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EMULGEL: AN EMERGING TREND IN NDDS

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ABSTRACT

The method of administering medication to any part of the body via the skin, vagina, eyes, or throat is known as topical drug delivery. Medication may be used for systemic or local effects. It is possible to create topical formulations with different physicochemical characteristics, such as liquid, semisolid, or solid. A drug emulsion is created and combined with an emulgel to create the topical system. Combining a surfactant and a co-surfactant results in Emulgel, a thermodynamically stable formulation with low interfacial tension and several advantages, including improved permeability and strong thermodynamic stability. When a gelling agent was applied, these emulsions-either water-in-oil or oil-in-water-gelled. incorporating an emulsion into a product. It also increases the gel's stability by acting as a dual-control release mechanism. Combining the terms "emulsion" with "gel" yields "emulgels." Emulgel features a continuous release pattern with dual control. Emulgel increases patient compliance and bioavailability. The pH, viscosity, particle size, zeta potential, stability analysis, skin irritation test, and medication content of the final formulation are all evaluated.

KEYWORDS: NDDS; Topical drug delivery; Emulgel; Emulsifying agent; Microemulsion; Novel topical drug delivery system.

INTRODUCTION

Topical medicinal administration makes it simple to treat both local and broad disorders. The direct accessibility of the skin as an organ for diagnosis and therapy is one emerging field in dermatological pharmacology. Topical drug delivery methods offer several advantages, including the capacity to apply a large amount of medication to a specific location, the avoidance of gastrointestinal incompatibility, and the avoidance of metabolic deterioration associated with oral administration. By avoiding the liver's first pass metabolism and ensuring steady distribution over a long period of time, several topical treatments provide improved bioavailability. The primary drawbacks of topical dosage forms are drug penetration through the stratum corneum in hydrophilic medication administration and drug breakdown and diffusion in hydrophobic medication delivery. When making emulgel, both water and oil Additionally, hydrophilic and hydrophobic medications are commonly applied to the skin using water-in-oil emulsions as carriers. Additionally, they dissolve drugs and penetrate skin effectively.[1,2,3]

Since emulgel is a new area for topical medication administration with few commercialized solutions to date, focusing on it is both exciting and difficult. Before moving on to emulgel, it is essential to comprehend the benefits of emulsion and gel for topical drug delivery. One of the two immiscible phases of an emulsion—the internal or discontinuous phase—is dispersed into the other (the outer or discontinuous phase) with the help of an emulsifying agent. Emulsions are systems of controlled release. The drug particle that was trapped in the internal phase travels through the outer phase and then absorbs gently into the skin to produce a regulated effect. Emulsions can be classified as either oil-in-water or water-in-oil. A gel, as defined by USP, is a semisolid system composed of liquid that has permeated it.

Combinations of small inorganic particles or large organic molecules. The gel retains small drug particles and maintains regulated drug release because it comprises a larger amount of aqueous or hydroalcoholic liquid in a cross-connected network of colloidal solid particles.[1,4,5,6]

FACTORS AFFECTING TOPICAL ABSORPTION OF DRUG[7,8]

(a) Physiological factors

1. Thickness of skin.
2. Content of lipids.
3. Hair follicle density.
4. Sweat gland density.
5. pH of skin.
6. Flow of blood.
7. Skin hydration.
8. Skin inflammation.

(b) Physiochemical factors

1. The coefficient of partition.
2. Weight of molecules (<400 Dalton).
3. Ionization level (only unionized medications are well absorbed).
4. Vehicle impact.[7,8]

FACTORS TO BE CONSIDERD WHEN CHOOSING A TOPICAL PREPARATION

1. The vehicle's impact For instance, an occlusive vehicle increases the active ingredient's penetration and boosts effectiveness. The vehicle itself may have protecting, emollient, drying, or cooling properties.
2. Assign the appropriate preparation type to the lesions. For instance, if you have extreme weepy dermatitis, stay away from fatty ointments.
3. Adapt the kind of preparation to the location. (For instance, lotion or gel for places with hair)
4. Potential for irritation or hypersensitivity. Gels are irritating, but ointments and w/o creams are generally less so. If an allergy to preservatives or emulsifiers is a worry, ointments do not contain these substances.[7,9]

ADVANTAGES OF TOPICAL DRUG DELIVERY

1. Increases adherence from patients.
2. Adequacy for self-administration.
3. First pass metabolism should be avoided.
4. More site-specific in nature.
5. Preventing incompatibility with the gastrointestinal system.
6. Enabling the use of medications with a limited therapeutic window and a short biological half-life.
7. The ease with which medicine can be stopped as necessary.[7,10]

DISADVANTAGES OF TOPICAL DRUG DELIVERY

- Some drugs have poor skin permeability.
- Contact dermatitis causes skin inflammation.
- Large-particle drugs are difficult for the skin to absorb.
- The potential for allergic responses.[7,10]

EMULGEL

It is both intriguing and challenging to concentrate on the emulgel market because it is a relatively new area of topical medicine administration with few commercialized products to date. Understanding the advantages of gel and emulsion is crucial before applying either for the topical delivery of medication. Emulsions consist of two immiscible phases, one of which is disseminated into another, and are systems of regulated release. Transparent, biocompatible, thixotropic, spreadable, readily detachable, emollient, and non-staining are all characteristics of emulgel. They are also aesthetically pleasing and greaseless. Additional benefits include their great cutaneous penetration and long shelf life. Emulgel works as a dual control release system because it possesses the properties of both an emulsion and a gel. Emulgel is one kind of biphasic semisolid formulation. These days, they are being used in conjunction with controlled delivery applications. Emulgel can distribute both lipophilic and hydrophilic drug moieties since it contains both aqueous and non-aqueous phases. Because it isn't greasy like other topical formulations like ointments, creams, etc., which are thick and require a lot of rubbing, it is applied to the skin suitably. It is commonly known that topical medication administration is effective. Emulgel can deliver hydrophilic or lipophilic medications since it has both aqueous and non-aqueous phases. In recent years, they have been used as a control release formulation. These biphasic systems offer a higher drug loading capacity and are more stable.[11,12,13]

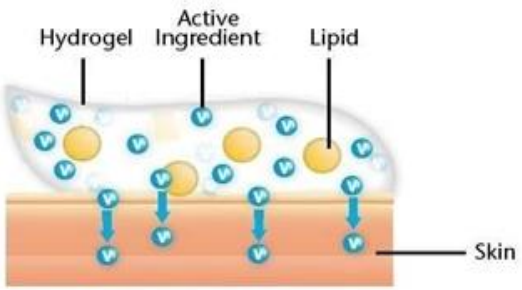

Figure 1: Structure of Emulgel.[11,14]

TYPES OF EMULGEL

a). Macroemulsion gel

Emulgel that has emulsion droplets bigger than 400 nm. Under a microscope, the individual droplets are easily visible, even if they are physically unnoticeable. Surface-active materials are thermodynamically unstable, notwithstanding their ability to help stabilize macroemulsions.[11,14] The type of emulsifier and the emulsification procedure determine whether the macro emulsion is O/W or W/O.[11,15]

b). Microemulsion gel

Microemulsions are thermodynamically stable and optically clear. This microemulsion, which is made up of spherically distributed, monodispersed droplets, has a diameter between 20 and 200 nm.[11,15] In specific ratios, it is made up of water, surfactant, co-surfactant, and oil. Among the unique properties that microemulsions may have are a broad interfacial region, extremely low interfacial tension, and the ability to dissolve both aqueous and oil-soluble substances. The elements of the microemulsion may promote a greater rate of medication penetration by lowering the stratum corneum's diffusion barrier.[11,16] Furthermore, by blocking drug absorption in the bloodstream, microemulsion-based gel promotes drug accumulation in the skin for efficient action.[11,13]

c). Nanoemulsion gel

When gel is combined with nano emulsion, the result is called nanoemulgel. An interfacial layer of surfactant and co-surfactant molecules stabilizes oil and water dispersions with droplet sizes smaller than 100 nm, resulting in transparent and translucent nanoemulsions that retain thermodynamic stability. The word "nanoemulgel" refers to the combination of emulsion and gel. A number of medications show higher transdermal penetration as compared to more traditional forms such as emulsions and gels. The nanoemulsion shows enhanced transdermal and dermal transport potential both in vitro and in vivo.[11,16]

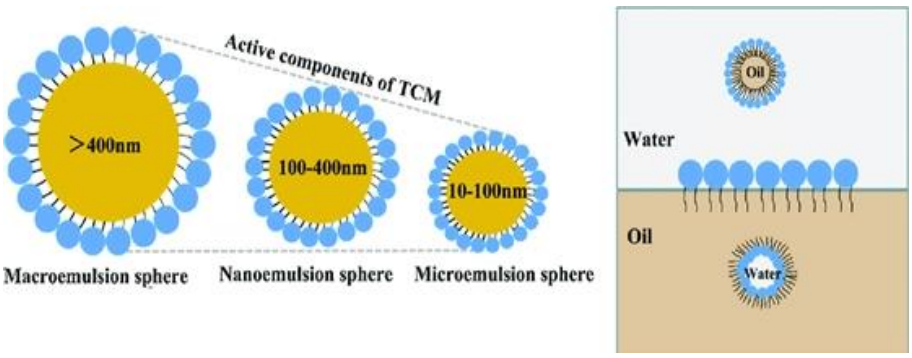

Figure 2: Types of emulgel.[11,17]

ADVANTAGES OF EMULGEL[18,19,20,21]

1. Delivery of hydrophobic drugs

Most hydrophobic medications cannot be added straight to gel bases due to solubility issues, which causes issues when the drug is released. Hydrophobic medications are added to the oil phase with Emulgel's assistance, and oily globules are then distributed throughout the aqueous phase to create an o/w emulsion. Additionally, this emulsion mixes well with gel base. This might be improving the drug's stability and release.

2. Better loading capacity

Emulgel's extensive network allows it to load more efficiently than other cutting-edge methods like liposomes and niosomes. Because of their nanoscale size and vesicular features, they may leak and have a lower trapping efficiency.

3. Better stability

Compared to emulgel, other transdermal formulations are less stable. Creams exhibit phase inversion or breaking, ointments exhibit rancidity because of their oily composition, and powders are hygroscopic. Emulgel does not encounter such issues.

4. Production practibility and low preparation cost

Emulgel preparation involves fewer, easier procedures, increasing the likelihood of production. Emulgel can be made without the use of any specialist equipment. Additionally, the cost of production is reduced because the additional materials are readily available and reasonably priced.

5. Controlled release

Drugs that have a shorter half-life can have their effects prolonged with Emulgel. Both hydrophilic (w/o emulgel) and hydrophobic (o/w emulgel) medications can be utilized with it.

6. No intensive sonication

Intense sonication is necessary for the production of vesicular molecules, which could cause medication leakage and degradation. However, since emulgel does not require sonication, this issue may be avoided during manufacture.

7. Improve patient compliance

1. They are easier to apply and less oily.
2. More site-specific in nature.
3. It lengthens the drug's mean residence time and contact time.
4. It is a non-invasive drug administration method that poses no risk of infection or trauma.
5. Emulgel is used for cosmetic purposes as well.[18,19,20,21]

DISADVANTAGES OF EMULGEL:

* Some medications have poor skin permeability;
* Bubbles occur during emulgel production;
* Large-particle pharmaceuticals are difficult to absorb through the skin.
*An allergic reaction or skin irritation associated with contact dermatitis.[18,22]

IMPORTANT CONSTITUENTS OF EMULGEL PREPARATION

Ideal properties of additives

- ✓ They must be non-toxic.
- ✓ They must be commercially available in acceptable grades.
- ✓ Their cost must be acceptably cheap.
- ✓ They must not be contraindicated.
- ✓ They must be physically and chemically stable by themselves and in combination with drugs and other components.
- ✓ They must be colour compatible.

Drug substances

NSAIDs, antifungal, antibacterial, and other agents can be utilized to deliver drugs through the skin. A topical drug delivery product's effective development is largely dependent on the medicine's sensible selection. The following are some desirable characteristics of the medicine that affect its dispersion through the skin and the device:

Physicochemical properties

- The drug's molecular weight should be under 500 Daltons.
- The medication should be more apt to both hydrophilic and hydrophobic phases.
- The drug's melting point should be low.
- The drug's solution shouldn't be extremely alkaline or acidic.
- The drug's saturated aqueous solution should have a pH between 5 and 9.

Biological properties

- The medication must have sufficient potency.
- The drug's half-life should be brief.
- The medication shouldn't cause trauma or allergic responses.
- The medication must not trigger an immune response.
- Topical administration works well for medications that break down in the gastrointestinal tract or are rendered inactive by the hepatic first pass effect.
- The near zero order release profile of topical delivery must prevent the development of drug tolerance.
- Topical distribution can also be used for medications that must be taken for an extended period of time or that have negative effects on non-targeted tissue.

FORMULATION OF EMULGELS

A number of excipients are included in emulgels to help formulate them and enhance their qualities. The following are the main excipients used in emulgel:

Emulsifiers

aid in the emulsification of the immiscible oil and water phases. Examples of common emulsifiers include cetostearyl alcohol, glyceryl esters, and sorbitan esters. The HLB value determines the O/W or W/O emulsion that an emulsifier will produce. The presence of emulsifying agents is necessary for both emulsification during manufacture and emulsion stability after the product's shelf life. Selecting the ideal emulsifying agent and concentration requires experience and

trial and error. Emulgel's aqueous phase was developed using Tween 20, while its oily phase was developed using span 20.[24,25,26,27]

Vehicle

Uses: Apply the drug to the desired location. Keep the targeted tissue at a therapeutic concentration long enough to produce a pharmacological effect. To make it easier for the drug to reach the place of action, release it.

1. Water-based material that forms the aqueous phase of the emulsion.
2. Common agents like water and alcohol are used.
3. Lipids: these substances come from the oil phase. Mineral oils are frequently utilized for externally applied emulsions either alone or in conjunction with soft or hard paraffins.[24,28]

Properties of vehicle

- ✓ Evenly and effectively apply the drug to the skin.
- ✓ Allow unimpeded migration to the site of action by releasing the medicine.
- ✓ Deliver the drug to its designated spot.
- ✓ Keep the therapeutic level of the desired medication constant.
- ✓ Barrier: In general, not much topical medication penetrates the stratum corneum.
- ✓ Both the active agent and the vehicle's characteristics affect the rate and degree of absorption.

pH adjusting agent

These substances are employed to keep the formulation's pH stable. For instance, NaOH, triethylamine, etc.

Thickeners

Emulgels ought to have a gel-like consistency and viscosity. Xanthan gum, carbomer, and hydroxypropyl cellulose are common thickeners. The type and concentration of thickener used determine whether an emulgel is fluid, soft solid, or hard solid.[24,27]

Gelling agents

These substances can be employed as thickening agents or to improve the consistency of any dosage form.[24,29]

Preservatives

Used to protect the emulgel from microorganisms. For instance, methyl and propyl parabens.[24,28]

Permeation enhancers

These are chemicals that cause a transient, reversible increase in skin permeability by interacting and partitioning into the skin's constituent parts. In order to promote absorption of the drug, drug delivery vehicles often contain penetration-enhancing chemicals that fluidize the lipid channels between coenocytes, temporarily disrupt the skin barrier, alter the way the drug is partitioned into skin structures, or improve skin delivery in other ways. For example, 8% clove oil and 5% menthol.[24,26,30]

Properties of penetration enhancers

- They should be devoid of poisons, allergies, and irritants. Ideally, they would respond rapidly and produce effects that are reproducible and predictable in terms of length and activity.
- They shouldn't have any pharmacological effects on the body or bind to receptor sites.
- The penetration enhancers should be unidirectional, which means they should prevent endogenous material from being extruded while allowing therapeutic substances to enter the body.
- The penetration enhancers should be compatible with both drugs and excipients, making them appropriate for use in a variety of topical formulations.
- Moreover, they should be aesthetically pleasant and have a proper skin "feel".

AQUEOUS MATERIAL

This creates the emulsion's aqueous phase. Water is typically used.

Oils

They are in charge of the emulsion's oily phase. Since the physicochemical characteristics of oil, such as molecular volume, polarity and viscosity greatly influence the spontaneity of the emulsification, micro-emulsification, and nanoemulsification processes, the droplet size of the corresponding emulsion, and drug solubility, the oil phase is crucial in the formulation of emulsion, microemulsion, and nanoemulsion. When creating an emulsion, microemulsion, or nanoemulsion, the oil with the highest solubilizing potential for the chosen drug candidate is often used as the oily phase. This aids in achieving the highest possible medication loading. Hence, the choice of the oily phase is often a compromise between its tendency to solubilize the drug and its capability to facilitate the formation of the respective emulsion with desired characteristics. The oil phases utilized in the creation of emulgel include balsam oil,[31,32] birch oil,[31,33] Castor oil,[31,34,35] Myristate isopropyl,[31,36,37] oil of myrrh,[31,38] hip oil of roses,[31,39,40] oil from wheat germ.[31,41,42]

Gelling agents

By combining emulsion to create emulgel, gelling agents are used to create gel bases. By expanding in the aqueous phase and creating a gel-like structure, these substances-also referred to as thickening agents-increase the consistency of any dosage form.[31,43] When a gelling agent is added, a system becomes thixotropic.[31,44] Because it demonstrated a higher drug release rate, HPMC-based Emulgel was determined to be superior to Carbopol-based Emulgel. Emulgels based on NaCMC were used for vaginal administration because they demonstrated improved mucoadhesivity, which extended the duration of drug residence and improved both in vitro and in vivo performance. Emulgel based on HEC demonstrated good rheological and drug release profiles, but little mucoadhesion. Emulgel with a pemulen basis that is intended for buccal administration.

Table 1: Pharmaceutical dosage forms employ a variety of gelling agents.[31]

Sr. No.	Gelling Agents	Concentration used (%w/w)	Pharmaceutical Adaptability	Active Pharmaceutical Ingredient
1	Sodium CMC	3.4%	Stand autoclaving hence suitable for sterile gels	Benzydamine
2	Carbopol-934	1%	Provide controlled release of API incorporated	Chlorphenesin
3	Carbopol-940	1%	Because of high viscous gel, provide controlled release of	Mefenamic acid

			API incorporated	
4	HPMC	2.5%	Having good stability, microbial resistance	Clorphenesin
5	Combination of HPMC & Carbopol	1.2%	Combination improve stability	Ketorolac, Clotrimazole
6	Pluronic® F127	1-3%	Good clarity and better solubility in cold water	Piroxicam
7	Pemulen	0.1-0.4%	Provide rapid release of oil phase, excellent stability	Flurbiprofen

PREPARATION OF EMULGEL

Step 1: Formulation of gel base

Triethanolamine and NaOH are used to bring the pH down to 5-6.5 after a known amount of polymer is dissolved into DDW and mixed at a reasonable pace with a magnetic stirrer to create the gel base.[1,45,46]

Step 2: Formulation of o/w or w/o type of emulsion

Using a magnetic stirrer, formulate Smix in the proper ratio. Drop by drop, while swirling constantly, add the Smix to the oil phase to create a transparent emulsion.[1,47]

Step 3: Formulation of emulgel

Using a homogenizer, add the prepared emulsion dropwise into the gel base while stirring constantly to create emulgel.

Table 2: The marketed version of emulgel.[1,48,49]

Sr. No.	Marketed formulation	API	Manufacturer	Use
1	Diclobar emulgel	Diclofenac diethyl amine	Barakat Pharma	Anti-inflammatory, analgesic
2	Voltaren emulgel	Diclofenac diethyl ammonium	Novartis Pharma	Anti-inflammatory
3	Miconaz-H-emulgel	Miconazole nitrate, Hydrocortisone	Medical union Pharmaceutical	Topical corticosteroid and antifungal
4	Diclomax emulgel	Diclofenac sodium	Torrent Pharma	Anti-inflammatory
5	Levorag emulgel	Hibiscus, licorice, natural extracts	THD Ltd.	Emollient

EVALUATION OF EMULGEL

Physical appearance

The color, homogeneity, consistency, and pH of the created emulgel compositions are visually examined. A digital pH meter (115 pm) is used to determine the pH values of 1% aqueous solutions of the gellified emulsion that has been made.[50,51,52]

Spreading coefficient

Mutimer's proposed equipment determines the spreading coefficient. It has a wooden block at one end that is fastened to a pulley. The "Slip" and "Drag" properties of emulgel are used to calculate the spreading coefficient. The wooden block has a ground glass slide fastened to it. This ground slide is covered with an excess of the emulgel under investigation (about 2 g). The second glass slide, which is the same size as the fixed ground slide, is then positioned between this slide and the emulgel mixture. The hook is included with the second glass slide. To remove air and create a consistent layer of emulgel between the two slides, a 500 mg weight is placed on top of them for five minutes. Using a hook, the measured weight is inserted into the pan that is fastened to the pulley. It is documented how long (s) it takes

the top slide to travel 5 cm. A better spreading coefficient is indicated by a shorter interval[50,51,52]. It is computed using the formula below.

$S=M\times L/T$

Where,

M = Weight attached to the top slide;

L = Glass slide length and

T = stands for time spent separating the slides.

Rheological study

A Brookfield viscometer of the cone and plate type is used to measure the viscosity of the created emulgel compositions. Ten rpm is the minimum shear rate and 100 rpm is the maximum.[50,51,52]

Globule size and size distribution in emulgel

The Malvern Zetasizer determines the size distribution and globule size. To achieve a uniform dispersion, 1.0 g of the sample is dissolved in filtered water and stirred. After that, the sample is pumped into Zetasizer's photocell.[50,51,52]

Drug content determination

By sonicating a known amount of emulgel in an appropriate solvent, such as ethanol, the drug concentration of the gel is determined. After a proper dilution at the maximum wavelength of the drug, the resultant solution is filtered, and an Ultraviolet-Visible (UV/Vis) spectrophotometer is used to measure absorbance.

Swelling index

One gram of gel on porous aluminum foil is taken and put separately in a 50 ml beaker with 10 ml of 0.1 N NaOH to calculate the swelling index. After being reweighed, the samples are then taken out of the beakers at various intervals and placed in a dry location for a while. The following formula is used to determine the swelling index.

$\text{Swelling Index (SW)}\ \% = [(Wt - Wo)/Wo] \times 100$

Where,

(SW) % = Swelling percentage in equilibrium;

Wo is the emulgel's initial weight at zero after time t and

Wt is the swollen emulgel's weight.

In vitro release study

Drug release experiments are conducted using Franz diffusion cells. About 200 mg of gellified emulsion is evenly placed to the egg membrane's surface. Between the diffusion cell's donor and receptor chambers, the egg membrane is pinched. To solubilize the medication, a freshly made Phosphate Buffered Saline (PBS) solution (pH 5.5) is added to the receptor chamber. A magnetic stirrer is used to agitate the receptor chamber. Following the proper dilutions, the samples (1.0 ml aliquots) are collected at a sufficient interval and their drug concentration is examined using a UV visible spectrophotometer. As time passes, the total amount of medication delivered across the egg membrane is calculated.[50,51,52]

Antimicrobial assay

The antimicrobial assay uses microorganisms to estimate antimicrobial agents both qualitatively and quantitatively. The ditch plate technique or agar well diffusion can be used to perform this experiment. A sterile nutrient agar medium is first used to make the agar plates for the agar well diffusion technique. After that, a predetermined amount of 24-hour broth culture is added to these plates. A sterile borer is then used to create 8 mm-diameter cavities on the agar plates.

After that, each chamber is filled independently with the test formulations (fixed volume). Lastly, all of the plates are incubated at 37° for 24 to 48 hours, and the zone of inhibition's diameter is measured in millimeters.[50,53] When using the ditch plate approach, the test formulation is put in a ditch after the ditch has been formed in a plate with media.

After that, the loopful of fresh culture is streaked from the ditch to the plate's edge at a straight angle across the agar.

The plates are then incubated for 18 to 24 hours at 25°, and the percentage inhibition is computed using the formula below:[50,54]

% Inhibition = L2 /L1 ×100

Where,

L1 = The streaking culture's total length and

L2 = Inhibition Length

Skin irritation test

Both in vitro and in vivo techniques are used in skin irritation research. The primary purpose of this study is to assess the emulgel components' tolerability following topical administration. Hen's Egg-Chorioallantoic Membrane (HET-CAM), a test advised by the Organization for Economic Cooperation and Development (OECD), is utilized in the case of the in vitro skin irritation investigation. Using recently laid hen eggs with developed chick embryos, this method examines how the test formulation irritates the chick embryo[50,55]. However, a number of studies have documented using rats or rabbits to conduct the in vivo skin irritation test. Before the investigation starts, the rat or rabbit's (4 cm2) skin is shaved. The shaven dorsal side is then treated with a designed emulgel formulation (specific dose) at a specified location on the animal's skin. Animals are checked for any indications of discomfort after a 24-hour period. The animals are given a score based on any skin irritation, such as erythema or edema. The type of medication included in the emulgel and the intended use of the created system may be related to the various additional in vivo animal studies conducted for emulgel. Anti-inflammatory and anti-fungal properties might be tested for in this way.[50,53]

Pharmacokinetic study

For emulgel compositions that exhibit systemic absorption when applied transdermally, a pharmacokinetic study is conducted. Rats and other animals are used to evaluate pharmacokinetic parameters, including total Area Under the Curve (AUC0-∞), time to achieve Cmax (Tmax), and peak plasma concentration (Cmax). After a predetermined amount of time following topical administration, a blood sample is taken from the animal via the retro-orbital vein in order to estimate the previously mentioned parameters. After that, the samples are centrifuged for 10 minutes at 15,000 rpm and 4°. Protein precipitation occurs when 100 µl of the separated plasma is combined with 1 ml of acetonitrile. The samples are then centrifuged once more for five minutes at 15,000 rpm and 4°, and the supernatant (20 µl) is gathered.

Lastly, High-Performance Liquid Chromatography (HPLC) is used to evaluate the material.[50,56]

Stability study

Emulgel's stability research is carried out in compliance with the International Council on Harmonization's (ICH) recommendations. In short, the emulgel compositions are packaged in aluminum collapsible tubes. These tubes are then kept for three months at various temperatures and relative humidity levels, including 5°, 25°/60% RH, 30°/65% RH, and 40°/75% RH. The formulations are removed from storage after a specific amount of time (15, 30, 60, and 90 days), and they can be tested for physical characteristics, viscosity, pH, drug content, and in vitro drug release, among other things.[50,54]

Dilution test

Visual verification of phase separation and clarity was achieved by adding Continuous phase to an emulgel dilution that was 50–100 times aqueous.[50,57]

ph measurement

The pH of every prepared emulgel is measured using a digital pH meter. A standard buffer solution is used once the pH meter has been calibrated. After dissolving 1 gram of the formulation in distilled water to create a homogenous solution, it is set aside for two hours. The pH is tested two hours later after the glass electrode has been immersed in the solution.[50,58]

Extrudability study

This empirical test is widely used to determine the amount of force required to extrude material from a tube. Plug flow is caused by the process of determining the amount of applied shear in the rheogram zone when the shear rate exceeds the yield value. The proportion of both emulgel and the basis for evaluating the extrudability of emulgel formulations in this study is extruded from a lacquered aluminum collapsible using the gramme weight required to extrude at least a 0.5 c emulgel ribbon in 10 seconds. Extrudability improves as the amount extruded increases. Each formulation's extrudability is evaluated three times, and the average outcomes are displayed. The following formula is then used to determine the extrudability:[50,59]

Extrudability = Weight used to extrude emulgel from tube (in gm) / Area (in cm^2)

Ex-vivo drug release study

Taking a sample of skin from a male Wistar rat, carefully cut it so that the dorsal side is facing up. Secure the skin slice securely in place by clamping it to one end of the modified diffusion cell's hollow glass tube. Apply Emulgel to the membrane in an even layer, making sure full coverage. Make a phosphate buffer with a pH of 5.5 to use as the drug release study's dissolving medium. Make contact between the donor and receptor compartments to assemble the diffusion cell. Before starting the medication release research, let the system settle.[11,61,62,63]

CONCLUSION

Emulgels will become a common drug delivery strategy due to its benefits in spreadability, adhesion, viscosity, and extrusion. Increased patient compliance is the reason for the widespread use of topical medication delivery systems. Additionally, they will be utilized to load hydrophobic drugs onto water-soluble gel bases.

CONFLICT OF INTERESTS

The author/editor has no conflicts of interest, financial or otherwise, to declare.

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