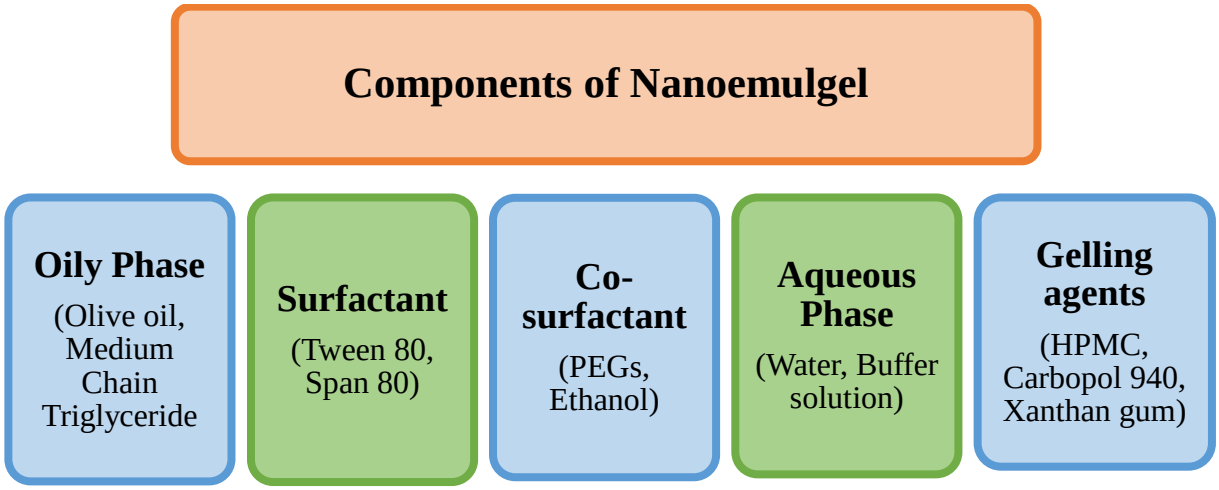

Fig. 4: Components of nanoemulgel

4.1 Oily Phase: Lipid i.e. oil, is a crucial component of the nanoemulgel. To choose the right oil phase based on the viscosity, permeability, and stability of prepared nanoemulsion, a number of studies are needed. Utilizing the therapeutic properties of some natural oils can occasionally influence the choice of oil phase [48]. Depending on the oil's source, long-chain fatty acid based vegetable oils have poor emulsification qualities, which leads to unstable nano-emulsions [49, 50]. However, it was shown that emulsification properties were improved when the oil had fewer hydrophobic properties [51]. Most commonly used oil phase in nanoemulsion represented in figure. 5

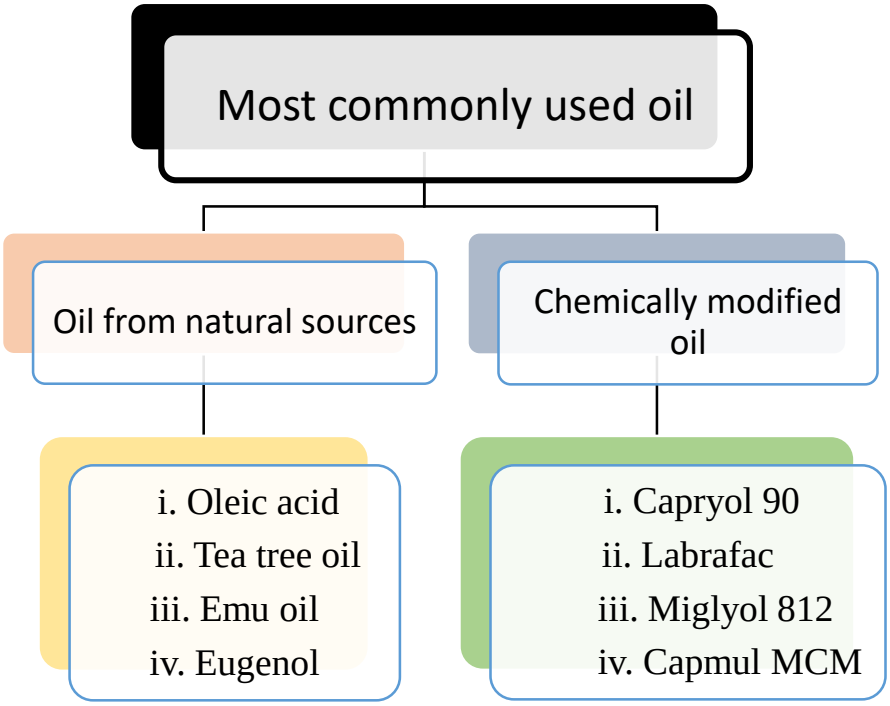

Fig. 5: Most Commonly used oil in nanoemulsion

4.2 Surfactants: Surfactants are crucial part of the nanoemulsion system, which is utilized to alter the dispersion entropy and lower the interphase tension that occurs in two non-miscible liquids in order to stabilize the thermodynamically unstable mixture. In addition to having strong emulsification properties, the surfactants employed to create nano-emulsions must be safe, stable, and have a high drug loading capacity [52]. These stabilizing systems fall under the following categories because of their ionic nature:

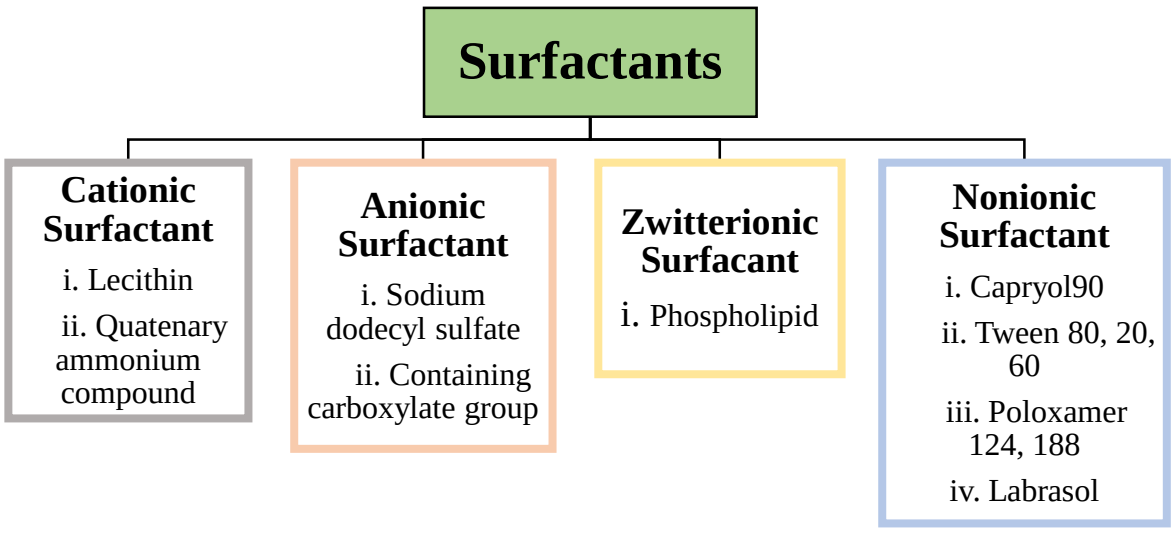

Fig. 6: Types of surfactants used in nano-emulgel formulation

The proper selection of surfactant is crucial since too much of it might irritate the skin and gastrointestinal tract when applied topically and orally, respectively. The surfactant's HLB value is an additional selection criterion. These surfactants are categorized as water-in-oil emulsifier (3-8) and oil-in-water emulsifier (8-16) according to their hydrophilic-lipophilic balance (HLB) values [53, 54]. Consequently, to form oil-in-water nano-emulsion, the selected surfactant Hydrophilic-Lipophilic Balance value needs to be more than 10. Tweens and spans with an HLB value greater than 8 are therefore utilized in o/w emulsion. Furthermore, when compared to pure Tween or Span systems, the mixture of Span 20 and Tween 20 enhance emulsion stability [55, 56]. On the other hand, surfactants with an HLB value below 8 are utilized to stabilize w/o emulsion [57].

4.3 Co-surfactant: By joining with surfactant and penetrating the surfactant layer, co-surfactant decreases interfacial tension, facilitates the emulsification process, and breaks the interfacial film to provide the required fluidity [58]. Since the interaction between surfactant and co-surfactant affects how therapeutic drugs or lipophilic medications partition in the aqueous and oil phase, choosing a co-surfactant is crucial [59]. In nanoemulgel and nanoemulsion systems, diethylene glycol monoethyl ether, 1, 2-propylene glycol, polyethylene glycol-400, carbitol, propanol (C_3H_8O), and butanol (C_4H_9OH) are most common co-surfactants [60].

4.4 Aqueous Phase: Most of aqueous phase, nanoemulsion are frequently made with distilled or ultra-purified water. When a gelling substance is added to a nanoemulsion and it changes phases hence nanoemulgels are created [61].

Nano-emulsions have a number of advantages, however their low viscosity limits their spreadability and retention time [62, 63]. By transforming the nano-emulsion into a nano-emulgel and employing an appropriate gelling agent, these issues can be fixed [64].

4.5 Gelling agent: Natural gelling agents are pectin, alginic acid, gelatin etc. They provide good biocompatibility, limitation is microbial degradation [65, 66]. Semisynthetic gelling agents are ethylcellulose, sodium alginate (C6H7NaO6) etc. they are more stable than natural gelling agent [67]. Synthetic gelling agents are carbomers and poloxamers [68, 69].

5. Methods of Preparation of nanoemulgel:

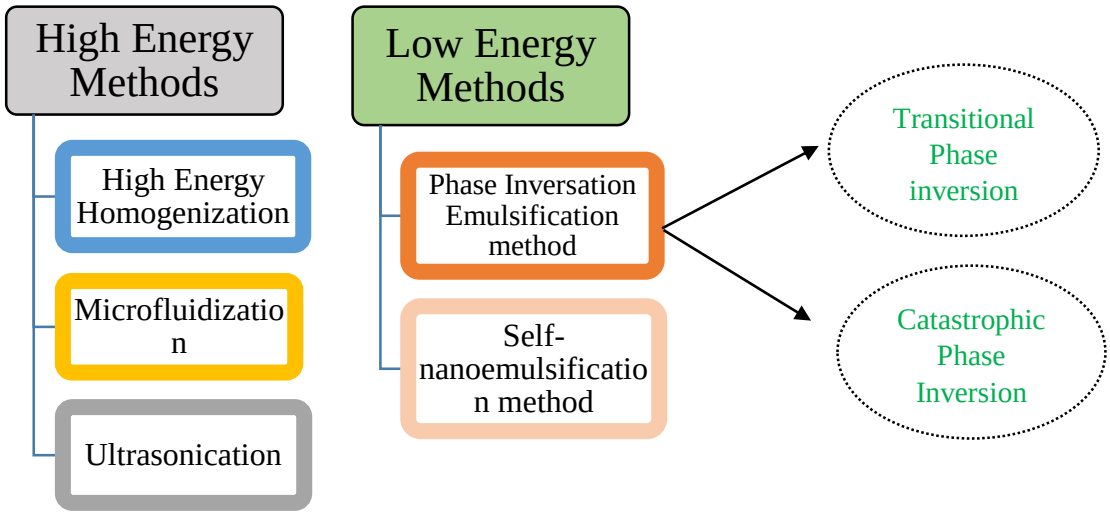

Fig. 7 Methods of Preparation of Nano-emulgel

5.1 High Energy Methods: The droplet size of nano-emulsions, which normally falls between 5 and 500 nm, requires a significant mechanical energy expenditure. The objective of supplying a significant quantity of energy for the manufacturing process can be achieved by utilizing a wide range of techniques [70, 71]. These techniques include the microfluidizers, ultrasonic generators, and high-pressure homogenizers. The most important benefit for preparation of nanoemulsion from this method, is its minimal emulsifier requirement [72].

5.1.1 High Energy Homogenization Technique: The High Energy Homogenization technique is used to decrease the particle size to the nano-scale range, which typically ranges from 5-500nm. Along with impact, attrition, turbulence, and hydraulic shear, extreme pressure of roughly 500–20,000 psi is applied during the emulsification stage of the microfluidizer technology [73, 74].

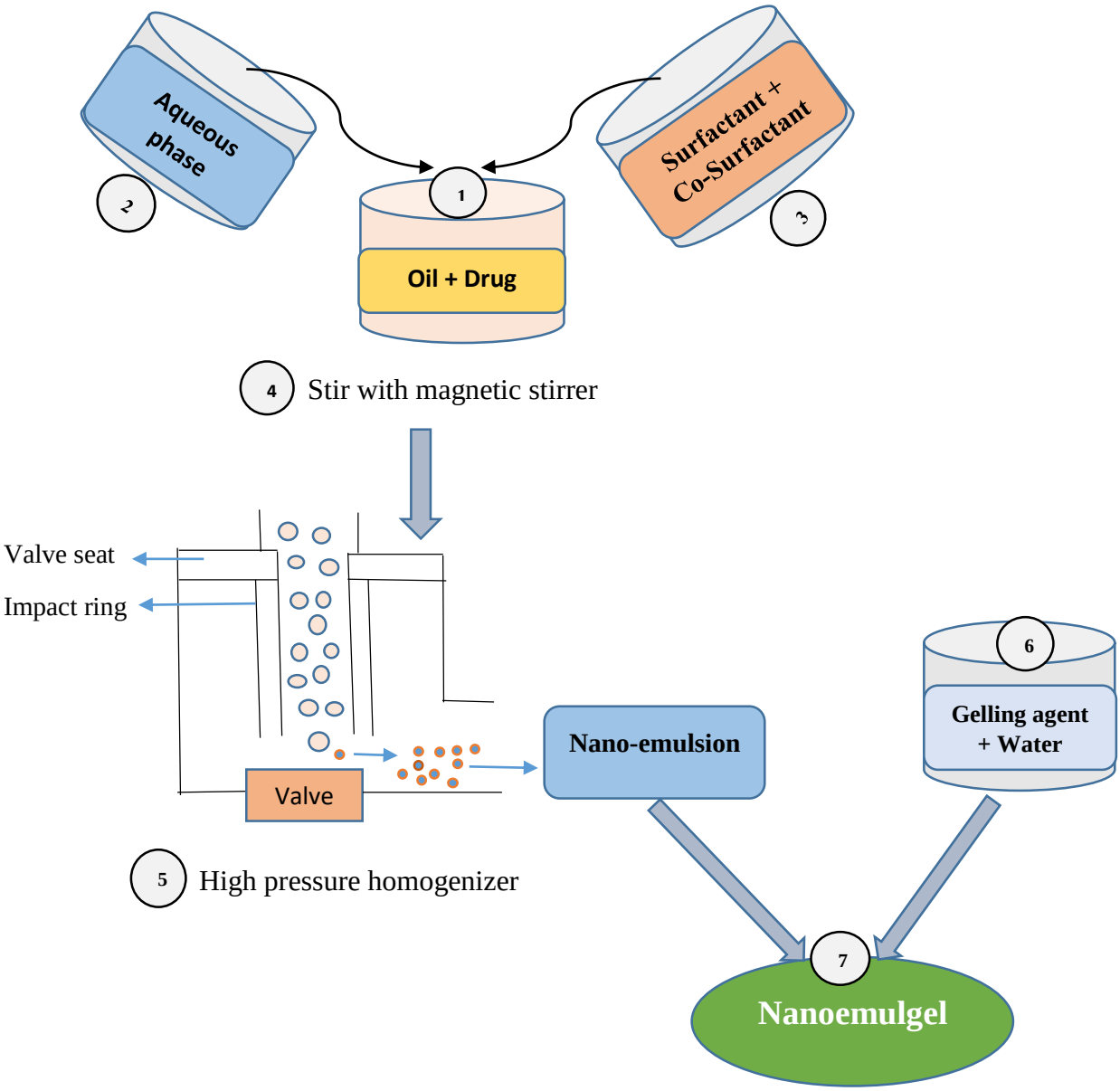

Fig. 8: Schematic representation of Nanoemulgel formulation by High Energy Homogenization Method

5.1.2 Ultrasonication Method: In many research labs, ultrasonicators are utilized. They reduce the size of droplets as the sonication period, power level, and emulsifier concentration increase by converting electrical waves into pressure waves [75]. In terms of operation and cleaning, ultrasonication is superior to other high energy techniques [76, 77]. A recent study demonstrated that the intensity, duration, and kind of surfactant all affect how well ultrasonic emulsification works [78].

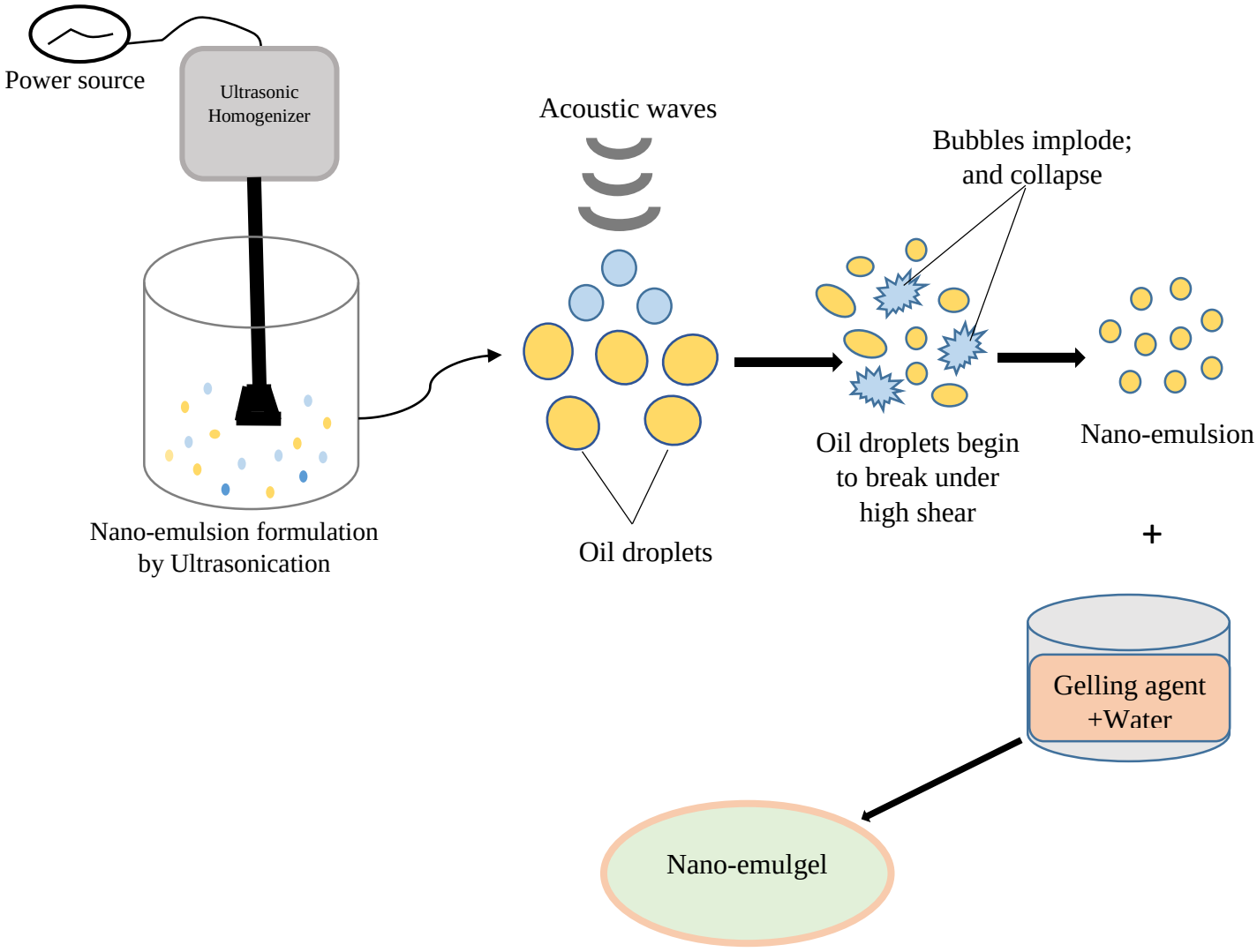

Figure 9: Schematic representation of Preparation of nano-emulgel by Ultrasonication Method

5.1.3 Microfluidization Method: Fluids are pushed through the micro channels during microfludization at high pressures (500–20,000 psi). Typically, micro channels are tiny channels that permit mixing at the micro scale [62, 63]. Food-grade nanoemulsions with consistent droplet size distributions and improved stabilities are produced using microfluidization techniques [79].

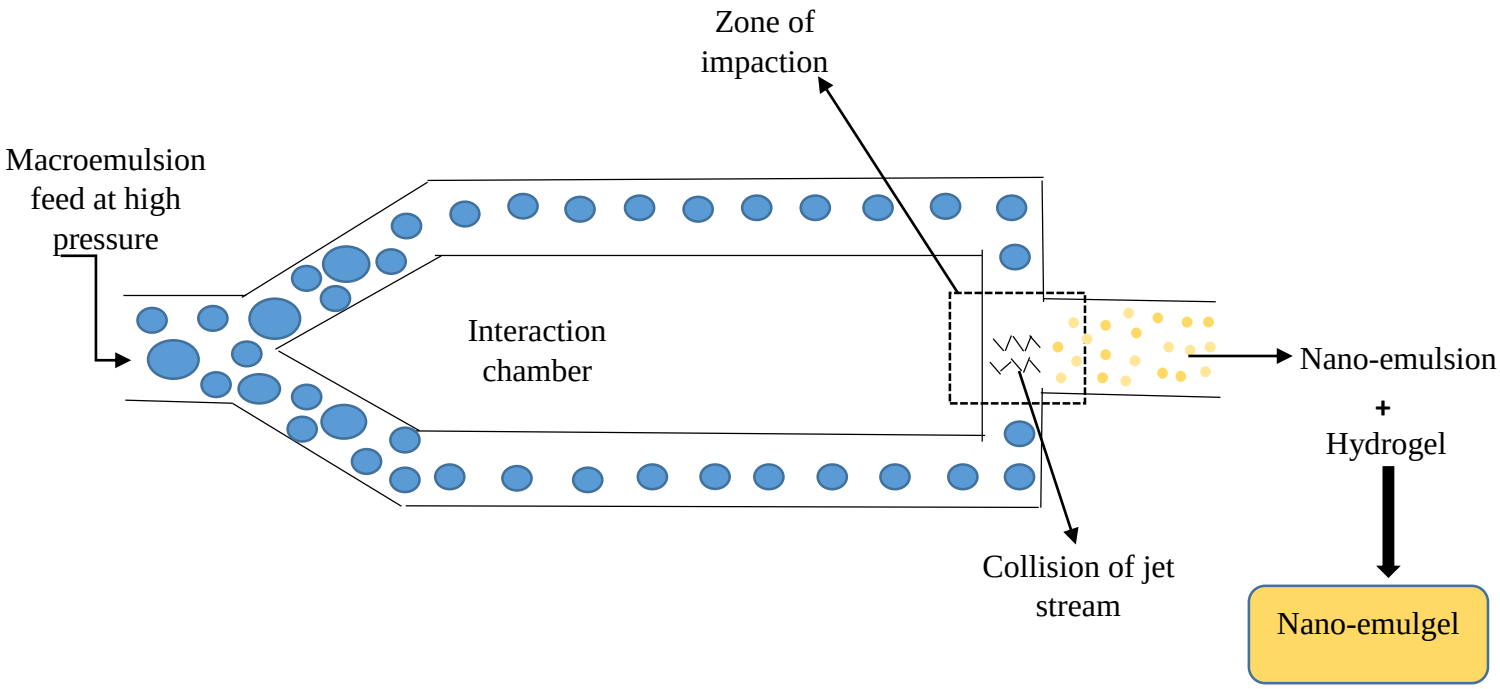

Fig. 10: Schematic representation of preparation of Nanoemulgel by Microfluidization method

5.2 Low Energy Methods: These techniques requires low energy for production of nanoemulsions. Low Energy emulsification techniques are more energy-efficient since they use the systems' inherent chemical energy and needed mild agitation to create the nanoemulsions [80]. Common techniques of Low energy methods are phase inversion emulsification and self-emulsification method. Low energy techniques are typically not considered for creating food-grade nanoemulsions since they necessitate high surfactant concentrations, which compromise the safety and flavour of food formulation [81]. Techniques with low energy consumption can be divided into several groups, some of which are as follows:

5.2.1 Phase inversion emulsification method: This approach involves a phase transition during the emulsification process. Variations in temperature, composition, and other factors can alter the surfactant's spontaneous curvature [82].

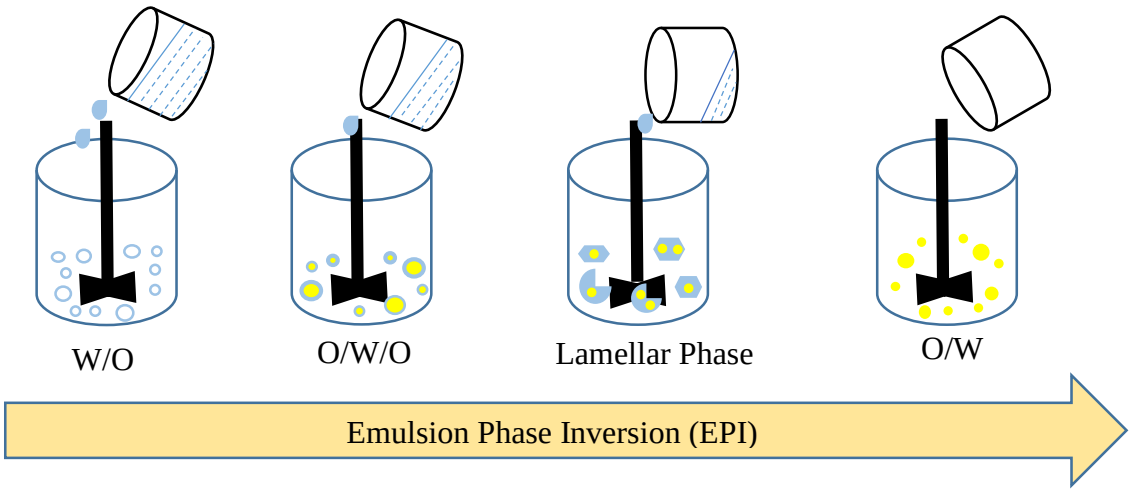

Figure 11: Schematic representation of Phase inversion emulsification method

5.2.2 Self Nano-emulsification Method: The self-emulsification approach creates nanoemulsions without altering the surfactant's spontaneous curvature. Based on the self-emulsification phenomena, SNEDDS have a reduced lipid content and more hydrophilic surfactants or co-surfactants (co-solvents) [83]. Additionally, SNEDDS have been utilized to deliver bioactive dietary ingredients [84]. An isotropic combination of an oil, surfactant, co-surfactant, and drug is known as SNEDDS. When this mixture is diluted with aqueous fluids in vivo, it forms a thin, optically transparent O/W nanoemulsion with the help of the digestive motility of stomach or intestine [85, 86].

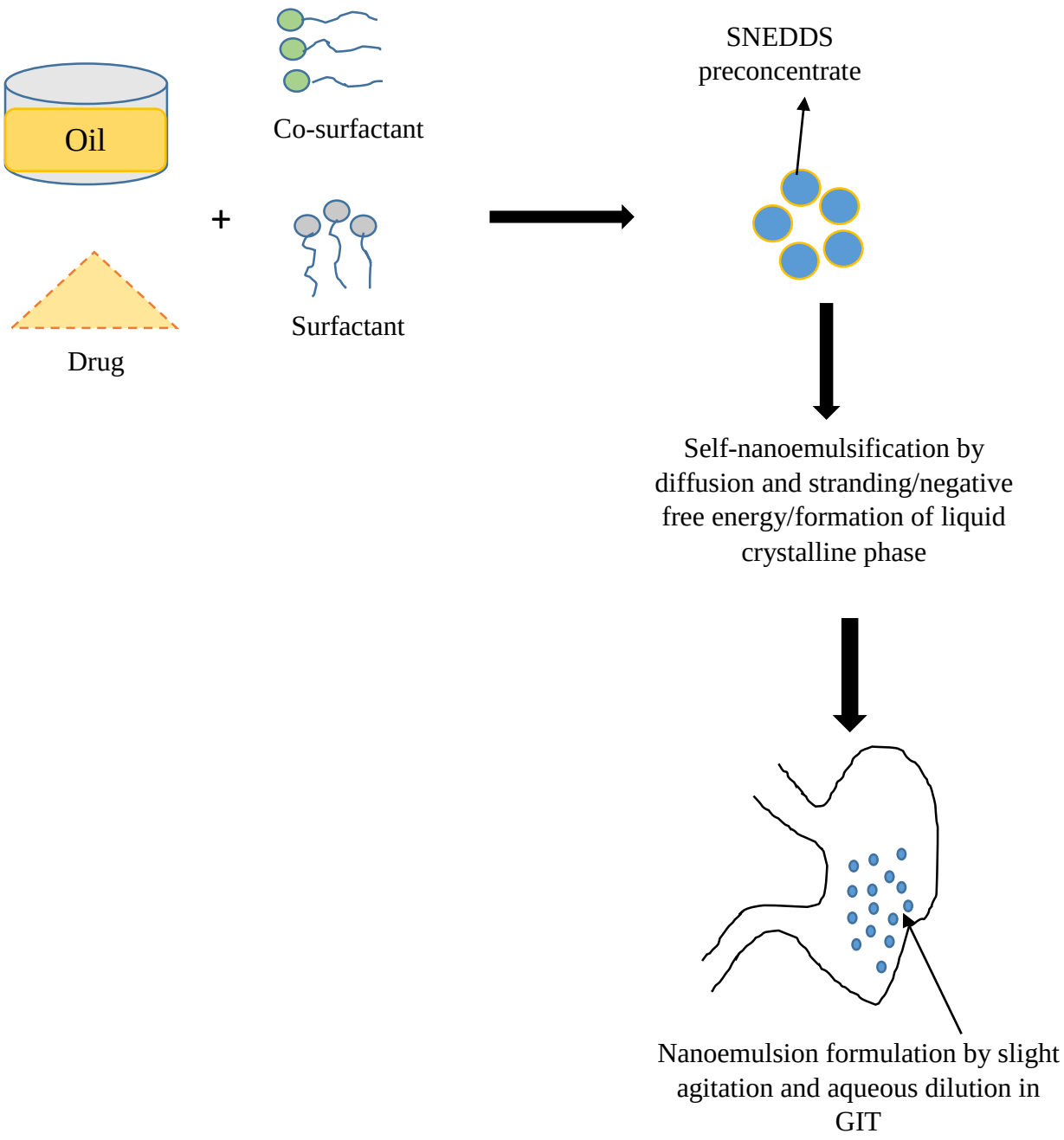

Figure 12: Schematic representation of Self nano-emulsification method.

6. Advantages and Disadvantages of Nanoemulgel:

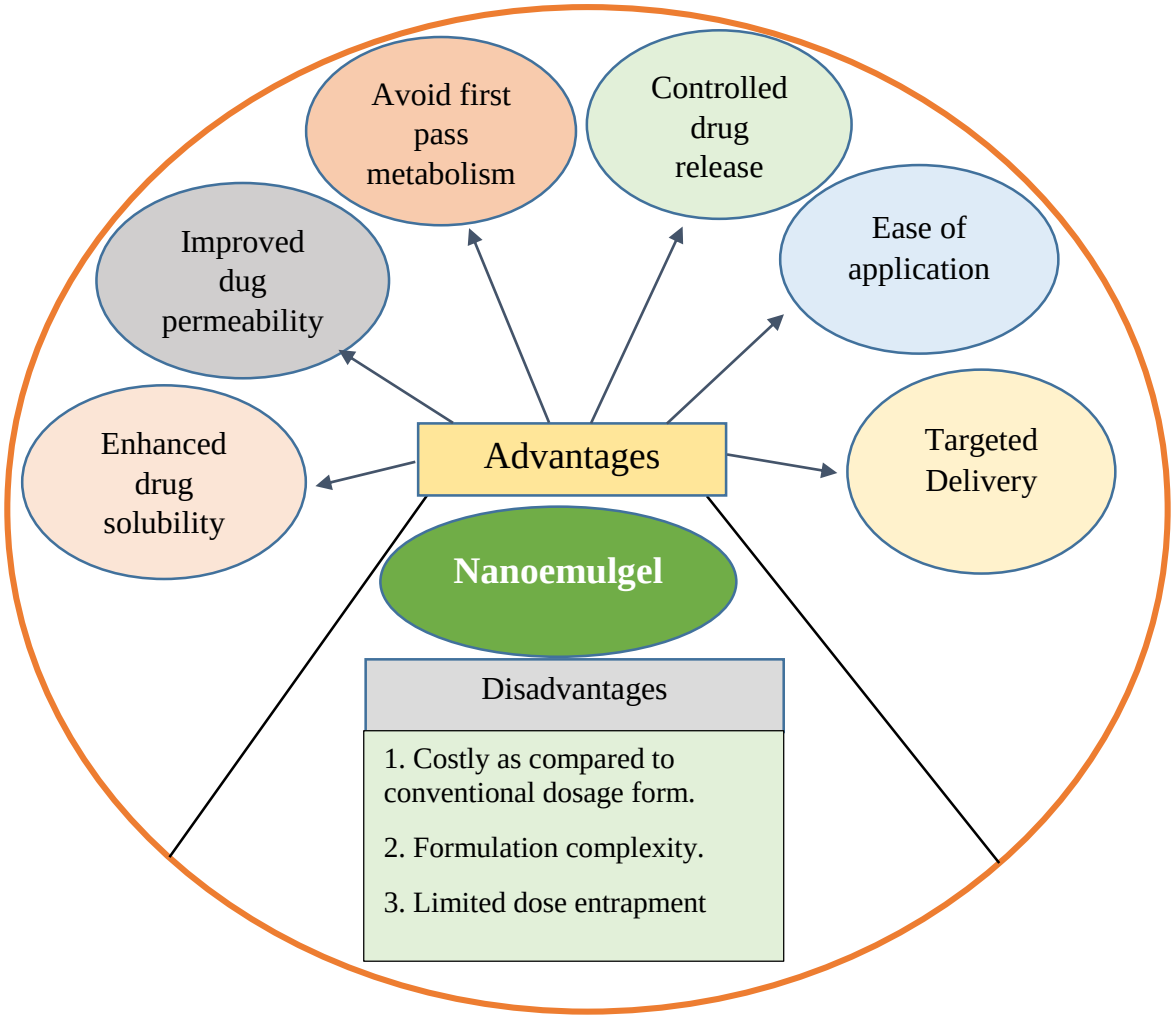

Figure 13: Schematic representation of advantages and disadvantages of Nanoemulgel

7. Characterization studies of nanoemulgel:

The characterization studies of pharmaceutical products is necessary to evaluate uniformity and quality across batches also these tests aid in comprehending helps behaviour and stability of the product. Nanoemulgel consists of nanosized globules so thermodynamic stability analysis and polydispersity index, evaluation are required. In addition to these physiochemical tests, in-vitro release test, spread-ability test, bio-adhesive test, skin irritation, pH measurement, viscosity, drug content determination are also needed.

7.1 Physical Characterization:

Organoleptic properties are inspected visually by colour, appearance, consistency, phase separation and homogeneity. Organoleptic is derived from greek words “organon” means organ (sensory organ) and “leptikos” means sensitive. It is the first step of evaluating any pharmaceutical formulation.

7.2 Zeta Potential and Analysis of thermodynamic stability:

For determining zeta potential, Malvern Zetasizer with dynamic scattering technique (DLS) and electrophoretic light scattering (ELS) was used at 633 nm by 1 volt electric field application. Zeta potential is a method for measuring surface charge characteristics and enhancing the nanoemulsion's durability. When the zeta potential is higher it can greater the electrostatic repulsion between the particles which minimizes aggregation [87].

7.3 Polydisperity index (PDI):

The polydispersity index determine by same instrument i.e. zeta sizer or master sizer. The technique of photon correlation spectroscopy, measures the diffusion constant and the Polydispersity index and interaction between dispersion as well as laser beam, the emulsion globule size may determine [88, 89]. In a test tube, 1 ml of nanoemulsion was diluted with 10 mL of water, gently stirred with a glass rod, analyse the fluctuation in light scattering because of Brownian motion. At 25°C, photon scattering was seen at a 90° angle. After this distribution and diameter of droplets were measured. According to Stock's law, mean globule/droplet size can be measured by:-

$$v = 18 \times D^2 \times \rho d/\eta$$

Here; v = rising velocity of droplet, g = gravitational constant, D = droplet diameter,

ρd = density difference between heavy phase and light phase, η = dynamic velocity.

7.4 Rheology Studies:

The study of material flow and deformation is known as rheology. The rheological characterization of materials demonstrates how the amount of excipients like: surfactants, oil, gelling agents effect the flow behaviour of formulation. The stability, therapeutic release, and in-vivo aspects of a formulation may be affected if its viscosity and flow properties differ.

7.5 Spreadability Test:

The parallel-plate approach, often called as the slip and drag technique, is a commonly applied due to its ease of use and affordability. Two glass slides were used; one was fastened to the wooden board, and the other could be moved by passing a thread through a pulley that supported a weight. "Drag" and "Slip" characteristics of the emulgel determine its spreadability [90]. The time needed to slip off is noted, and the following formula is used to determine spreadability:

$$S = M \times L/T$$

Here; S = spread-ability, M = weight of upper slide, L = the slide length, T = time taken.

7.6 In-vitro release test:

The Food and Drug Administration states that both a vertical diffusion apparatus and an immersion chamber are used in In-vitro release test (IVRT) for semi-solid dosage formulations. The vertical diffusion apparatus involves a donor and receptor chambers which contains the

receptor medium, and the dosage form sample, respectively. Receptor medium can be either a buffer or a hydro-alcoholic solution, depending on the API's stability, sink state, and solubility. For topical preparations, the media's temperature should be kept at about 32 °C ± 1 °C. Using a magnetic stirrer coated in Teflon, the receptor media is stirred. Although the cell body of the immersion cell model serves as a reservoir [91].

7.7 Bio-Adhesive Property:

The bio-adhesive strength is “the amount of force required to remove drug carrier system from a biological surface”. For topical dosage form bio-adhesion is crucial for extended contact of drug with skin. Pig or rat skin is typically used for this test; the latter is chosen due to its similarity to human skin [92].

7.8 pH measurement:

potential of Hydrogen measurement is crucial criteria, particularly for topical formulation. To replicate the state of the skin, the nanoemulgel's pH should be between 6 and 7. If the produced emulgel has an acidic or basic pH, it causes irritation to patient. The electrochemical approach is the most used way to measure pH, an electrode or pH sensor is uses that generates a voltage that is proportionate to the solution’s hydrogen ion concentration. The pH sensor is linked to a transmitter or pH meter, which shows or transmits the pH value. Depending on the applications, such as skin or other mucous membrane, pH of nanoemulgel fluctuates. For instance, Human skin have a pH of 4.5 to 6 and for nasal cavity it is 6.3 [93].

7.9 Viscosity Determination:

The Brook field viscometer (Brookfield) was used to measure the viscosity of several emulgel formulations at 25ºC. Viscosities were measured after spindle 1 rotated the emulgels at 10, 50, and 100 rpm. In triplicate, the viscosity was tested.

7.10 Drug Content Determination:

The formulation was dissolve in 100ml of PBS (Phosphate Buffer Saline), constantly agitated for half an hour. Whatman filter paper was used to filter the finished product and the absorbance of the solution was measured at 232 nm using an ultraviolet-visible spectrophotometer, and the amount of drug present was calculated by using given formula [94]:

$$\text{Drug Content \%} = \frac{\text{Actual amount of drug in formulation}}{\text{Theoretical amount of drug in formulation}} \times 100$$

7.11 Skin irritancy test:

For this test mainly wistar rats are selected, nanoemulgel is carefully applied to the small or designated area of the skin on these rats. Observation are carried out over a predetermined period, usually 24-72 hours check any sign of irritation are occurred or not such as: redness, inflammation or itching. A systematic scrolling method such as the Draize scale, is used to evaluate these reactions and determine how sever is the irritation.

8. Recent Prospective and Future Directions: Due to their poor solubility, which results in low bioavailability, hydrophobic medicines have proven to be difficult to formulate and deliver to biological systems. Among the topical formulations are lotions, ointments, and creams. For topical medicine administration, nanoemulgel has become one of the most promising alternatives. Within the framework of the healthcare system, the nanoemulgel is used to treat a wide range of acute and chronic conditions, including those connected to baldness, psoriasis, inflammation, cardiovascular issues, fungus, and other ailments. The prospects for nanoemulgel in the future appear to have a strong chance of financial gain when all of these advantages associated with medicine administration are taken into account. Furthermore, it is logical to assume that nanoemulgel as a delivery vehicle will hold promise for various drugs which have been abandoned from the production process due to a number of reasons, including clinical inefficacy, limited bioavailability, and other comparable issues. This is because nanoemulgel may hold promise for these sorts of medications. Although numerous nanoemulgel are being marketed e.g., Bactroban, Differin Gel which gives hope that nano-emulgel may be commercialized near future. As a result, it has the potential to garner attention because of its effectiveness, safety, and ease of application for topical medication administration. Nano-emulgel is a future-oriented tool that could replace conventional formulations, despite certain drawbacks.

9. Conclusion: This review study mainly focus on brief information regarding components, listed several techniques of creating nanoemulgel based on (energy, phase conversion and self-emulsification), advantages and disadvantages of nanoemulgel with schematic representation and characterization. Due to low bioavailability and high first pass metabolism of lipophilic drug it is successfully addressed by nanoemulgel drug delivery system, nanoemulgel is regarded as superior and unique topical formulation because it has no stability issues such as destabilization issue, cake formation issue, moisture entrapment issue, coalescence, poor adherence and spreadability with traditional emulgels, suspension, powder oil globules, nanoemulsion respectively. Techniques for creating nanoemulgel drug delivery systems can be easily categorized in a way according to the energy needed, phase inversion type, and self-emulsification. High-energy techniques for creating nanoemulsion drug delivery systems offer more flexibility in terms of composition selection and better control over particle size dispersion. Researchers have employed high energy techniques to enhance the delivery of medications and bioactive dietary ingredients. Sophisticated instruments are needed for high energy method; as a result, high energy methods are more expensive than low energy methods, which are more efficient and need less energy. In order to deliver hydrophobic drugs with low bioavailability, researchers most frequently use SNEDDS (Self-Nanoemulsifying Drug Delivery System).

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