An Overview on Emulgel

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ABSTRACT

In comparison with the other semisolid formulations, the use of gels seems to be more advantageous both in cosmetics and pharmaceutical preparations. When gel and emulsion are used in the combined form, they are referred as emulgel. Emulgel is the promising drug delivery system for the delivery of hydrophobic drugs. Emulgel, an interesting topical drug delivery system, has dual release control system, i.e., gel and emulsion. Emulgel have several merits like greaseless, easily spreadable, easily removable, emollient and transparency. Preparation of emulgel is done by incorporation method. Emulgel are commonly used for the delivery of analgesics, anti-inflammatory, anti-fungal, anti-acne drugs and various cosmetic formulations. Studies on emulgel promises a better future in delivering more numbers of topical drugs as emulgel by their merits over other drug delivery systems.

Key Words: *Emulgel, Topical drug delivery, Emulsion, Incorporation method*

eIJPPR 2019; 9(1):92-97

HOW TO CITE THIS ARTICLE: Sreevidya V.S (2019). "An overview on emulgel", International Journal of Pharmaceutical and Phytopharmacological Research, 9 (1), pp.92-97.

INTRODUCTION

Topical drug delivery system is the dosage form which is administered on the skin and other routes of drug delivery get failed or for skin disorders. The topical drug delivery system has the advantage of negotiating the first pass metabolism. It also helps to avoid the risk and inconvenience of i.v route therapy.

Topical formulations are prepared in different consistency such as solid, semisolid, and liquid. The topical delivery system is failed in the administration of hydrophobic drug. In each formulation with the active ingredients many excipients are used. Sometimes more than one formulation can be combined to enhance the drug delivery; emulgel is such type of combination. It is the combination of emulsion and gel [1].

Emulgel is prepared both in oil- in- water and water- in- oil type emulsion mixed with gel. Oil- in- water type is used for lipophilic drugs and water- in- oil type is used for hydrophobic drugs' delivery [2]. The emulgel have many advantages like thixotropic, greaseless, easily spreadable, easily removable, emollient, non-staining, bio-friendly, pleasing appearance, transparent and cosmetically acceptable, which also have a good skin penetration and long shelf- life [3].

The emulsion and gel preparations have their own properties. But the gels show some limitations as hydrophobic drug delivery. This limitation is overcoming by emulgel. By the use of gelling agent classical emulsion can be converted in to emulgel [4].

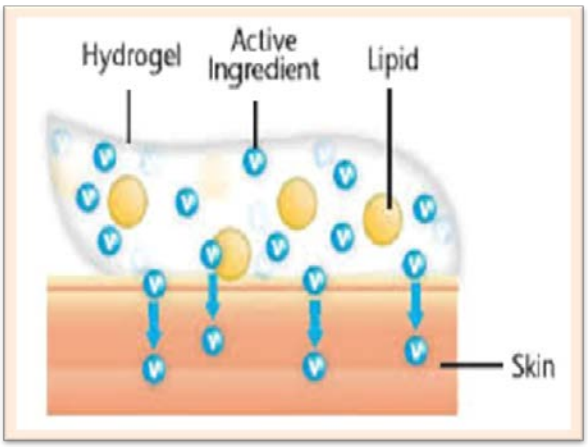

Fig. 1: Emulgel structure [5]

Two types of topical delivery products are available. They are external and internal products [6]. As their name indicates, the external products are applied by spreading

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest .
Received: 21 October 2018; **Revised:** 16 February 2019; **Accepted:** 22 February 2019

or spraying, and the internal products are applied orally, vaginally or rectally [7].

The topical preparation can be classified by their consistencies, which are solid preparation, liquid preparation, semi-solid preparation and miscellaneous preparation [8].

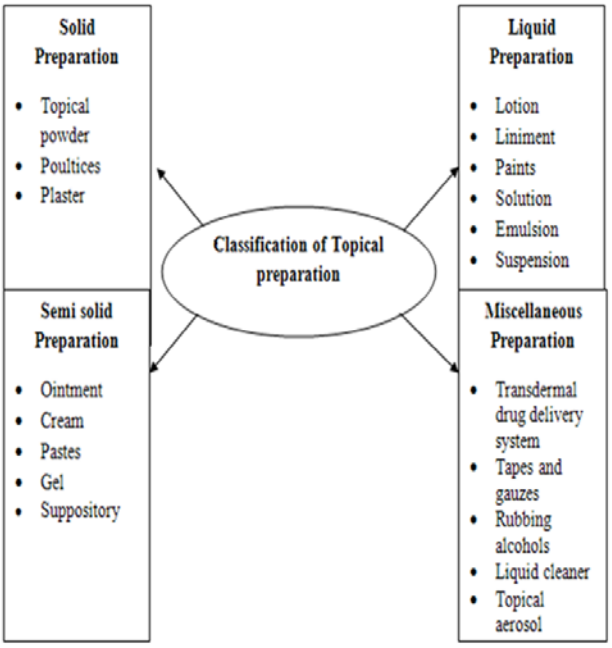

Fig. 2: Classification of topical preparation [9].

Some factors will affect the absorption of drug through every route. Some factors like skin thickness, skin pH, hydration, inflammation, partition coefficient, molecular weight and other factors affect topical route. The topical delivery system has many advantages and also disadvantages. The main advantage is avoidance of first pass metabolism and gastrointestinal incompatibility. Nearly all topical preparations are applied on the skin. They penetrate through the skin and give the action in right site. The skin is the largest sense organ in our body, which consist of approximately 2 m^2 of surface area and pH of skin is 4.0 to 5.6. The skin contains four layers; non-viable epidermis, viable epidermis, viable dermis and subcutaneous connective tissue.

Non- viable epidermis [stratum corneum]: It is the outer layer of skin, which is 10-20 cell thick. The cells are 34- 44 µm long, 25- 36 µm wide, 0.5- 0.20 µm thick with surface area of 750- 1200 µm.

Viable epidermis: It lies between stratum corneum and dermis with 10 - 50 µm thickness. The tonofibrils help for joining the cells.

Dermis: It is seen under the viable epidermis, and it is a structural fibrin. Thickness of the dermis ranges from 2000 – 3000 µm and contains loose connective tissue.

Subcutaneous connective tissue: It is considered as a true connective tissue with loose texture, fibrous connective tissue, blood and lymph vessels.

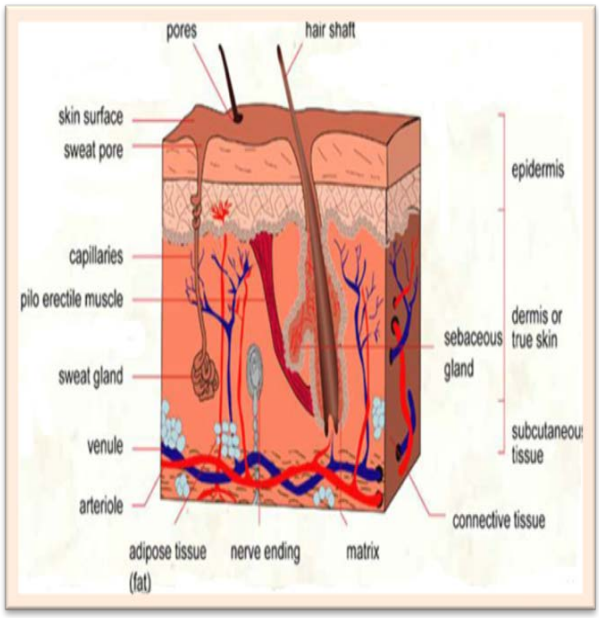

Fig. 3: Structure of skin [10]

The topical drug absorption is done by three mechanisms; which are transcellular, intercellular, and follicular. The drugs penetrate the stratum corneum by passive diffusion [11]. For that the rate limiting steps are diffusion and dissolution. Topical drugs are used for three functions; the epidermal formulation, endodermal formulation and transdermal formulation. Transcellular mechanism is the shortest and direct route. Intercellular mechanism is the common route. The follicular mechanism is through hair follicles and sweat glands [12].

The drug penetration is enhanced by chemical (surfactant, water, solvents, etc.), physical (stripping, iontophoresis, ultrasound, etc.), biochemical (peptides and metabolic inhibitors) and super saturation enhancement [13].

ADVANTAGES AND DISADVANTAGES OF EMULGEL

ADVANTAGES

- Incorporation of hydrophobic drugs
- Better loading capacity
- Better stability
- Controlled release
- No intensive sonication
- Avoiding first pass metabolism
- Avoiding gastrointestinal incompatibility
- More selective for a specific site
- Improved patient compliance
- Convenient and easy to apply [14]

DISADVANTAGES

- Skin irritation on contact dermatitis
- The possibility of allergenic reactions
- The poor permeability of some drugs through the skin
- Drugs of large particle size are not easy to absorb through the skin
- The occurrence of the bubble during formulation of emulgel [15]

FORMULATION OF EMULGEL

For the preparation of emulgel some constituents are used including drug, which are:

- Vehicle

Vehicle should follow the ideal characters given in the Pharmacopeias

- **Aqueous** material

The aqueous phases used are water, alcohol, etc.

- **Oil**

Oils are used for preparation of emulsion. Mineral oils and paraffin are used either alone or in combination [16].

- **Emulsifiers**

Emulsifiers used for preparation of emulsion. Some examples are span 80, tween 80, stearic acid, sodium stearate.

- **Gelling agents**

Gelling agents are used for prepare gels, which enhance consistency of preparation.

- **Penetration enhancers**

Penetration enhancers help to absorb drug to the skin [17].

- **pH adjusting agent**

IDEAL PROPERTIES OF ADDITIVES

- They should be nontoxic.
- They should be easily available.
- They should be cheap.
- They do not be contraindicated.
- They should chemically and physically be stable.

PREPARATION OF EMLGEL

Emulgel are prepared by incorporating gel and emulsion. The emulsion and gel are prepared separately and mixed together.

For preparing emulsion, aqueous phase and oil phase are taken separately and mixed together. Then the gel is prepared by using gelling agent. After preparing gel and emulsion, they are mixed with gentle stirring. The chemicals are used as oil phase are castor oil, clove oil, liquid paraffin, etc. Water and alcohol are used as aqueous phase [18].

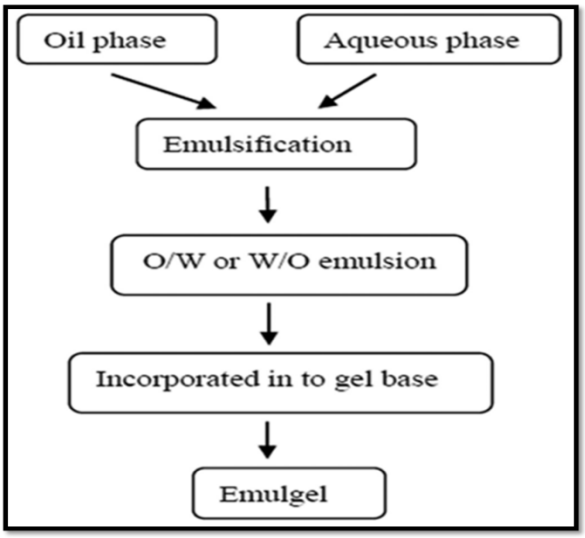

Fig. 4: Flow chart of emulgel preparation [19].

The aqueous phase is prepared by mixing tween 80 and water and also the oil phase prepared by mixing paraben and propylene glycol. The drug is dissolved in ethanol and the two phases are mixed with continuous stirring. Then the polymers are dissolved in water with the pH of 6.0-6.5. After preparing emulsion and gel separately, they are mixed together to get emulgel.

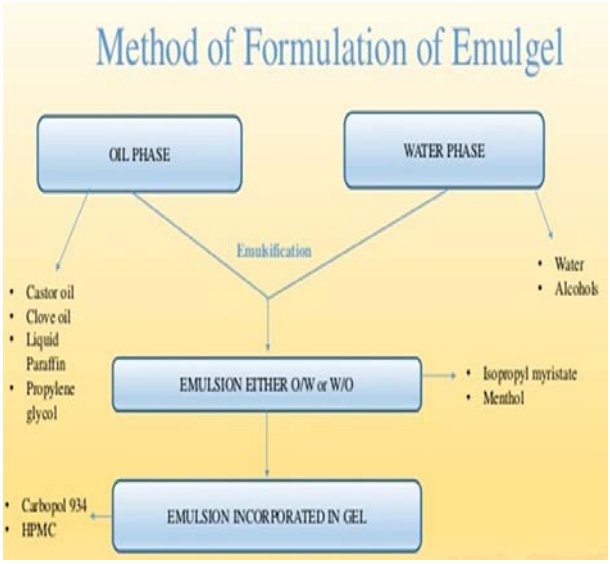

Fig. 5: Method of formulation of emulgel [20]

EVALUATION TECHNIQUES

Physical examination:

The color, homogeneity, consistency and phase separation are checked here [21].

Spreadability:

Spreadability is checked by “slip” and “drag” character of emulgel. To determine Spreadability, the apparatus

consisting a wooden block is provided by a pulley at one end. In the block a ground glass is fixed. 2 g of emulgel is placed on it, and is covered with another glass slid as a sandwich. One kg of weight is placed on it and the Spreadability is checked.

Determination of pH:

It is determined by using digital pH meter. The pH meter is dipped into the emulgel and the pH is checked; it is repeated for 3 times.

Rheological study:

In Rheological study the viscosity is determined at 25 ºC. The apparatus used is cone and plate viscometer [22].

In vitro drug release study:

It is carried out by using Franz diffusion cell. It helps to determine the drug release [23].

Microbiological assay:

For this method Ditch plate technique is used. Through this method the bacteriostastic or fungiststic activity is evaluated.

Accelerated stability studies:

It is performed by ICH guidelines. The stability test is done in hot air oven at 37 ± 2 ºC, 45 ± 2 ºC and 60 ± 2 ºC for 3 months [24].

Drug content:

The drug content is determined by UV spectroscopic analysis. The equation used is,

Drug content = (Concentration × Dilution factor × Volume taken) × Conversion factor.

Globule size and distribution in emulgel:

It is determined by Malvern Zetasizer. The emulgel is dissolved in water, agitated, and inserted in to the apparatus to determine the value.

Centrifugation study:

This method is used to determine the stability of emulgel. It is done only after one week of preparation. This study was done by using minicentrifuge at 3000 rpm for 30 minutes.

Swelling index:

One gram of emulgel is taken in a porous aluminum foil and placed separately in a 50 ml beaker containing 10 ml of 0.1 N NaOH. Then, the samples are removed at different time intervals, and reweighed. Swelling index is determined by the equation;

Swelling index (SW) % = [(Wt-Wo)/Wo] × 100

Where, Wt = Weight of swollen emulgel after time t, Wo = Original weight of emulgel at zero time.

Skin irritation test:

This test is very important because the preparation is a topical formulation. The test is carried out on the animal skin. The emulgel is applied to the animal skin, and then the animals are returned in to their cages. After 24 hr the animals are tested. Then the emulgel are removed from the site and wiped with tap water.

Stability studies:

The emulgel were packed in aluminum collapsible tubes, stored in extreme conditions, and the stability is checked.

PACKAGING OF EMULGELS

Packaging of emulgels are usually done in membrane sealed lacquered aluminum tube with inner coating of a phenoxy-epoxy based lacquer closed with propylene screw cap or an aluminum laminated tubes closed by a moulded seal, with a propylene screw cap.

Material for laminates tubes

1. Foil laminates

It provides light, air and moisture barrier.

2. All plastic laminates

It has a chemical resistant barrier.

Marketed emulgels

Sl No	Brand name	Active ingredient	Manufacturer	Uses
1	Voltarol 1.16% emulgel	Diclofenac Diethylammonium salt	Novartis	Anti-inflammatory
2	Miconaz-H-emulgel	Miconazole nitrate, Hydrocortisone	Medical union pharma ceuticals	Topical corticosteroid & antifungal
3	Denacine Emulgel	Clindamycin phosphate	Beit jala pharmaceutical company	Anti-acne
4	Diclon emulgel	Diclofenac diethylamine	Medpharma	Anti-inflammatory
5	Cataflam emulgel	Diclofenac potassium	Novartis	Anti-inflammatory

SUMMARY

In topical drug delivery system, a large number of formulations are used, but they also have their own disadvantages. Most of these disadvantages are overcome by emulgel preparation. The emulgel have proven as most convenient, better, and effective delivery system through the project. Incorporation of emulsion into gel makes it a dual control release system to further solve the problems such as phase separation, creaming associated with emulsion, and improvement of stability. Emulgel needs constituents as like the emulsion and gel preparation.

The preparation of emulgel is done with three steps; preparation of emulsion, preparation of gel and incorporation of these two preparation. Every formulation needs a proper evaluation. So, here also there are nearly twenty five types of evaluation methods, such as photo microscopy, Spreadability, rheological study, *In-vitro*

drug release study, etc. Nowadays, the emulgel is widely used. The most commonly used emulgels are Miconaz-H-emulgel, Isofen emulgel, Diclon emulgel, etc. Normally the emulgels are used as anti-inflammatory drugs.

CONCLUSION

In the coming years, topical drug delivery will be used extensively to impart better patient compliance. Emulgel is a recent technique for topical drug delivery and it is suitable for hydrophobic drugs. Since it is also capable in enhancing spreadibility, adhesion, viscosity and extrusion. They will become a popular drug delivery system. Moreover, they will become a solution for loading hydrophobic drugs in a water soluble gel base.

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