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An Overview on Empirical Characterisation of Emulgel

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Abstract: ***Gel is a convenient mean of dosage form that has better efficiency than creams and ointments. Even though it has many advantages it also has major problem such as stability problems, stickiness, irritation, difficult in absorption of large molecules, lack of hydrophobic drugs incorporation, etc. Hence, to overcome this, modern dosage form was introduced known as emulgel. When gel and emulsion get combined it results in the formation of emulgel. The principle goal of this review aims to discuss about the significance & overview of emulgel, its benefits & drawbacks, components & preparations, evaluation and factors affecting it. That provides sufficient knowledge on the topic of emulgel. Emulgel used for the delivery of many pharmacologically active drugs. Hence, emulgel is going to be an improved medication delivery technology in pharmaceutical as well as in various fields with lesser limitations.***

Keywords: Emulgel, Gel, Dosage form, Drugs delivery, Components, Evaluation

1.Introduction

The Pharmaceutical sector had provided sincere effort in curing and development of numerous medications, drugs, and delivery systems influenced by diseases. [3] Sublingual, oral, rectal, topical, parenteral, inhalation, and other administration methods were employed in the past to treat a variety of illnesses. [1]

Oral methods are thought to be the most flexible and used widely used but, they still have drawbacks such poor solubility and absorption. [2] Localized activities are provided at the administration site via topical medication delivery systems. They are given topically into the body via the vaginal, rectal, ophthalmic, and percutaneous routes, and they also reduce side effects and increase absorption. There is a large variety of cosmetic and dermatological medications available in topical dose forms. [4-5]

The following are a few examples of the various kinds of topically applied drug delivery systems now in use worldwide:

Solid: Plasters, powders, etc.
Semi-solid: Gels, poultices, ointments, creams, pastes, etc.
Liquid: Emulsions, paints, tinctures, lotions, etc.
Miscellaneous: Topical aerosol, trans-dermal patches, rubbing alcohols, gauzes, etc. [5]

1.1. Gel:

Gel is a suitable and favoured dosage form for distributing the API to the targeted areas among the previously mentioned topical dosage forms. Gel's are in a three-dimensional and cross-linked structure that traps the tiny drug particles and encourage their regulated release in the body. Gels have several advantageous qualities, such as spreadability, non-staining, greaselessness, and thixotropy, but a significant disadvantage is the delivery of hydrophobic medicines to the skin due to their insolubility in the aqueous phase. [6]

1.2. Emulsion:

Emulsion is a subcategory dispersion systems made up of 2 immiscible (biphasic) liquids one is dispersed into another. The continuous phase involves dispersing the disperse phase in a liquid phase. The (O/W) oil-in-water & (W/O) water-in-oil type of emulsions that are being categorized mainly in it. [7]

Emulsions are able to serve as controlled medication delivery systems. The medicine that will be delivered is maintained in the mixture's oil phase in this. The internal oil phase of an emulsion will act as a reservoir for drugs and transport the medicine to the layer of skin in a regulated manner. Emulsions have many positive attributes, but one significant negative aspect is how much time they really remain interacting with the skin.

Despite the many advantages of both gel and emulsion, emulgel was created because there may be another dosage form that is more effective for each product. [6]

1.3. Emulgel:

Emulsion + gel = Emulgel

Emulgel is a preparation results due to the combination between an emulsion and a gel. [6] There are two different kinds of emulgels: o/w and w/o type. Both the substances are solidified by the incorporation of a gelling substance. In the pharmaceutical sector, both varieties of emulgels are frequently employed as a method of delivery for multiple drugs to penetrate the skin. They possess a greater degree of patient's acceptability as it joins the best features of emulsions and gels. [5]

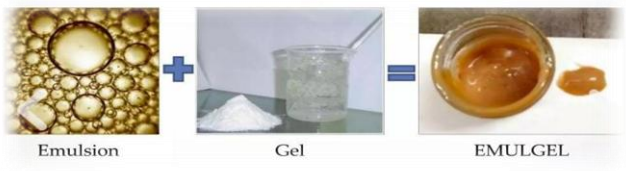

Figure 1: Combination of Emulgel

Because it is not greasy, it might be administered to the layers of skin more effectively than similarly applied products like creams, gels, ointments, etc, which are very thick & need to be rubbed hardly. [3]

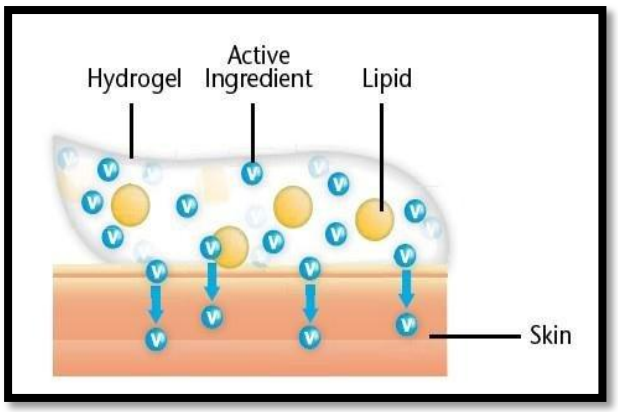

Figure 2: Structure of Emulgel

Emulgels has more importance in the percutaneous semisolid pharmaceutical dose formulations since the mid-1980s. The widespread use of emulsion systems for different treatments, particularly for dermatological formulations, is where their broad application as a pharmaceutical dosage form arises from. [3]

Examples include Diclofenac emulgel, which is only one of numerous emulgels that are employed in pharmaceutical applications. Diclofenac is a widely recognised NSAID that is frequently used to treat inflammatory and painful medical conditions. Isopropyl alcohol is a common ingredient in many of its topical medicines to boost solubility. Eczema and sensitivity might result from using it often. Diclofenac emulgels are made without isopropyl alcohol in order to prevent this.

1.3.1. Advantages of emulgel:

1. A higher level of patient acceptance.
2. Make tailored medicine delivery available.
3. Simple way to end treatment.
4. The use of medications that are hydrophobic.
5. Avoiding vigorous sonication.
6. Releasing under control.
7. Improved stability.
8. A higher capacity for filling.
9. Site specificity.
10. Avoids liver metabolism.
11. AvoidsGIT difficulties.
12. Manufacturing viability and economical in formulation.
13. Increased bioavailability allows even small dosages to be more effective than other semi-solid preparations that are more commonly used. [8-9]

1.3.2. Disadvantages:

1. Macromolecules are not well absorbed.
2. Bubble entrapment during preparation.
3. Drugs which are hydrophobic are the greatest candidates for these delivery techniques.
4. An adverse or skin irritant reaction caused by contact.
5. Only medicines with extremely low plasma concentration needs can be employed.
6. Drugs may get damaged by an enzyme in the skin. [8]

1.3.3. Rationale:

There are numerous medicinal treatments available which are given to the mucus membranes or to the skin to enhance their quality, restore their fundamental functions, or pharmacologically alter a response in tissues. These topical medications, however, which are often offered as creams, lotions, ointments, or moisturisers, have a variety of disadvantages. [10]

Additionally, they also have lower spreading coefficient & need to be rubbed during administering. It also shows the problems in stability. Because of all these semisolid preparation-related concerns, both pharmaceutical preparation and the use of simple gels in cosmetic products has decreased.

Colloids with 99 percent fluid which is immobilised via surface tension with a minor quantity of gelating material present is called a gel. Considering the many benefits of gels, delivering hydrophobic medications is a significant challenge. Therefore, this restriction is being overcome via an emulsion-based method, allowing any non-hydrophilic restorative molecule to be effectively fused & delivered through gel. [9]

1.3.4. Emulgels are of various types are:

Based on the droplet size or dispersion pattern emulgel are classified as:

1. Macro-emulsion gel
2. Nano-emulsion gel
3. Micro-emulsion gel

a) Macro-emulsion gel:

These are the most prevalent kinds of emulgels used when the emulsion droplet size is >400 nm. Even though they're practically opaque, the lens of a microscope clearly shows the individual drops.

b) Nano-emulsion gel:

Droplet dimensions of < 100 nm is referred to as a nanoemulgel when the nanoemulsion is mixed into gel. In vitro and in vivo, nanoemulsion formulations have better percutaneous and cutaneous delivery qualities.

c) Micro-emulsion gel:

The droplet sizes of micro-emulsions, which vary from 10 to 100 nm, allow them to be transparent and thermodynamically stable and they don't combine. [8]

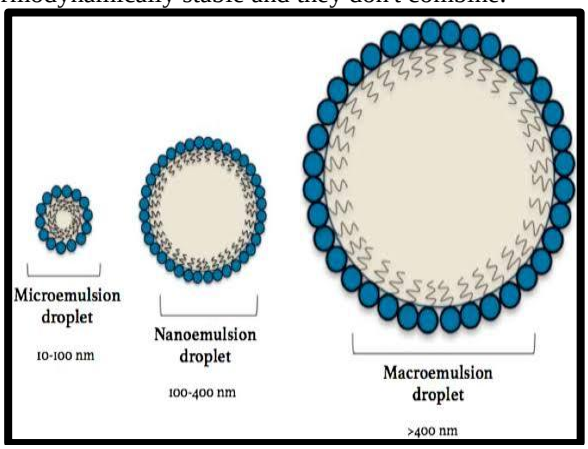

Figure 3: Structure of Macroemulsion gel, Nanoemulsion gel, Microemulsion gel

2. Anatomyof Skin:

To develop the most suitable and acceptable preparation, a fundamental knowledge of the physiology of the skin is now required. As most of the topical medications, especially emulgels are meant to be applied topically.

With a surface area of around 2 meter, the average adult human body gets circulates about 1/3rd of the blood. As well as the skin creates an impermeable barrier. This will safeguards the more fragile & deeper components. In an individual square cm of the typical human skin, there are around 200-300 sweat glands and 40-70 hair follicles. Additionally, the skin pH varies from 4-5.6. The sweat and fatty acids released by the sebum also have an impact on the skin surface pH. [10]

1.4. The skin is made up of four distinct layers of tissues, which are as follows:

1. Non-living epidermis,
2. Living epidermis,
3. Dermis,
4. Subcutaneous tissue

1. **Non-living epidermis:**

This is a main physical boundary called the stratum corneum, the outer layer of skin, which ranges in thickness from 0.5 to 0.20 m. It is composed of protein (75-85%) mostly keratin and lipid (5-15%).

2. Living epidermis:

Below the stratum corneum outer layer & dermis, the viable epidermisis present with a thickness range from 50 to 100 µm. Its water content is 90%.

3. Dermis:

Just underneath the healthy epidermis is the dermis, of 2000 to 3000 µm thickness and is composed of a protein fibre that serves as a flexible connective tissue matrix.

4. Subcutaneous tissue:

Hypodermis, otherwise called as the subcutaneous tissue, is composed of white, loose connective tissue that consists of nerves, lymphatic and blood vessel arteries, and glandular pores of sweat gland.[11]

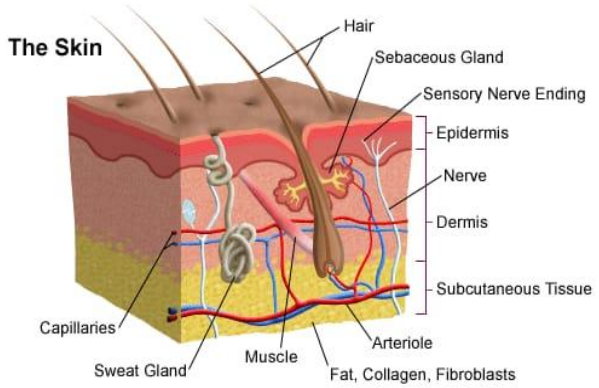

Figure 4: Cross section of the Skin

1.5. Mechanism of topical drug absorption:

1. Transepidermal

a) Intercellular-The intercellular route is the most typical approach for medicines to enter the skin. It involves the medication diffusing across the continuous lipid matrix and surrounding the corneocytes.

b) Transcellular-This route involves diffusion into and partition of alternate lipophilic and hydrophilic regions. And is the best way for medicines to cross the different extracellular matrix and corneocyte layers.

2. Transappendageal

a) Transglandular - It involves the sweat glands being used as a conduit for medication compounds.

b) Transfollicular - It involves the passage of medication molecules through the sebaceous glands that are connected to the hair follicles. [12]

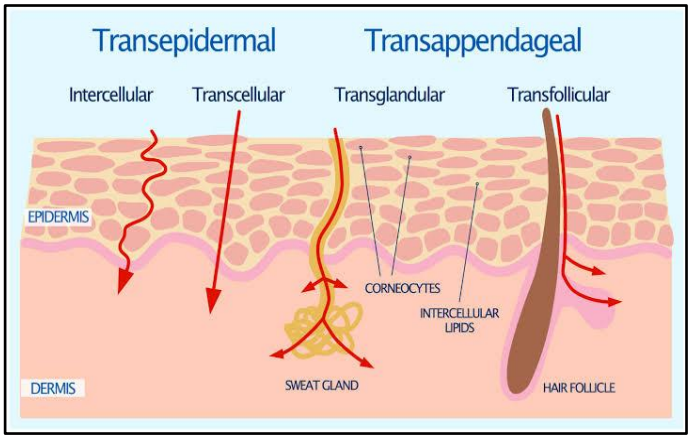

Figure 5: Mechanism of topical drug permeation

1.6. Parameters influencing a drug's topical absorption:

1.6.1. Physiological Elements:

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

1.6.2. Physiochemical Elements:

1. Molecular mass (around 400 Da).
2. The partition co-efficient.
3. Ionization level (unionised medicines alone are readily absorbed).
4. Vehicles impact. [13]

3. Emulgel Formulation:

Ideal characteristics for additives:

1. They must not be harmful.
2. They need to be available readily in suitable grades.
3. They must be reasonably priced.
4. They should not show any contraindications.
5. They must match in terms of colours.
6. They need to be stable both chemically and physically on their own and in mixtures with other substances and medications. [14]

3.1. Composition of Emulgel:

Drug:

The drug is the major active pharmaceutical ingredient that should be compatible with other additives.

Ideal characteristics of a drug candidate for Emulgel formulation:

1. The drug dosage is minimal, < 10 mg.
2. The drug's molecular weight must be 400 Dalton or below.
3. A 10 hour or shorter medication half-life.
4. Should have 0.4 to 0.8ranges of partition coefficient.
5. Should have a higher cutaneous coefficient of permeability.
6. The therapeutic index and bioavailability via oral route should be minimal.
7. The drug should have little polarity and not irritate or sensitise. [14]

Vehicle:

The bioavailability (rate and extent of absorption) of a drug and the therapeutic efficacy of a dose form are dependent on the vehicle and its constituents.

Aqueous phase:

Aqueous ingredients are needed to prepare the emulgel's aqueous phase. Normal water, distilled water, and alcohol are examples of commonly used aqueous phase agents**.**

Oil Phase:

Oily components are needed to prepare the emulgel's oil phase. Mineral oils are used alone or along with hard or soft paraffin that are most frequently used for topically applied emulsions. [14]

The following characteristics applicable to the vehicle that will be utilised in the emulgel preparation:

1. Distribute the medicine evenly and rapidly throughout the cutaneous surface.
2. Enable the drugs to be freed so it is easier to get to the region where it acts.
3. Distribute the drug molecules to the targeted area.
4. To achieve the required pharmacological effect, it needs to be possible to keep the tissue of interest at a therapeutic medication level for enough time to be effective.
5. Designed specifically for the anatomic spot that requires treatment. [14]

Emulsifiers:
Emulsifying chemicals are being useful in formulation with enhancing emulsification and managing the medicament stability to preserve their shelf period, which might be prolonged to days, months, or years.

Example: Tween 80, Polyethylene glycol 40 stearate, Stearic acid, Span 80, Sodium stearate, etc.

Gelling Agent:

These are the substances that are utilised as thickening agents intended to make any dosage forms more consistent.

Example: Carbopol-940, HPMC-2910, Carbopol-934, etc. [10]

Preservatives:

These are the substances that stop or slow down microbial development, preventing formulation against spoiling. [14]

Example: Propyl paraben, methyl paraben, etc. [8]

Antioxidants:

Antioxidants are employed as effective excipients to slow down or prevent molecules from oxidising.

Example: Ascorbylpalmitate, Butylated hydroxyl anisole (BHA), Butylated Hydroxyl Toluene (BHT), etc.

Humectants:

These are those agents that stop moisture loss.

Example: Glycerine, propylene glycol, etc. [8]

Permeation enhancing agents:

Drug carriers commonly include penetration improving elements that rapidly dissolve the lipid routes between corneocytes and breach the cutaneous barrier, alter way the drug is partitioned into skin structures, and enhance skin delivery in other ways. [13] These agents penetrate the skin and combines with its constituent to temporarily improve the cutaneous penetrability, which can be reversed. [18]

Characteristics of penetration enhancing agents:

- ✓ They need to be non-irritating, non-toxic, and non-allergenic.
- ✓ They need to have a suitable skin acceptance.
- ✓ They should preferably act quickly, with predictable and reproducible activity and duration of effect.
- ✓ They must be pharmacologically inert, meaning they must not interact to receptor sites, within the body.
- ✓ Permeability enhancing agents must have a single way of action that permits analeptic substances to penetrate the body with minimum loss of physiological material.
- ✓ Effective permeability enhancing substance must be appropriate for blending with a variety of topical formulations & have to interact well with both additives and medications. [19]

Mechanism of penetration enhancers:

Permeation enhancers can work in one or more of three ways, according to their principal processes.

1. The stratum corneum lipid's highly organized structure being disturbed.
2. Corneum protein interaction within the cells.
3. Partition enhancing way. [17]

3.1.1. Optimization of Drug Absorption and Penetration:

1. Chemical method:

Chemicals can be used to temporarily change how the skin's protective barrier works and let low permeability medications through.

Example: Clove oil, Menthol, Oleic acid.

2. Physical method:

Several physical enhancement techniques are available to enhance penetration and absorption of drug.

Example: Iontophoresis, Electroporation, Microneedle, etc.

3. Biochemical method:

It is a method used to make pharmaceutical medications to a biochemical expansion.

Example: A synthetic peptide of 11 amino acids was discovered by phage screening.

4. Super-saturation method:

By applying the fick's law to create concentration gradients, this enhancement technique increases penetration. Using this technique, supersaturated systems are created through the elimination of extra solvents.

5. Prodrug approach:

Prodrug is the term for the drug's inactive lipophilic form which gets converted to active form after metabolism. [20]

3.2. Preparation of Emulgel:

The Emulgel formulation was made using, with a few alterations, the technique stated in Mohammad et al (2004). [15]

Steps involved in emulgel preparation:

Step 1: Emulsion preparation.
Step 2: Preparing ofthe gel.
Step3: The emulsion incorporation within the prepared gel.

Examination of materials:

By adding a large quantity of the medicine in various oils and then stirring constantly for 72 hours until it reaches the point of equilibrium, the solubility of drug was tested. After centrifuging the samples, the supernatant was collected, and using the appropriate analytical techniques, solubility was assessed. Then, the additives in every class with greater drug solubility are chosen for additional research. [16]

Step 1: Emulsion preparation:

The initial step of emulsion formulation for W/O or O/W type involves the compounds to dissolve and that remains water-soluble in an aqueous vehicle (such as tween 80 in purified water) and the dissolution of compounds that are oil-soluble in an oil vehicle (such as the dissolution of span 20 in liquid paraffin). To ensure the droplet dispersion of two phases, both phases were combined in turbulent mixing conditions. [6]

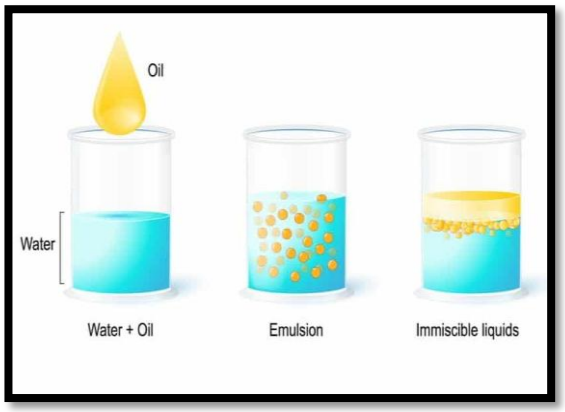

Figure 6: Emulsion preparation

Step 2: Preparing of the gel:

The Carbopol 940 and Carbopol 934 were dissolved in distilled water and being continuously stirred in a average speed with a automatic shaker to produce a gel formulation. The pH had been changed to 6 to 6.5 pH value via Triethanolamine (TEA) [15] and the final volume was made via distilled water. To remove air bubbles, the gel material was subjected to sonication for about 15 minutes and then left overnight.[17]

Step 3: The emulsion incorporation within the prepared gel:

The gel stage was blended steadily onto the emulsion phase stage at a ratio of 1:1 to produce emulgel. Emulsion incorporation into gel basis. [14]

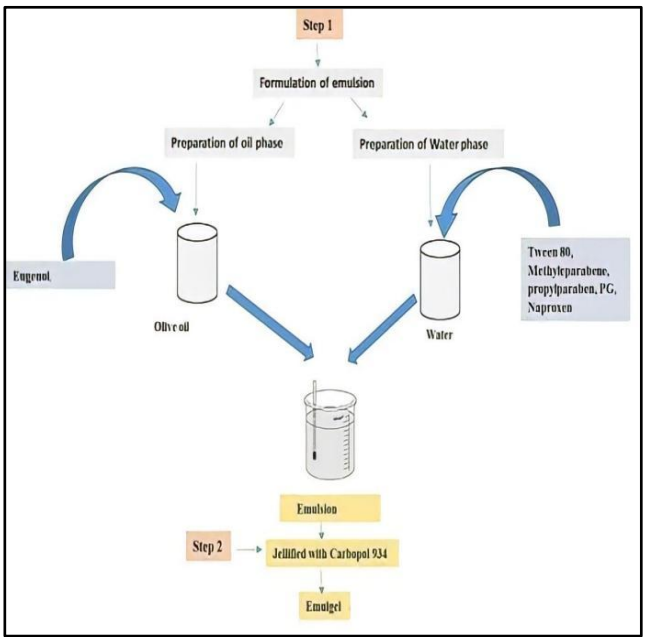

Figure 7: Formulation of an Emulgel

4. Emulgel characterisation and evaluation:

1. Physical Evaluation:

The emulgel prepared should be viewed visibly and determined by their colour, consistency, homogeneity and phase separation.[10]

2. Spreadability:

According to Mutimer et al. (1956), an instrument that is adapted appropriately in the lab and put to use for the study is employed to measure spreadability. This is constructed of a block of wood containing the pulley in a ends. It measures the spreadability of "Slip" & "Drag" properties of emulgels.

A grounded slide made of glass is affixed to this block. Extra emulgel (around 2 g) is put on the supporting slide for the research. Then, amid the glass slide and a second glass slide using the hook and identical sizes as the fixed grounded slide, the emulgel is positioned. By pressing a weight of one kilogram on top of the two slides for five minutes to press out the air, an even layer of emulgel is created between them. Extra emulgel has been removed from the edges by rubbing. The top plate is then subjected to an 80 gram pull after that. Record the time (in seconds) required for the peak of the slide to move 7.5 cm using a thread that is attached to the hook. A shorter period indicates more spreadability.

The spreadability is determined using the formula:

$$S = M.L/T$$

Where
S = Spreadability of product,
M = Weight attached to upper slide,
L = Length of the glass slides
T = Time it took to fuly separate the slides from one another [10]

3. Extrudability study:

The method used to assess the extrudability of formulated emulgel was according to the percentage of emulgel and extruded emulgel from a laminated aluminum collapsed tube on applying an amount of material based on gm required for extrude not less than 0.5 cm emulgel ribbon for about 10 seconds. Greater extrusion volume enhances the extrudability. The extrudability of each formulation is assessed on 3 separate occasions with the mean outcomes being shown.

Formula for determining extrudability is:

$$\text{Extrudability} = \frac{\text{Applied weight to extrude emulgel from tube (in gm)}}{\text{Area (in cm}^2\text{)}}$$ [21]

4. Rheological Study:

The viscosity of the several emulgel formulations is assessed using a cone as well as plate viscometer using a spindle 52, and by a thermostat controlled flowing water bath at an average temperature of 25 °C. [21]

5. The size and distribution of globules in emulgel:

Malvern zeta sizer was used to calculate globule size and distribution. A uniform dispersion was achieved by dissolving a 1.0 gram sample in purified water then stirring it. A sample was inserted into the zetasizer's photocell. The distribution and mean globule diameter were determined. [13]

6. Swelling Index:

To determine the topical swelling index of emulgel, one gm of the gel is kept on a piece of porous aluminum foil after which it is placed individually to a 50 ml beaker with 10 ml of 0.1 N Sodium hydroxide solution. The samples were then taken out of the beakers at various intervals and placed in a dry place.

Formula for swelling index is:

Swelling Index (SW) = [(Wt – Wo)/Wo] x 100

Where,
(SW) % = Equilibrium percent swelling
Wo = Original weight of emulged at zero time after time t,
Wt = Weight of swollen emulgel [13]

7. pH determination:

pH can be measured with a digital pH meter. Three times, the pH meter is dipped into the emulgel and the reading is taken. [13]

8. Isotonicity:

This is assessed using the haemolytic method. The created formulations were put on certain blood drops, which were analyzed using a 45 optical microscope alongside hypotonic, hypertonic, and regular saline solutions. [22]

9. Centrifugation study:

The emulgel stability is assessed using a centrifugation. Only after a week of preparation is it finished. Minicentrifuges can be used for this study, spinning about 3000 rpm over 30 minutes. [17]

10. Drug Content Determination:

Weigh about 1g of emulgel and combine it with an appropriate solvent. To obtain a proper answer, it should be filtered. A ultraviolet UV spectrophotometer is used to determine its absorption. The drug's standard formulation is formed by the same solvent. The identical standard plot can be used to compute dosage & amount of drug by entering the absorbance value.
Drug content is calculated as follows:

Drug content = (Concentration x Dilution factor x Volume taken) x (Conversion factor) [17]

11. Accelerated Stability Studies:

Stability tests were carried out in accordance with ICH recommendations. For three months, the formulations were kept inside a hot air oven at 37 2°, 45 2°, and 60 2°. Every two weeks, samples were examined using a UV-visible spectrophotometer to determine their drug content. By tracking the pH change within the gel at periodically, stability research was conducted. [17]

12. *In Vitro* experiments study:

In this experiment, Franz diffusion cells are utilized. Emulgel is distributed equally over the egg membrane's face. The egg membrane is locked in place among the donor and receptor compartments of the diffusion cell. The medication is then made soluble by adding freshly produced PBS (pH 5.5) solution to the receptor chamber. A stirrer of magnetic instrument is utilised to stir the chamber. It is necessary to collect sampling of the emulgels in 1.0 ml of aliquots at proper time gaps, and the sample content is then adequately analysed using a UV-visible spectrophotometer. Corrections have been made collectively in order to determine the overall quantity of discharge the drug periodically. Time is employed to determine the overall amount of medicine that crosses the egg membrane. [10]

13. Ex-vivo assessment of emulgel:

(MICE SHAVEN SKIN):

The modified method is used to gauge bio-adhesive strength. The freshly sliced skin is washed with a 0.1 N NaOH solution after being cut into pieces. The wooden piece was joined to one glass slide, while the other two layers of skin were independently linked to each of the glass slides on the opposite side. The right and left pans were balanced by increasing the load in the left-hand pan. The excess mass on the left pan is eliminated. one gram of topical emulgel is sandwiched between the two slides holding the hairless skin portions, then pressure is then put on to remove any air bubbles. The balance is kept in this position for five minutes. In the left-hand pan, weight is added over time at a rate of 200.
The following formulas are used to compute the bioadhesive strength:

Bioadhesive Strength = Weight required (in gm) / Area (cm^2) [13]

14. Skin Sensitivity Test (Patch Test):

Apply the emulgel formulation to rat skin that has been adequately shaved, and undesirable results are tracked for as long as 24 hrs, including modifications to skin color or morphology. The full group of 8 rats can be used in the investigation. When there is no irritability, the test is considered successful. If the cutaneous discomfort feeling appears in over two animals, the investigation must be repeated. [13]

15. Microbiological assay:

Evaluation of fungistatic or bacteriostatic activity of a component is done using the ditch plate method. It is mainly used for preparations that are semisolid. The Sabouraud's agar desiccated plates were previously produced. In a trench carved out of the plate, 3 gm of emulgel were poured. Freshly made culture loops are smeared at an angle across the agar from the drain to the plate's edge. The growth of fungi was examined after incubation at 25°C for 18 - 24 hrs. The % inhibition was determined using the formula:

% Inhibition = L2 x 100

Where,

L1 = Total length of the streaked,
L2 = Length of inhibition [14]

16. Stability Assessments:

Evaluations of stability are carried out in accordance with the standards set forth by the ICH. The formulations are kept in a hot air oven at a temperature of 37°C, 45°C, and 60°C about three months & the samples were checked for content of drug for each 2 weeks during the experiment via a UV-visible spectrophotometer. The evaluation of stableness is assessed by periodic evaluation of change in pH of gel. [10]

5. Emulgel Packaging:

Emulgel is packaged in either aluminium coated tubes that have a moulded seal and a propylene screwed cap, or in membrane sealed painted aluminium tubes with an interior layer of phenoxy-epoxy lacquer.

Layout of laminates:

1. **Foil laminates**-These are used to protect sensitive preparations from air, moisture and light.
2. **Plastic laminates**-They are employed for reactive preparations because they have a chemical resistant barrier. [17]

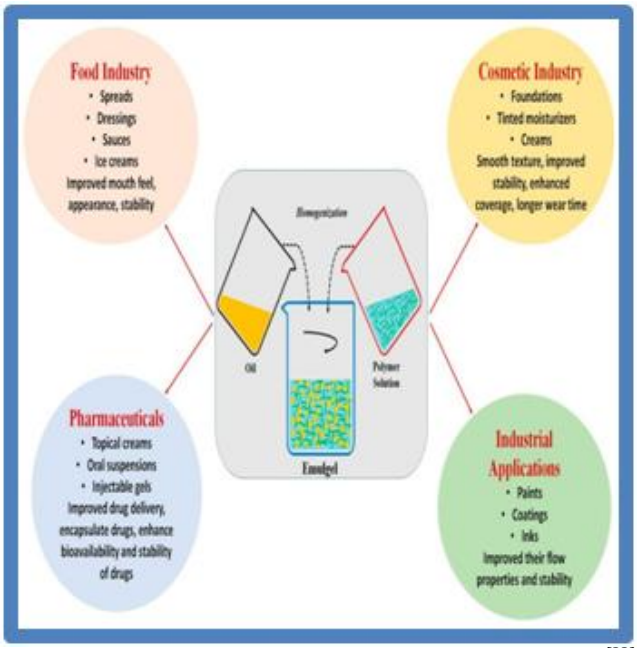

Figure 8: Applications of Emulgel in various industries. [33]

Table 1: Current studies on emulgel

S.no	Drug	Aim	Uses	Reference
1.	Ocimumbasilicum	Formulation and evaluation of Ocimumbasilicum-based emulgel for wound healing using animal model	Wound healing	[23]
2.	Coenzyme Q10 (coq10)	Improving the anti-ageing activity of coenzyme Q10 through protransfersome-loaded emulgel	Acts as an antioxidant agent, including in skin anti-ageing, and plays a major role in the social determinants of health.	[24]
3.	Propolis	To develop an alternative medicine, propolis, in emulgel formulation for burn and wound treatment.	Diabetes, cold sores, and swelling and sores inside the mouth	[25]
4.	Oryza sativa extract [Black Glutinous Rice]	Sun Protection Factor Activity of Black Glutinous Rice Emulgel Extract (Oryza sativa varglutinosa)	Antioxidant activity	[26]
5.	Naproxen/eugenol	The aim of this study was to fabricate and characterize a pharmaceutical emulgel co-loaded with naproxen/eugenol for transdermal delivery to improve the analgesic and anti-inflammatory effect	Analgesic and anti-inflammatory effects	[27]
6.	Mannosylatedthiolated chitosan-coated silver nanoparticles	This study was aimed to develop mannosylatedthiolated chitosan-coated silver nanoparticles (mtc-ag) loaded emulgel for the treatment of cutaneous leishmaniasis.	Treatment of cutaneous leishmaniasis.	[28]

7.	Metronidazole	Clinical comparative study of optimized metronidazole loaded lipid nanocarrier vaginal emulgel for management of bacterial vaginosis and its recurrence	Used to treat a wide variety of infections	[29]
8.	Isoxazole–carboxamide derivatives	Synthesis of novel isoxazole–carboxamide derivatives as promising agents for melanoma and targeted nano-emulgel conjugate for improved cellular permeability	Anticancer, anti-tuberculosis, anti-inflammatory, and acetyl cholinesterase inhibitors.	[30]
9.	Anise (Pimpinellaanisum L.) Essential Oil	Formulation, In Vitro and In Silico Evaluations of Anise (Pimpinellaanisum L.) Essential Oil Emulgel with Improved Antimicrobial Effects	Upset stomach, intestinal gas, "runny nose," and as an expectorant, Appetite stimulant, diuretic	[31]
10.	Betamethasone dipropionate (BD)	The aim of this work was to develop a new vehicle for BD, focusing on the preferences of patients with psoriasis as a strategy to improve treatment adherence	Used to treat itching, swollen and irritated skin.	[32]

Table 2: Drugs available in the market: [17-14]

Drug Name	Product / Brand Name	Manufacturer	Uses
Diclofenac-diethyl-ammonium	Voltarenemulgel	Novartis pharma	Relief of body pain, inflammation and swelling
Clobetasol propionate	Topinate gel	Systopicpharma	To treat various skin conditions such as dermatitis, eczema, and allergies
Metronidazole, clindamycin	Lupigyl gel	Lupinpharma	Treatment of bacterial infections
Clindamycin phosphate, allatoin	Clinagel	Stiefelpharma	To treat acne, which appears as spots or pimples on your face, chest, or back.
Clotrimazole, Betamethasone	Cloben gel	Indoco Remedies	Treatment of fungal skin infections such as ringworm, athlete's foot, nappy rash, sweatrash, and vaginal thrush.
Nadifloxacin	Nadicin cream	Psycho Remedies	For the treatment of bacterial infections
Tazarotene	Zorotene gel	Elder Pharmaceuticals	Treating acne along with reducing blackheads and whiteheads.

6. Conclusion

This article has reviewed adequate informations about emulgel, which covers its major importance and limitations. The use of Emulgel, a recently developed topical drug delivery technology for hydrophobic medicines, will help to improve patient compliance.

Therefore, emulgel possess various beneficial properties, it will increase efficacy and decrease side effects. So, we conclude that emulgel as enormous importance in the upcoming years.

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