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Nanoemulsification in Drug Delivery and Nanogel Formulation: A Review

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ABSTRACT

Purpose: Nanoemulsification - a unification of nanotechnology and emulsification is crucial in advanced drug delivery as decreasing droplet size increases the interfacial area, which accelerates dissolution rate, improve bioavailability and therapeutic outcome. The aim of this work is to aggregate information on nanoemulsification as a valuable technique in the formulation of nanogels.

Principal Methodologies: Data were obtained through detailed reviews of Google Scholar, Scopus, PubMed and Science Direct to extract information that are related to the subject in discourse.

Key findings: The various findings are presented herein. Nanoemulsification has been described as the formulation of a heterogenous product in which two immiscible liquids (oil and water) are mixed and stabilized with a surface-active agent to produce droplets within the nano-range of 20 – 200 nm. It yields products with larger surface area and increased solubility especially for hydrophobic drugs. Nanoemulsion protect delicate active ingredients from enzymatic degradation and prevent premature degradation of drugs *via* encapsulation. Tiny droplets contribute to reducing creaming and sedimentation of dispersed systems. Nanoemulsified products, due to their larger surface area and reduced droplet size, are more easily absorbed than conventional emulsion. They are characterized by increased bioavailability of therapeutic actives. Nanogel can be developed *via* nanoemulsification. Nanogels possess unique features such as softness, deformability and permeability that make them attractive in nanomedicine and targeted drug delivery of proteins, vaccines and small molecules.

Conclusion: This review critically analyzes nanoemulsification, properties that make nanoemulsion desirable in drug delivery as well as the delivery of nanoemulsion as a nanogel.

Keywords**:** Drug delivery**,** nanoemulsification, nanogel.

1. INTRODUCTION

Nanoemulsification is a combination of two technologies: nanotechnology and emulsification. Nanotechnology is a technology for manipulation and control of matter on the nanoscale [1]. Emulsification is a process of achieving a formulation containing immiscible liquids (oil and water) [2]. Both nanotechnology and emulsification are approaches of optimizing drug delivery. Therefore, nanoemulsification is a double strategy for optimizing drug delivery. Drug products that specifically elicit their actions at the exact required site with little or no interaction with other receptors, cells or tissues are characterized by reduced adverse drug reactions and improved therapeutic outcomes. Research has been ongoing on the formulation of novel pharmaceutical products with these qualities. One of the interesting techniques that has gained recent popularity due to vast qualities is nanotechnology [1]. Researchers are focusing on nanotechnology as it offers a wide range of choices in dosage form design and formulations. Nanoformulations provide

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active ingredients at the exact, required site of action and in exact concentration for optimum drug delivery. Their unique sizes in nanometers give them distinct properties from their parent molecules. They improve drug targeting and bioavailability, reduce dose frequency and side effects, and increase efficacy and patient compliance. Furthermore, they achieve this using very minute quantities [1, 2]. This review tends to answer the following questions. What is the importance of nanoemulsification techniques in relation to other techniques in drug delivery? How can it be achieved in the formulation of a nanogel? What are the benefits of nanogel formulation? Chircov C. and Grumezescu A. [3] studies on nanoemulsion centers on its application in various dosage form design in biomedicine for different diseases. Gaikwad R. and Shinde A. [4] focus on preparation methods of nanoemulsion, characterization and applications. Most studies focus on the advantages and disadvantages of nanoemulsion. Some compare emulgel and nanoemulgel as topical drug delivery [5, 6]. The study elucidates nanoemulsification as a technique in nanogel formulation for an advanced drug delivery system. It tends to differentiate the ambiguity between nanoemulsion, nanoemulgel and nanogel. Nanoemulsions are nano – sized emulsions with size range from 20 – 200 nm [3]. They are fine water-in-oil (w/o) or oil-in-water (o/w) dispersions of fluids that are immiscible. They possess kinetic stability and are stable on heterogeneous systems [4]. They are formulated with very low concentration of an emulsifying agent. A nanoemulsion possesses unique properties that make it desirable in drug delivery. It possesses large surface area thereby increasing the penetration of the emulsion in desired site. The formulation prevents droplet flocculation which helps the system to survive in solitude without being divided. It is said to improve the reproducibility of the plasma concentration profile and bioavailability [7]. The active ingredients in some nanoemulsion are protected against environmental variables such as pH, hydrolysis and oxidation. Through PEGylation and, or lymphatic transport system, they can bypass and potentially reduce hepatic first – pass metabolism. Some certain lipid – based formulations may enhance routing active ingredients to lymphatic transport system instead of the portal vein [7]. Nanoemulsion can be formulated into gels, creams, aerosols, sprays and can be administered via the oral, intravenous, intrapulmonary, intranasal, topical and intramuscular route [8]. Nanogels (NG) are cross – linked swollen polymer networks that form three-dimensional nano –sized hydrogels [10]. It provides a suitable environment to itself by retaining moisture and thus prevents dehydration at penetration site [9]. Nanogels have special characteristics to encapsulate multiple bioactive chemicals in a single formulation [10]. Nanoemulsions are mainly composed of oil, emulsifying agents, and aqueous phases [3]. It is a thermodynamically unstable system [3]. Nanogels can be formulated via sequential polymerization and cross – linking, which largely depends on the starting ingredients [11, 12]. Nanogel can also be synthesized through nanoemulsification techniques with an oil-soluble emulsifying agent [12]. The formulation of a NG offers an improved solubility especially of the hydrophobic drug molecules, improve skin penetration of topical formulations, and provides a controlled and targeted release of therapeutics or theranostics [13]. These qualities provide an advanced drug delivery system where drugs are delivered at specific site with little or no side effect which invariably increases drug compliance. It is beneficial in topical delivery. Due to the droplet size, nanoemulsion can easily be absorbed through the skin micro pore into the systemic circulation, they are sometimes less viscous, therefore they are converted into gels to improve skin retention and to avoid easy removal from the skin [14]. The aim of this work is to aggregate information on nanoemulsification as a double strategy in optimization of drug delivery, the use of nanoemulsification in the formulation of a nanogel, elucidation of a nanoemulsion, nanogel and nanoemulgel and the advantages of a nanogel in drug delivery.

2. METHODOLOGY

Over two hundred review articles from various databases (Google Scholar, Scopus, Pubmed and Science Direct) were reviewed to extract relevant information on the subject of nanoemulsification. These searches were conducted between March and August of 2026. The review covered both research and review articles. Questions were broken into words such as nanoemulsification, nanotechnology, nanoemulsion, drug delivery, nanogel and nanoemulgel were used for the search. These keywords were combined to build terms using Boolean operators such as “AND”, “OR” and “NOT”. Then, quotation marks were used for exact phrases. Filters were used to limit search to suit the review goal. Searches were saved and date of search documented. Publications used were those published within the past few years, ranges 0 – 15 years. Similar papers were removed to avoid duplication. Abstracts were scanned to determine suitability of work to the review and the full texts were reviewed and reference lists checked. There was no restriction in the search in terms of the mechanism of formulation. However, the search on the application was limited only to pharmaceutical formulations. A little above hundred articles were identified, about forty were screened out. Therefore, articles which fell within the inclusion criteria were selected, while about forty that fell in the exclusion criteria were left out during the information gathering.

3. KEY FINDINGS

3.1. Drug Delivery

Drug delivery encompasses the approaches, formulations, technologies and devices used to transport medicinal substances within the body, to either diagnose or treat a disease and achieve desired therapeutic effect [8, 15]. It includes all the routes that are utilized to improve the efficiency, safety and convenience of the therapeutic delivery [8]. The main objective of drug delivery is to be precise, directly at the desired area and at a specific time and concentration to achieve therapeutic/diagnostic aim [16]. Environmental or enzymatic degradation, non-specific toxicity, fast clearance rate and inability to cross biological barriers are impediments that can stall this desire. One of the technological means that can be used to overcome these obstacles is nanoemulsification [8].

3.2. Nanotechnology

Nanotechnology involves manipulation of matter with at least one-dimension size being in the range of 1 to 100 nm [1]. It is a technology that has to do with research and applications whose trait is scale [17]. It also includes a particular technological goal of precisely manipulating atoms and molecules to fabricate macroscale products now called molecular nanotechnology [17]. Nanotechnology encompasses all technological devices, innovations, products and biomaterials in nanoscale meant for application in nanoscience to develop tools, devices that may have unique properties due to their increased surface area [1, 18]. It is a multi-disciplinary science that combines chemical, material engineering and biotechnology [18]. Nanoparticles are intentionally engineered and manufactured through controlled processes for a specific technological or medical use, while 'ultrafine' particles are unintentionally generated as by-products emitted from vehicle exhaust, combustion or atmospheric reactions. Due to their large surface area – to – volume ratio, both display unique physical and chemical properties compared to their bulk materials [19].

3.2.1 Nanomaterials used in Drug Delivery

Nanoparticulate matter is a distinct state of matter from solid state, liquid state, gaseous state and plasma state [24]. Nanomaterials exhibit unique chemical, physical and biological properties at the nanoscale, especially when related to their respective particles at higher scales. A nanogel is a specific nanomaterial which fell under organic and polymeric nanomaterial.

3.2.2 Nanoemulsification

Nanoemulsification is the action of an emulsifying agent in reducing the interfacial tension between an aqueous phase and an oily phase to form a thermodynamically unstable system of particle size 20 to 200 nm [3]. Nanoemulsification is one of the methods used in nano drug delivery [16]. Nanoemulsion development process involves two simultaneous steps namely: hydrodynamic breakdown and interfacial modifications. Hydrodynamic breakdown modulates phase dispersion and suspension of the dispersed phase into the dispersion medium while interfacial modification helps in the adsorption of emulsifiers over the interface. These typical steps are involved during emulsification for umpteen number of times in a short period (typically a microsecond) [20]. Larger droplets have ellipsoidal shape and two radii of curvature while smaller droplets have spherical shape and single radius (requiring higher energy for deformation). In order to produce smaller and stable droplets, the dispersed phase requires extensive stress either by stimuli responsive methods such as elevated temperature, electric shock and ultrasonic vibrations or by agitation [21]. Emulsifiers lower the interfacial tension, minimize energy requirement and stabilize droplet distribution [21]. Their selection is based on their solubility in oil and water phases, type of nanoemulsion required, the required hydrophilic – lipophilic balance (HLB) value *et cetera*. Nonionic surfactants (Tween and Span) with HLB values greater than 8 are normally used to develop o/w nanoemulsion, while those with HLB values less than 8 are used to develop w/o type nanoemulsion [22]. Water – in – oil type of nanoemulsion is usually stabilized by steric hindrance created by the hydrophobic tails of the amphipathic emulsifiers. Charged droplets are usually produced when nonionic surfactants are used as emulsifiers. This is due to the presence of impurities of hydroxonium and hydroxyl ions. If the formed nanoemulsion is acidic (the pH being 3–6), a negative charge will be observed. However, a positive charge will be observed if the nanoemulsion is basic (the pH being above 7). A kinetic stable nanoemulsion may be formed under both conditions [23]. Aliphatic chain of emulsifiers gets protruded toward oil phase while the hydrophilic head accumulates aqueous environment inside [24].

3.2.3 Uniqueness of Nanoemulsions

Nanoemulsions are superior to conventional emulsions in various ways. A reduced amount of organic solvents are required during the preparation of nanoemulsion. There is higher solubilization capacity for both, hydrophilic and

lipophilic drugs due to the presence of the emulsifier. Nanoemulsions have higher kinetic stability, increased interfacial areas, possess rapid absorption by internalization into the enterocyte, and are characterized by improved drug solubility and better bioavailability [7]. Nanoemulsions are more kinetically stable with lower tendency to sediment, flocculate or coalesce. This is due to the properties such as surface charge and smaller droplet size. The force of gravity is being overcome by the Brownian motion of the droplets [26]. The droplet particle size and the reduced surface tension between the oil and aqueous phase inhibit agglomeration and precipitation. Therefore, the possibility of creaming or sedimentation is highly reduced [27]. Nanoemulsion enables the crossing of biological membranes by reversible alteration of the cellular arrangement and improving the interaction with the cells after solubilization of the lipid barrier or its fusion with the cell wall [7, 28]. Nanoemulsion can be used to deliver flavors, fragrances, as well as drugs of natural and synthetic origin. They are suitable as food, cosmetic and pharmaceutical formulations. The surface charge over nanoemulsion offers better interactions and hence leads to better efficacy [29].

3.2.4 Formulation of Nanoemulsions

Just like the conventional emulsion, nanoemulsion comprises the aqueous phase, the oil phase and the emulsifier. The emulsifier is meant to lower the interfacial tension so as to stabilize the distribution of the inner phase droplets within the outer phase. In the case of nanoemulsification, there is formation of a kinetically stable but thermodynamically unstable system called nanoemulsion (Figure 1).

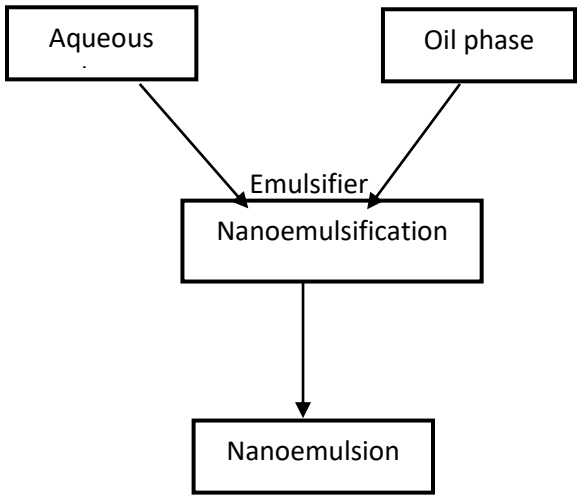

Figure 1: Formulation of nanoemulsion

Formulation of nanoemulsion requires the presentation of the droplets in the size range of 20 to 200 nm. This is attainable using nanotechnology such as high-speed homogenization [30]. Generally, the quality of a nanoemulsion depends on the following factors: the ingredients being used, their concentrations, order of addition, method of preparation, the speed of sharing, the quantity of the emulsifier as well as its quality [31]. Multilayered nanoemulsions (MLNEs) can also be developed as water-in-oil-in-water or oil-in- water-in-oil formulation. This approach has been used by Olorunsola *et al*. for the formulation of insulin as water-in-oil-in-water nanoparticles [30, 32]. Such formulations are developed to manipulate the surface properties, viscosity, permeability and chemical reactivity [33]. A nanoemulsion can be used as the dosage form. However, it can be processed to other dosage forms. It can be converted to a gel. It can also be converted into a powdered form by spray drying techniques. This method increases its stability and facilitates its commercial use [29, 34].

3.3 Evaluation of Nanoemulsions

Several methods can be used for the assessment of nanoemulsions. Droplet size and their distribution can be studied by dynamic light scattering (DLS), transmission electron microscopy (TEM) examines the morphology and surface structure, scanning tunneling microscopy (STM) and atomic force microscopy (AFM) for the exploration of the surface morphology [31, 40]. Nanoemulsions are evaluated on the basis of viscosity, *in vitro* permeation through biological membranes, and drug content determination. To predict stability, Zeta potential analysis predicts the

physical stability against droplet aggregation, thermogravimetric analysis (TGA) and high-performance liquid chromatography (HPLC) can be carried out [35, 40]. Kinetic stability study is used to measure the stability of nanoemulsions. In doing this, the nanoemulsion is exposed to various temperature conditions (freeze-thaw cycle, cooling and heating) in the range of − 20 to 40 °C and monitored for change in size or phase of the nanoemulsion droplets. In long term stability study, nanoemulsion may be stored at ambient or refrigerated conditions for six months and observed for significant change in drug content, encapsulation efficiency, particle size, zeta potential, particle size distribution, viscosity [31]. Study carried out by Singh *et al.,* performed stability studies on nanoemulsion and observed no change in viscosity, drug content and particle size three months after it was left at 25º/60 % RH and 30º/65% RH [40, 41]. *In vivo* assessment can be done by bioavailability studies using high-performance liquid chromatography (HPLC). It can also be done by assessing pharmacological activity. Dermatokinetic investigation is suitable for assessing the efficient delivery of the topical products [28].

3.4 Advantages and limitations of Nanoemulsification

Through the technique of nanoemulsification, very small liquid droplets of 20 – 200 nm are formed [3, 7]. The formulation improves the body absorption of poorly soluble medicines, it protects therapeutic active from oxidation, hydrolysis and environmental degradation via encapsulation. It enables controlled and targeted release of drugs. The process offers an improved retention time of topical active ingredients when the viscosity is enhanced through nanogel or emulgel formulation [41]. The technique can be adapted into formulation of several dosage forms such as sprays, creams, foams and oral route of administration. The system is used in the formulation of nanogel a thermodynamic unstable product. Nanoemulsification uses high energy as specialized equipment like high pressure homogenizers and ultrasonicators are required. There is also concern of surfactant safety as biocompatible surfactants must be selected to avoid toxicity risk.

3.5 Nanogels

Nanogels are three-dimensional hydrogel materials of nanoscale dimension formed from cross-linked polymer-based networks with a high capacity of holding water, without actually dissolving into the aqueous medium [29]. They can be of natural origin, synthetic, or both. They have high degree of tenability in terms of size, shape, surface functionalization and degradation mechanisms. The average size of a nanogel matrix spans from 20 to 200 nm. Nanogels possess unique features that make them attractive in drug delivery systems. They are kinetically stable, have increased solubility, and high drug loading capability [31]. Nanogels have been classified based on the method of crosslinking as either physically or chemically cross-linked nanogels. Chemical crosslinking involves formation of covalent bonds between the polymer chains of low molecular weight monomers or crosslinking of polymer precursors. The most commonly employed method for preparing chemically cross-linked nanogels is heterogeneous polymerization reaction in the presence of either bifunctional or multifunctional cross-linkers [36]. The use of functional initiators and macroinitiators further allows the incorporation of functionalities in the interior or on the surface of nanogels facilitating multivalent bioconjugation [36]. Physically cross-linked systems are formed under milder conditions and tend to be more fragile. Hydrophobically-modified polymers and other associating polymers have been used for preparing functional nanogels [37]. Polymer concentration and environmental parameters such as temperature, pH, and ionic strength, are known to influence the quality of the nanogel formed. Nanogels are soft, deformable and penetrable [12]. The softness and the potential to respond to external stimuli such as pressure, temperature, pH, ionic strength and different analytes make them interesting as soft model systems for drug delivery [31]. They are used in nanomedicine and targeted drug delivery to release therapeutic compounds such as proteins, vaccines and also small molecules at the diseased site.

3.6 Nanoemulgel

A nanoemulgel (NEG) is a hybrid system that mixes tiny oil – in – water droplets (nanoemulsion) into a regular gel base [38]. It is an emerging drug delivery system intended to enhance the therapeutic profile of lipophilic drugs [38]. Nanoemulgel acts as a colloidal system consisting of emulsion and gel. The emulsion part protects the drug from enzymatic degradation and hydrolysis and improves the permeation of the drug at site of application. The gel part improves the viscosity and spreadability which results to increased retention time and reduced interfacial tension [38]. Nanoemulgel differs from Nanogel in many aspects especially in synthesis. Nanoemulgel utilizes nanoemulsion into a regular gel base while a nanogel is a swollen polymer network of (different origin) nano – sized hydrogel particles that traps drugs [11, 38].

Table 1. Difference between a nanogel (NG) and Nanoemulgel (NEG) [12, 38. 39]

Core Difference	Nanogel (NG)	Nanoemulgel (NEG)
Structure	A polymer mesh network (often made of nanomaterial like carbomer and chitosan)	A dual – phase system of nanosized oil/lipid phase and water with an emulsifier.
Drug solubility	Suitable for hydrophilic drugs or proteins that integrate easily into the swollen matrix	Mostly engineered to carry lipophilic and lipophobic drugs by dissolving them in the oil before formation of a gel.
Function	Suitable for carrying water soluble, large molecules, proteins, genes and vaccines	Suitable in dissolving and delivering oily, hard – to – absorb therapeutic actives through the skin
Texture and feel	Typically aqueous, non – greasy, transparent, and completely water soluble.	It retains a non –greasy spreadable feel due to the surrounding hydrogel structure.
Skin penetration	It releases active compounds via polymer swelling and diffusion through the skin surface	It utilizes tiny oil droplets (10 – 100 nm wide) which fuse with and disrupt the skin's outer layer (stratum corneum) to push active molecules deeper through the skin

3.6.1. Nanogel for Delivery of Nanoemulsion

The formulation of NG is carried out using reverse emulsion polymerization method. It uses the non – ionic surfactants namely span 80 and Tween 80 as emulsifiers. This method was invented due to the gap that exists in polyelectrolyte type NG [42]. Polyelectrolyte type (PEL – NG) has wide application prospect in controlled drug release and immobilized catalysis. It comprises of two types of methods - Bottom to Top approach and Top to bottom approach. The Top – down is achieved by microfluidic systems. This system was not feasible due to complex structure and low yield, giving the gap that has been filled by the invention of Reverse polymerization [41]. The bottom – up approach is mainly realized by a template method. The emulsion used for formulation of a Template system is suitable for Polyelectrolyte type Nanaogel. It is noteworthy that monomers for polyelectrolyte nanogel are generally charged, the stability of the emulsion system is degradable easily. The reverse polymerization method aimed at avoiding these defects and adopts nonionic surfactant [42].

3.6.2 Preparation of a Nanogel

Steps involved in the formulation of a Nanogel:

Mixing of water, monomer, an initiator and a cross –linking agent uniformly to form an aqueous phase. Addition of an emulsifier into an oily solvent and uniformly stirring to form the oily phase. Mix the aqueous phase and oily phase to obtain a uniform emulsion. Finally, add a catalyst like tetramethylethylenediamine (TEA) into the emulsion to carry out the polymerization reaction to obtain a Nanogel [42]. The Nanogel prepared by this method has good stability, there is uniform distribution of the particle size and controllable particle diameter. The formulated Nanogel is both lipophilic and hydrophilic, therefore hydrophilic and lipophilic drugs can easily be delivered as it is dissolved in the emulsion. Also, the resultant NG formulated is highly deformable facilitating better absorption [42].

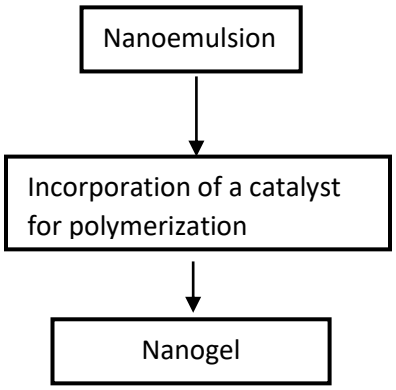

Figure 2: Formulation of Nanogel

3.6.3 In vivo Behaviour of Nanogels

Nanogels are designed to achieve long circulation half – lives of their therapeutic agents in addition to delivering the agent at the desired site. To realize this, the nanogel must overcome barriers, especially when administered via other routes such as oral, intradermal, pulmonary, and intraocular. Depending on the route of administration, nanogels prolong circulation half-life of their therapeutic agents by: preventing their fast clearance especially in the case of small molecules and preventing quick degradation or metabolism which is more relevant for biomolecules [34]. PEGylation of a nanosystem is one of the methods for enhancing long circulation properties and reduction in Mononuclear Phagocytic System (MPS) like liver and spleen. However, some studies have shown that PEGylation of nanoparticles tends to shift their accumulation towards spleen instead of the liver as compared to the non-PEGylated nanosystems [36]. A unique feature that helps nanogels to partially escape splenic filtration process is their softness and deformability. Such formulations behave like erythrocytes, which in spite of having a size range in microns are able to pass through the splenic filtration bed that has a pore size of few hundred nanometers, due to their flexibility and deformability [36]. This inherent property of nanogels is highly advantageous for *in vivo* application [38].

3.7 Applications in Drug Delivery for Tropical Disease Management

Nanoemulsions have emerged as versatile drug delivery systems. This is due to their ability to enhance solubility of poorly soluble drugs, improve bioavailability, provide controlled and targeted release of drugs at site of action and formulate into various dosage form design [27].

3.7.1 Oral drug Delivery

It has provided the bases for formulation of previously poorly water – soluble drugs to oral dosage form which remains the most preferred route in terms of patient compliance. Nanoemulsion can facilitate lymphatic transport, thereby bypassing first – pass metabolism and improving systemic bioavailability [27]. Medications such as Celecoxib for pain management, Efavirenz for HIV and Cyclosporine for an immune – suppression had improved clinical efficacy through these advanced lipid – based nanoemulsification [35].

3.7.2 Topical and Transdermal Delivery

Nanoemulsions formulated into nanogel or nanoemulgel are useful for dermal and transdermal drug delivery due to their enhanced skin penetration capability [27]. They provide uniform drug distribution and increased hydration of the skin [26, 27]. Controlled drug release of nanoemulsions minimizes systemic side effects [26]. An example is antifungal Terbinafine hydrochloride [10,11, 43].

4 CONCLUSION

Nanoemulsification combines nanotechnology and emulsification for the purpose of optimizing drug delivery. Nanoemulsion is formulated via Nanoemulsification. One of the techniques employed is reverse polymerization in formulation of a nanogel. The patented method was crucial to fill the gap of low yield, complexity of formulation and easy degradability of polyelectrolyte NG. The review was able to elucidate the difference between nanogel (NG) and nanoemulgel (NEG). The formulation of nanogel via nanoemulsification improves the solubility of both hydrophobic and hydrophilic drugs, increases skin penetration, targeted and controlled release of drugs [40]. With these, solubility and bioavailability of the drugs are improved. It is a promising field that, if harnessed, provides versatility in dosage form design, increased drug targeting and improved patient compliance of therapeutic and theranostic agents. Future perspective should also focus on the growing interest in herbal and nutraceutical formulations as this will present valuable opportunity for nanoemulsion technology. Incorporation of phytoconstituents into nanemulsion systems may improve their stability, bioavailability and therapeutic performance [41]. There is room for further research to address the thermodynamic instability of nanogel, reduction of high energy in the formulation and large-scale production challenges [27].

5 DECLARATIONS

Conflict of Interest

The authors declare that they have no conflict of interest

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Authors' Contribution
Amarachi C. Offor: Conceptualization (equal), data curation (lead), Methodology (supporting), Writing – original draft (lead), Funding acquisition. Ntiido B. Aniekan: Writing – review and editing (supporting), Validation. Ekaete I. Akpabio: Methodology (supporting), Project administration (supporting), Supervision (supporting), Writing – review and editing (supporting). Emmanuel O. Olorunsola: Conceptualization (lead), Methodology (lead), Writing – original draft (supporting), Supervision, Visualization

Originality Statement
On behalf of all the Authors I declare that the Review article manuscript titled "***Nanoemulsification in Drug Delivery and Nanogel Formulation: A Review"*** is an original work, it has not been published anywhere before and it is not under consideration in any other journal. All text, data and illustrations produced by third parties have been properly cited and acknowledged.

AI Declaration
No artificial intelligence tools were used in the preparation of the manuscript.

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