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Review Article

Emulgel: A Revolution in Topical Drug Delivery

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ABSTRACT

Emulgels represent the next big step in topical drug delivery by combining the benefits of emulsions and gels with a view to enhancing the therapeutic efficacy of hydrophobic drugs. This review discusses composition, mechanism, preparation, evaluation, and therapeutic applications of emulgels. In the usage of emulgels, improvement takes place in drug solubility, stability, and skin penetration, thus addressing the shortcomings of conventional topical formulations. This paper discusses the science of emulgels and the dual control release system, involving both immediate and sustained drug release, it runs through the methodology of preparing emulgels by formulating the emulsion and gel phase separately and then finally forming the mixture with all lipid phases. The paper further discusses sophisticated formulation techniques, including high-energy emulsification and incorporation of nanoparticles. Standard evaluation methods for emulgels are outlined, covering the physical appearance, rheological properties, pH measurement, stability studies, and in vitro drug release testing. The therapeutic potentials for emulgels are explored within its myriad applications, which are severely aimed at dermatology and pain relief. It identifies stability, formulation complexity, and several more critical areas, from which the focus to avert problems in these areas can be taken. The authors discuss potential future research developments leading to personalized medicine, the collapse of nanotechnology, and expanded progressed therapeutic applications. To conclude, although the emulgels secured much apprehension as to topical drug delivery, lots of things are yet to be done in the areas for further research in order to overcome various limitations that flummox them from wide use in clinics.

INTRODUCTION

The skin is a complex organ that covers an average surface area of approximately 2m² and gets about a third of the body's blood circulation. Learning its physiology is a key to the good preparations of a skin. The skin is provided with many hair follicles and sweat duct, event with the skin's pH from 4 to

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5.6 because the pH is regulated by sweat and sebum. Internally, the skin has a four-fold structure: the non-viable epidermis, the viable epidermis, the viable dermis, and the subcutaneous connective tissue. It is the final layer of the skin that functions as a guard to keep the external materials from entering the skin. It is a shield that has multiple cell layers which are flattish like plates, have a considerable lipid and protein fixes. This material's features are necessary for the clear understanding of the drug's ability to enter the skin. The improvement of topical drug designs to effectively system circulation via skin is the priority area of hydrophobic drug delivery. In particular, emulgels are been in focus for their benefits like for example, they thicken and get thinner, are completely free of grease, work well over broad areas of the skin, and have a long shelf life. These properties make them a better option as compared to the traditional skin-saving products in stores. The use of a penetration enhancer such as an emulgel, for better drug delivery through the skin, is one of the most promising options as a dermatological application of such products progresses.[1]

1.1 How Emulgel works: The science behind it

The emulgel or nano-emulgel represents the combination of an emulsion and a gel that greatly enhances drug release due to several mechanisms: Emulgels improve the stability and therapeutic profile of lipophilic drugs by solving limitations such as poor solubility, unpredictable absorption, and low oral bioavailability. By combining the emulsion and gel, dual-control release is provided, increasing stability and allowing immediate and controlled release [2]. This combination also gives due credit to drug release when contrasted with other topical drug delivery systems caused by a lack of excess oily bases and insoluble excipients [3]. Emulgels provide versatility for drug delivery making them capable of delivering hydrophobic and hydrophilic drugs for various therapeutic purposes [4,5].Moreover, emulgels have shown potential in delivering probiotic-drug combinations, which is particularly beneficial for treating conditions like Crohn's disease and ulcerative colitis [6]. Several mechanisms increase retention time on the skin for topical dosage forms: The active ingredients are embedded into the emulgels, providing a dual-control release system by the combination of an emulsion and gel, enhancing the stability of the drugs with sustained release rates. The gel phase offers a non-greasy, easily spreadable base that adheres well to the skin, increasing contact time and improving patient compliance [7]. This is an important property. Prolonged contact provides sustainable drug release and better absorption. The emulsion part in the emulgel allows both hydrophilic and lipophilic drugs to be incorporated together, thus improving solubility and permeability through the skin [8]. Therefore, the drug in the oil phase of the emulsion could bypass the barrier function of the skin for drug penetration. Besides, emulgels can also be used with penetration enhancers like mentha oil and clove oils to enhance drug absorption through the skin [9]. It is interesting to note that emulgel performance may be dramatically influenced by the preparation methodology and formulation parameters. For instance, the gelling agent concentration, oil type, and emulsifiers affect the stability and efficacy of the emulgel . Continuous manufacturing techniques, like melt extrusion, which afford better controlled globule size and drug release rates, can be utilized to produce emulgels [10].

1.2 What makes up an Emulgel?

1.2.1 Medicines That Can Be Used in Emulgels[11]:

Emulgels are a special type of formulation that mixes the properties of gels and emulsions in order to enhance or deliver a certain kind of medication.

Hydrophobic Drugs: Some hydrophobic (water-insoluble) drugs are absolutely unsuitable for solubility and absorption through the skin, and emulsions thus serve to better their solubility and absorption from traditional gel bases.

Topical Preparations: Emulgels are used in various topical therapeutic drugs for skin conditions. They avail safer local actions with minimal side effects that other conventional dosage forms could not provide.

Anti-inflammatory Agents: Emulgels are used to formulate several anti-inflammatory drugs. Sustained-release and better localization properties are achievable with the emulgel formulation, thus ensuring their potency against conditions like arthritis and localized pain.

Antifungal and Antibacterial Agents: Emulgels have also been used as carriers for antifungal and antibacterial actives. The emulsion enhances the stability and efficacy of the active ingredient, making it ideal for the treatment of skin infections.

Cosmetic Ingredients: The emulgel preparation has widely been applied in the cosmetic segment along with that of pharmaceuticals. The textural feel makes such delivery systems, such as those for acne cream flavors, SDLs, and vitamins, very attractive indeed.

Novel Polymers: Novel use of polymeric systems in emulgels providing a formulation route for stable emulsions and creams makes such polymers excellent emulsifying agents and thickeners, improving general emulgel efficiency and widening the spectrum of active agents possible.

1.2.2 Gelling Agents and Drug Release

The gelling agents within emulgel formulations are exceedingly important for enhanced delivery of the drug and increase stability. Apart from providing the essential viscosity, gelling agents alter the release profile of active ingredients. This draft, hence, deals with the importance of various gelling agents in the optimization of emulgel formulations. The gelling agents like chitosan and fucoidan have shown to prolong drug release and enhance stability in emulgel formulations. For instance, a formulation containing 2.54% chitosan and 0.896% fucoidan manifested 99.7% drug release within 12 hours following a zero-order release model [12]. Moreover, Lepidium sativum mucilage has been found to enhance drug penetration and release rate in topical formulations [13].

Physical Properties and Stability:

The use of gelling agents directly impacts the physical properties of emulgel, including viscosity and spreadability. For instance, formulations with varying concentrations of gelling agents like Viscolam MAC 5% have shown considerable differences in stability and efficacy [14,15]. The gel phase in emulgels has augmented stability and bioadhesive characteristics, thus enhancing patient compliance by reducing greasiness [16].

1.2.3 Influence of Oils and Surfactants on Active Ingredient Release in Emulgel Formulation[17]

Oil Phase Composition: This includes the type of oil used in emulgel formulations affecting the solubility and stability of active ingredients. For instance, oils with strong lipophilicity enhance hydrophobic drug solubility to impregnate more easily into the emulgel matrix. Most therapeutic agents are hydrophobic and require appropriate carriers for efficient delivery.

Surfactant Role: Surfactants play an important role in the stabilization of emulsions in emulgel. They reduce surface tension along the interface between oil and water phases; this promotes formation of a stable emulsion. Choice surfactant (e.g., Tween 80 or Span 80) affects the droplet size of the emulsion, which affects the rate of liberation of the active ingredients. Smaller droplet size means more available surface area for the drug to escape, hence enhancing bioavailability of the active compound.

Release Mechanism: The viscosity and thixotropic property of the formulation dictate the release of active ingredient from emulgels. Emulgels are formulated so that they allow better spreadability and slippery characteristics hence uniform application on the skin. The viscosity can be altered by changing the concentration of gelling agents such as Carbopol and could modify the release data for active ingredients.

Hydrophilic lipophilic balance: The HLB value of surfactants plays a critical role in stabilizing what type of emulsion is formed-oil-in-water or water-in-oil. In harmony, it maintains emulsion stability and release of active ingredients. The proper HLB of surfactant will facilitate penetration of drugs via modulation of skin barrier characteristics.

Acceptance of patients: Characteristics of formulation affect the patient's compliance: these are pickings of oils and surfactants. The less greasy and more easily spreadable emulgels are likely to command greater patient acceptance and hence better efficacy of treatment.

1.2.4 Role of Penetration enhancers:

Some penetration enhancers can significantly affect the stability and efficacy of an emulgel in drug delivery applications. The selection of the penetration enhancer and its concentration can optimize these formulations, ultimately enhancing their therapeutic activity.

Effects on Stability:

Viscosity and Rheology: Penetration enhancers may affect the viscosity of emulgels and consequently their spreadability and stability. For example, specific gelling agents such as carbomers may stabilize the emulsion system through the prevention of phase separation. Interactions with Emulsifiers: The interaction of penetration enhancers with emulsifiers could promote emulsion stability, ensuring homogeneity of the drug throughout the gel [18].

Drug Release and Penetration:

Enhanced Permeation: The penetration enhancers could enhance the drug permeation across the skin barrier and hence bioavailability. Thus, it increased the drug release profiles from optimized emulgels over conventional formulations [19]. Dual Process of Release: Emulgels provide a dual process of release with emulsion aiding the initial drug release and the gel matrix serving the purpose of prolongation. It can be further enhanced by the addition of penetration enhancers [20]. On the other hand, though penetration enhancers enhance drug delivery but excessive use could cause skin irritation or even compromise the emulgel's stability, substantiating the call for prudent formulation strategies to strike a balance between efficiency and safety [21].

2. Preparation of an Emulgel [22]

A methodology is adopted in preparing emulgel that balances the processes involved in the preparation of both emulsion and gel. A detailed discussion of the process has been described in the article.

2.1 Preparation of the emulsion:

Separate Phases: Prepare the oil phase and the aqueous phase separately. The usual oil phase will include castor oil, clove oil, or liquid paraffin; the aqueous phase will be made usually using water-alcohol.

Mixer Phases: When both phases are prepared, mix both phases with gentle stirring to form the emulsion. It can be of two types, namely oil-in-water or water-in-oil, depending on the nature of the drug being delivered (lipophilic or hydrophobic).

2.2 Gel Preparation:

Gelling Agent: To prepare the gel, use an appropriate gelling agent. The agent is of central importance because it provides viscosity and stability to the gel.

Incorporation: After gel formation, the emulgel is mixed with the emulsion that was formed before. This combination of the two makes a classical emulsion form an emulgel.

2.3 Final Mixing:

Gentle Stirring: Mix thoroughly but gently the emulsion and the gel for impassivity of the emulsion consistency.

Emulgel Properties: The resultant emulgel will have a horde of beneficial properties, which includes thixotropic, non-greasy, spreadability, and acceptability for cosmetic purposes; such advantageous properties characterize emulgels ideal for applications in topical drug delivering systems.

3. Formulation Techniques [23]

Advancement in techniques can also add to the quality and efficacy of emulgel applications as drugs are matrically controllable delivery systems. This unique quality arises from their structure with a combination of compatibility between emulsions and gels in terms of control over drug solubilization, stability, and release. The following segments outline the most productive strategies gathered in recent times for that purpose.

- High-Energy Emulsification: This method increases the surface area of the dispersed phase so that this will improve drug solubility and stability.

- Microfluidization and Ultrasound-Assisted Emulsification: These novel techniques can augment the efficacy of emulgel formulations against the refinement of emulsions leading to superior penetration of drugs.

- Embedding Nanoparticles: The use of nanomaterials enhances drug bioavailability and targeted delivery in emulgels.

Optimization Strategies

- Multi-objective optimization: Strategies such as machine learning algorithms, like ANN and SVR, have been used to weigh the parameters of consistency against drug diffusion properties leading to an enhancement in formulations [24].

- Gelling Agent and Emulsifier Selection: Viscosity, spreadability, and drug release rate of an emulgel greatly depend on the type and concentration of components such as carbomers and surfactants.

Therapeutic Applications

- Drug Delivery Enhancement: Emulgels show enhancements in drug penetration and

sustained release; this opens a door for a diverse range of therapeutic areas-dermatology and pain management [25] .

- As controlled release systems, emulgel formulations, like that of lornoxicam emulgels, achieve such sustained release-a target for treatment of rheumatoid arthritis [26] .

4.Evaluation of Emulgel:

4.1 Physical Appearance and Organoleptic Properties

Physical evaluation for stability and consistency testing and for assessing therapeutic properties are done through a series of established standardized methods with which we establish that the emulgel conforms to the required quality for topical medicinal use.

- Visual Inspection: Evaluating color, consistency, and phase separation to ensure homogeneity [27].

- Organoleptic Characteristics: Texture and odor assessment as a measure of acceptability [28].

4.2 Rheological Properties [29,30]

- Viscosity: Measurement of viscosity, with a viscometer, of emulgels is done to evaluate the thickness. The viscosity of emulgels is generally determined by a Brookfield viscometer[31], which is widely used in the pharmaceutical industry owing to its accuracy and reliability in viscosity measurement of semi-solid formulations. Through rheograms depicting the flow attributes of the formulation, the rheological behavior of emulgels could also be assessed. For instance, all of the formulations exhibited pseudoplastic flow that indicates a decrease in viscosity with the increased shear rate. This property is advantageous for topical application since it promotes easy spreadability on the skin. In addition to the viscosity measurements, textural analysis contributes complementary information relating to the properties of emulgel. In textural analysis, a textural analyzer measures the textural property of an emulgel, shedding light on its consistency and spreadability. All of these parameters are important to ensure patient compliance and effectiveness of drug delivery. Measurements taken include viscosity by means of a Brookfield viscometer, rheological studies, and texture analysis providing a general assessment of the physical characteristics and performance properties of emulgels [32].

- **Spreadability:** Determined by the distance the emulgel spreads under a predetermined weight, gives an indication of how easy the preparation can be applied. Spreadability testing is another important evaluation parameter of emulgels to ascertain their application and distribution across the skin surface. Generally, a fixed amount of emulgel (e.g., 1 g) is placed between two glass plates with known weight and dimensions. The area produced by spreading the emulgel under a specified weight (e.g., 100 g) for a specific time (generally 1-5 minutes) is then measured. This test helps to quantitatively determine how easily the emulgel spreads over skin surfaces. Coincidentally, some studies reported spreadability in centimeters while others used grams per second. The spreadability values for optimized formulations were 9.9 and 9.5 cm, respectively [33] . While some characterized spreadability as the time that takes to separate two glass slides with a sample. The type of reporting variations shows a need for standardization in techniques of evaluating

emulgels. The spreadability study is vital in the determination of quality and performance of emulgel such as ease of application and uniform distribution on the skin surface, aspects that might have great effects on patient compliance and therapeutic efficacy.

4.3 Stability and pH

- **pH Measurement:** Ensuring that the formulation lies within a skin-friendly range (5-7). The pH evaluation in emulgel analysis assists in ascertaining the topical suitability of the formulation. Based on the information provided: pH of the emulgel formulations was generally ascertained using a pH meter. For example, the pH of ebastine emulgel preparations was in the range of 5.2 ± 0.17 to 5.5 ± 0.20, which were found suitable for topical applications [34]. However, it must be highlighted that pH measurement is susceptible to the uncertainty of pH measurement among generalities. Estimation of the uncertainty of measurement made in routine pH measurement with a pH meter using two-point calibration and a combination glass electrode. The author cites 14 components of potential uncertainty predominantly connected with the experimental particulars, alongside the fact that pH measurement uncertainty strongly depends on the experimental details along with the pH value itself [35]. It has also been pointed out that the Spanish National Research Council works for optimized application on pH measurement regarding the determination of pH in emulgel formulations. A work elaborated a modified version termed the S-ESL method, developed for cement matrix materials, but adaptable for investigating emulgel. The main objective was to avoid underestimating pH variations while stirring in solution and taking a reading, without affecting the necessity for inert gas to block off air contact [36].

- **Stability studies:** Time-period studies done to assess physical stability under different conditions.

4.4 Drug Release and Efficacy

- **In Vitro Drug Release:** Evaluation of the release profile for the active ingredient involves the use of a Franz diffusion cell. The Franz diffusion cells or modified Franz diffusion cells are mostly used for in vitro drug release studies on emulgels. The emulgel formulation is placed in the diffusion cell between the donor and receptor compartments on a synthetic membrane or on skin excised from an animal. The receptor compartment is filled with an appropriate medium, and samples are periodically taken for analysis of the drug release. The choice of the release medium and the membrane greatly affects the resultado. Some studies have used phosphate buffer saline (PBS) for the release medium, while others might use more complex media in an attempt to mimic physiological conditions. The temperature is generally set at 37 °C to simulate body temperature [37,38]. Dialysis membrane methods are also used, where the emulgel inside a dialysis bag or tube is immersed in a release medium. The drug diffuses through the membrane into the surrounding medium, and a specific volume is withdrawn at various time points for analysis [39].

- **Therapeutic Activity:** Specific assays test anti-inflammatory or antibacterial properties [40].

5.Therapeutic applications [41]

Emulgels existence provides a very good seamless advancement in topical drug delivery systems by proactively combining the advantages of emulsions and gels to create a highly effective carrier for hydrophobic drugs. They are very unique in their formulation due to their stability and bioavailability, and they are highly compliant with the patient, and this would also be useful for a varied number of applications across various fields of therapy.

Improved drug penetration and absorption

- The emulgels prepared should also enhance the solubility and stability of hydrophobic drugs, hence allowing a greater penetration of the drug into the skin.
- The use of surfactants and co-surfactants in emulgels reduces the interfacial tension of drugs and enhances permeability.

Stability and Controlled Release

- Emulgels possess thermodynamic stability, thus overcoming many typical problems posed by conventional emulsions like phase separation and poor drug release patterns.
- They would offer dual mechanism control and sustain relief, helping in the maintenance of therapeutic levels for longer periods of time.

Therapeutic Applications Versatility

The applicability of emulgels in dermatology, pain management, and antimicrobial applications is well-documented and denotes the utilization of such formulations in effective drug delivery. The formulation ranges from antifungals to analgesics by allowing activity to be achieved over a wide range of therapeutic agents so that the horizon across which these preparations may serve can be broadened. However, alongside several advantages, efforts must still be in place for their about large-scale production along with stable formulations for prolonged use and finally realizing their full potential for clinical practice.

6. Limitations [42]

Despite their usefulness as topical drug delivery agents, emulgels incur defects and limitations as compared to the traditional ones. The resultant disadvantages can either affect their efficacy or invite overload in clinics.

Stability Problem

- Stability problems may occur from manufacturing to storage, possibly leading to an inconsistency in drug release kinetics and hence efficacy.
- Phase separation is one of the classic emulsion problems, which may, in turn, interfere with emulgel formulation.

Complexity of Formulation

- Formulating an emulgel involves complicated optimization processes with respect to a multitude of components including gelling agents and emulsifiers; thus, the development could become quite challenging. Depending on the choice and concentration of these components, there might be variability in the performance of the final product.

Patient Acceptance

- Though emulgels are conceived to be responsible for enhancing patient compliance through improved drug delivery, patients may find complex formulations off-putting, opting for simpler alternatives.

These limitations notwithstanding, emulgels offer considerable advantages over traditional formulations in terms of bioavailability, target-specific delivery that could outbalance these shortcomings in some particular therapeutics. Extending this work will help mitigate these challenges and take steps toward improving, optimizing, and promoting the application of emulgel formulations in clinics.

7. Current research gaps and future directions:

In order to find a delivery vehicle, Emulgels were reported as a promising vehicle for the delivery of drugs, especially for delivery of hydrophobic drugs.It is expected that further research would solve some pertinent problems regarding the clinical application of emulgels.

7.1 Current Research Gaps [43]

- Formulation Techniques: Whereas aroma-wave-assisted emulsification and microfluidization are already tried and true, work needs to be directed towards the establishment of standardized procedures for reproducibility and scale-up for emulgel manufacture.

- Clinical Applications: Very few reports deal with the therapy of emulgels with regard to other diseases apart from dermal ailments, like systemic disorders or diseases newly diagnosed.

- Regulatory Hurdles: The pathway for regulatory approval for emulgels is not well documented; therefore, further research is essential to promote a compliant context.

7.2 Future Directions [44]

- Personalized Medicine: Research in this future is directed towards fine-tuning emulgel formulations tailored to the individual patients in enhancing therapeutic benefits.

- Incorporating Nanotechnology: Inclusion of utical applications.

- Long-Term Stability Studies: A major consideration for the transfer of emulgels from laboratory to clinical practice.

However, despite their desirable aspects, formulation complexity and significant regulatory challenges could be hindrances to emulgels' applications. Resolving those issues will be indispensable for the emulgels' realization of their true potential in modern therapeutics.

7.2.1 Future Prospects of Emulgel in Drug Delivery [45]

The future prospects of emulgel as a topical drug delivery system look bright, given several attributes leaning toward important advantages on efficacy and applicability.

- Patient Compliance: Emulgel formulations are thixotropic, grease-free, and spread easily to obtain better patient compliance with topical medications. This feature may lead to a greater degree of research and development in this area whereby the emulgel may become the preferred topical delivery system for patients. Again, such systems could be patented.

- Versatile for Drug Formulation: This is a platform suitable for almost all types of drug formulations, hydrophobic and hydrophilic, affording wide applicability in therapy. These adaptable properties suggest, therefore, that further investigations will be inclined towards the formulation of emulgel with a variety of active pharmaceutical ingredients (APIs),

thereby expanding its application for treatment of various diseases.

- Improved Bioavailability: Gel bases containing emulsions improve bioavailability for hydrophobic drugs. This feature serves as an important basis for efficient topical therapies, and ongoing work may explore successfully optimizing the various formulations for enhanced drug absorption through skin absorption.

- Stability and Shelf Life: Emulgel formulations possess good stability and an extended shelf life, an important factor for commercial viability. Future investigations will be focused on running accelerated stability tests to ensure that these formulations remain potent for sale to the market.

- Limiting Issues: Although emulgel is advantageous for many reasons, it also suffers from formidable issues that include possible skin irritation or poor permeability to certain drugs. Such future research will include attempts to explore new gelling agents or modifications of existing formulations aimed at enhancing the compatibility of the skin with the molecules and improving their absorption.

- Market Growth: Emulgel formulations are likely to witness market growth due to the increasing demand for effective topical drug delivery systems. More and more pharmaceutical companies, recognizing the advantages offered by wetting agent emulgel formulation, have put a variety of innovative uses in the market.

7.2.2 Future Prospect of Emulgel [46]

Emulgel, as a drug delivery system, bears great promise for the future based on topical need in the delivery of hydrophobic drugs.

- **Enhanced Drug Delivery:** Emulgel formulations seem to be really useful in the delivery of hydrophobic drugs, which have always been a problem in their topical application. The emulgel system permits these drugs to penetrate into an oily phase more efficiently.

- **Limitations of Classical Formulations:** Conventional topical formulations, such as ointments and creams, usually contain oleaginous bases that inhibit the incorporation of water, making them thick and greasy. Emulgel in contrast is the combination of the characters of both gel and emulsion attacks, making a much better medium of releasing drugs.

- **Controlled Release Mechanism:** The emulgel system thus acts as a controlled release drug delivery system. The active ingredient molecules are entrapped in an internal phase and are released through the outer phase at a controlled rate to enhance their absorption in the skin.

- **Cosmetic and Pharmaceutical applications:** Transparent appearance gives the emulgel a wide cosmetic application as well as it finds a place in pharmaceuticals. It is one of the best materials for consumers because of it being greaseless, spreadable, and friendly to the skin.

- **Compatibility and stability:** To maintain the stability and compatibility of various excipients in different emulgel formulations would be a further avenue of research where such techniques such as FTIR analyses could focus to ascertain the best possible storage

conditions, ensuring through stability of the drug in a solid state.

- **Broader Therapeutic Applications:**

To treat a variety of conditions that include muscle pain, acne, and psoriasis, emulgel can be used. Considering the emulgel can now deliver both hydrophilic and hydrophobic drugs, its compatibility allows in combination therapies.

8.CONCLUSION:

Topical drug delivery systems including emulgels represent a remarkable advantage in the formulation of topical drug delivery systems since they combine benefits from emulsions and gels. They certainly have better penetration and bioavailability for the hydrophobic entities. Emulgels provide a dual-control release mechanism in terms of enhanced stability and effectiveness of drugs. They have broader applications in therapeutics, notably dermatology-based and pain-related medications. Formulation takes a delicate precision mechanism through optimization of several components. The issues of stability during manufacturing and storage are a major challenge for emulgel formulations. Future endeavors should focus on personalized medicine and the use of nanotechnology in emulgel formulations. The stability studies for longer duration prove to be vital when transitioning emulgels from laboratories to clinics. Despite the drawbacks, emulgels are undoubtedly promising for facilitating patient compliance thanks to their favorable properties. Further studies should address these current challenges and complete the full realization of the clinical potential of emulgels.

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