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Emulgel as a novel drug delivery system: a comprehensive review

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Abstract

Nowadays emulgel systems are currently of attention to the pharmaceutical scientists because of their substantial potential to act as drug delivery vehicle by incorporating a broad range of drug molecules. Emulgel is one of the recent technology in NDDS used topically having characteristics of dual control release i.e. emulsion as well as gel. Emulgels have emerged as one of the most interesting topical delivery systems as it has dual release control system i.e. gel and emulsion. When gel and emulsion are used in combined form, the dosage form are referred as emulgel. In current review article, various aspects of the emulgel are discussed.

Keywords: emulgel, NDDS.

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Introduction

There are lots of advantages of gels but there is a major limitation of gel which is in the delivery of hydrophobic drugs to solve this problem emulsion base approach is utilize so that hydrophobic nature pores can also get the proper treatment by the property of gel, here the gel and emulsion is combine and form emulgel. By this preparation we can reach for diagnose and treatment in dermatological pharmacology of the skin at the targeted organ. In the novel vesicular system and also in the conventional system emulgel have major advantage by which emulgel is become batter topical drug delivery system also this new system can be use in the analgesic and antifungal drugs [1,2,3].

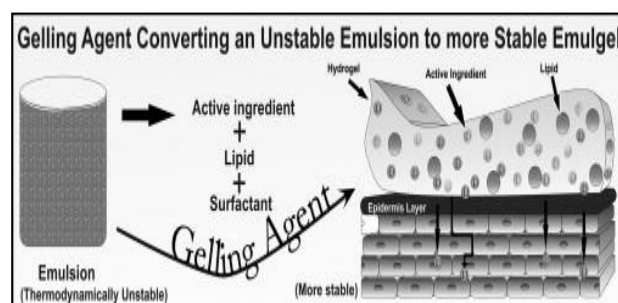


Figure 01: Emulgel

Advantages

- 1- Incorporation of hydrophobic drugs
- 2- Better loading capacity
- 3- Better stability
- 4- Controlled release
- 5- No intensive sonication
- 6- Avoiding first pass metabolism
- 7- Avoiding gastrointestinal incompatibility
- 8- More selective for a specific site
- 9- Improved patient compliance
- 10- Convenient and easy to apply [4, 5].

Disadvantage

- 1- Skin irritation on contact dermatitis
- 2- The possibility of allergenic reactions
- 3- The poor permeability of some drugs through the skin
- 4- Drugs of large particle size are not easy to absorb through the skin
- 5- The occurrence of the bubble during formulation of emulgel [6,7].

Factors Affecting Topical Absorption of Drug

Physiological Factors [8-11]

1. Skin thickness.
2. Lipid content.
3. Density of hair follicles.
4. Density of sweat glands.
5. Skin pH.
6. Blood flow.
7. Hydration of skin.
8. Inflammation of skin [7, 8]

Physiochemical Factors¹²⁻¹⁵

1. Partition coefficient.
2. Molecular weight (<400 dalton).
3. Degree of ionization
4. Effect of vehicles.

Factors for topical Preparation [16]

- 1- Effect of the vehicle
- 2- Match the type of preparation with the site.
- 3- Match the type of preparation with the type of lesions. [1, 2]

Constituents of emulgel Preparation

1. Aqueous Material

This forms the aqueous phase of the emulsion. Commonly used agents are water, alcohols [28].

2. Oils

These agents form the oily phase of the emulsion. For externally applied emulsions, mineral oils, or combined with soft or hard paraffin's are widely used both as the vehicle for the drug and for their occlusive and sensory characteristics [17].

3. Emulsifiers

Emulsifying agents are used both to promote emulsification at the time of manufacture and to control stability during a shelf life that can vary from days for extemporaneously prepared emulsions to months or years for commercial preparations [18].

4. Gelling Agent:

These are the agents used to increase the consistency of any dosage form can also be used as thickening agent.

5. Permeation Enhancers: These are agents that partition into and interact with skin constituents to induce a temporary and reversible increase in skin permeability [19].

Emulgel preparation

The oil phase of the emulsion were prepared by dissolving Span 20 in light liquid paraffin while the aqueous phase was prepared by dissolving Tween 20 in purified water. Methyl and Propyl paraben was dissolved in propylene glycol whereas drug was dissolved in ethanol and both solutions was mixed with the aqueous phase [5]. Both the oily and aqueous phases were separately heated to 70° to 80°C; then the oily phase were added to the aqueous phase with continuous stirring until cooled to room temperature. And add Glutaraldehyde in during of mixing of gel and emulsion in ratio 1:1 to obtain the emulgel [20].

Characterization

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Extrudability study

The method adopted for evaluating emulgel formulation for extrudability is based upon the quantity in percentage of emulgel and emulgel extruded from lacquered aluminum collapsible tube on application of weight in grams required to extrude at least 0.5 cm ribbon of emulgel in 10 seconds. More quantity extruded better is extrudability. The measurement of extrudability of each formulation is in triplicate and average values are presented²². The extrudability is than calculated by using the following formula:

Extrudability = Applied weight to extrude emulgel from tube (in gm) / Area (in cm²) [7, 9, 10]

Rheological Study

The viscosity of the different emulgel formulations is determined at 25°C using a cone and plate viscometer with spindle 52 and connected to a thermostatically controlled circulating water bath [23].

In vitro release studies

The in vitro drug release studies were carried out using a modified **Franz diffusion (FD)** cell the formulation was applied on dialysis membrane which was placed between donor and receptor compartment of the FD cell phosphate buffer pH 7.4 was used as a dissolution media. The temperature of the cell was maintained at 37

°C by circulating water jacket, this whole assembly was kept on a magnetic stirrer and the solution was stirred continuously using a magnetic bead. A similar blank set was run simultaneously as a control. Sample (5 ml) was withdrawn at suitable time intervals and replaced with equal amounts of fresh dissolution media then samples were analyzed spectrophotometrically at 285 nm and the cumulative % drug release was calculated. The difference between the readings of drug release and control was used as the actual reading in each case [24].

Ex vivo drug release study

The ex vivo drug release study of selected formulations (F2 and F4) was carried out in a modified Franz diffusion cell, using **wistar male rat skin**. A section of skin was cut and placed in the space between the donor and receptor compartment of the FD cell, keeping the dorsal side upward. Phosphate buffer pH 7.4 was used as dissolution media. The temperature of the cell was maintained constant at 32 °C by circulating water jacket. This whole assembly was kept on a magnetic stirrer and the solution was stirred continuously using a magnetic bead. A similar blank set was run simultaneously. The samples were withdrawn at suitable time intervals and replaced with equal amounts of fresh dissolution media. Samples were analyzed spectrophotometrically at 285 nm [25].

Swelling Index

To determine the swelling index of prepared topical emulgel, 1 gm of gel is taken on porous aluminum foil and then placed separately in a 50 ml beaker containing 10 ml 0.1 N NaOH. Then samples were removed from beakers at different time intervals and put it on dry place for some time after it reweighed. Swelling index is calculated as follows:

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

Where, (SW) % = Equilibrium percent swelling,

Wo = Original weight of emulgel at zero time after time t, Wt = Weight of swollen emulgel [2,3,4,5]

Evaluation Techniques

Physical examination: The color, homogeneity, consistency and phase separation are checked here.

Spreadability

Spreadability is checked by slip and drag character of emulgel, to determine Spread ability 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 [10]. Spreading coefficient was determined by apparatus suggested by

Mutimer. It consists of a wooden block, which is attached to a pulley at one end. Spreading coefficient was measured on the basis of 'Slip' and 'Drag' characteristics of emulgels. A ground glass slide was fixed on the wooden block. An excess of emulgel (about 2 g) under study was placed on this ground slide. The emulgel preparation was then sandwiched between this slide and second glass slide having same dimension as that of the fixed ground slide. The second glass slide is provided with the hook. Weight of 500 mg was placed on the top of the two slides for 5 min to expel air and to provide a uniform film of the emulgel between the two slides. Measured quantity of weight was placed in the pan attached to the pulley with the help of hook. The time (in s) required by the top slide to cover a distance of 5 cm was noted. A shorter interval indicates better spreading coefficient [12].

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 °C. The apparatus used is cone and plate viscometer.

In vitro drug release study

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

Microbiological assay: For this method **Ditch plate** technique is used. Through this method the bacteriostatic or fungistatic activity is evaluated.

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

Emulgel drugs and products in Pharma, cosmetic and cosmacutical industry

MiconazH tropical emulgel is use in the tropical corticosteroid & antifungal activity.

Denacine emulgel is use in the Anti acne activity.

Diclone emulgel is use in anti inflammatory activity.

Ctaflam emulsion anti-inflammatory inflammatory activity.

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

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 spreadability, 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.

Reference

1. A. S. Panwar, S. Gandhi, A. Sharma, N. Upadhyay, M. Bairagi, S. Gujar, G. N. Darwhekar, D. K. Jain College of Pharmacy, IPS Academy, Rajendra nagar, Indore M.P. -452010, India.
2. Chauhan N, Kumar K, Pant NC. An updated review on transfersomes: a novel vesicular system for transdermal drug delivery. Universal Journal of Pharmaceutical Research 2017; 2(4): 42-45.
3. Shaikh SC, Sanap D, Bhusari DV, Jain S, Kochar PP, Memon FS. Fabrication and evaluation of herbal ointment formulations of *Moringa oleifera* for topical delivery. Universal Journal of Pharmaceutical Research 2018; 3(4): 34-38.
4. Shah A. Arpan, Kamdar Kamal, Shah Rushabh, Keraliya A. Rajesh., 2013. Emulgel: A Topical Preparations for Hydrophobic Drugs. Ph Tech Med.
5. George Zhu, Xu HL, Zhou XP, Zhi QW. Enhancement of wound healing by topical application of epidermal growth factor in animal model. Universal Journal of Pharmaceutical Research 2020; 5(1): 12-20.
6. Bhatt Preeti, Gnanarajan. G, 2013. Emulgels: A Novel Formulation Approach for the Topical Delivery of Hydrophobic Drugs A Review. International Research Journal of Pharmacy .
7. Gharib SM. Role of non steroidal anti-inflammatory drugs in acute upper gastrointestinal bleeding. Universal Journal of Pharmaceutical Research 2016; 1(1): 12-16.
8. Edenta C, Ezeaku IN, Zainab A, John DF. Development and evaluation of nanoemulsion formulations for improved oral delivery of carvedilol. Universal Journal of Pharmaceutical Research 2017; 2(1): 5-10.
9. K.P. Mohammade Haneef, Sherry Easo, P.V. Hafsa, Guru Prasad Mohanta, Chandini Nayar, 2013. Emulgel: An Advanced Review. Journal of Pharmaceutical Science and Research.
10. Gurleen Kaur, Preeti Budhlakoti, *Kapil Kumar, Deepak Teotia, Ikram. Development and characterization of moxifloxacin loaded niosomal in- situ gel formulations. International Journal of Modern Pharmaceutical Research. 2021, 5(6), 44-47.
11. Arirudran B, Priyadarshini P, Rao USM. Estimation of anti-inflammatory activity as well as apoptotic activity of ethanolic extracts of *crocus sativus*. Universal Journal of Pharmaceutical Research 2018; 3(6): 6-11.
12. Abhilasha, S., Narasimhan, C.L., Kumar, S.A., Kumar, S.N.K., Bhavani, R.D., Thangarajeswari, M., Prema, V. and Kalaiselvi, P., 2017. Ethanolic Extract Of *Aegle Marmelos* Mediates Its Hypocholesterolemic Effect By Retarding Circulatory Oxidized Ldl Formation Via 12/15 Lipoxygenase Pathway.
13. Singh, A., 2022. Role of microbial metabolites in cardiovascular and human health. In Microbiome, Immunity, Digestive Health and Nutrition (pp. 137-148). Academic Press.
14. Singh, A., 2022. Role of microbial metabolites in cardiovascular and human health. In Microbiome, Immunity, Digestive Health and Nutrition (pp. 137-148). Academic Press.
15. Shiv Chandra Singh, A., Yu, A., Chang, B., Li, H., Rosenzweig, A. and Roh, J.D., 2021. Exercise Training Attenuates Activin Type II Receptor Signaling in the Aged Heart. Circulation, 144(Suppl 1), pp.A14259-A14259.
16. ALGIN YAPAR E, BESKAN U, KARAVANA SY. A recent overview of locally administered topical otic dosage forms. Universal Journal of Pharmaceutical Research 2019; 4(4): 39-42.

17. Türkmen A, Esentürk-Güzel İ, Kara BA. Innovative drug delivery systems for infectious diseases of the skin. *Universal Journal of Pharmaceutical Research* 2022; 7(4):68-76.
18. Pathan, I.B, Setty C.M, 2009. Chemical penetration enhancers for transdermal drug delivery systems. *Tropical Journal of Pharmaceutical Research*.
19. K.P. Mohammade Haneef, Sherry Easo, P.V. Hafsa, Guru Prasad Mohanta, Chandini Nayar, 2013. Emulgel: An Advanced Review. *Journal of Pharmaceutical Science and Research*, 5(12), pp 254-258.
20. Singla et al, 2012. Emulgel: a platform for topical drug delivery. *International Journal of pharmaceutical and biological sciences*.
21. Anwar W, Dawaba HM, Afouna MI, Samy AM. Screening study for formulation variables in preparation and characterization of candesartan cilexetil loaded nanostructured lipid carriers. *Universal Journal of Pharmaceutical Research* 2019; 4(6):8-19.
22. Awanika Shukla, Kapil Kumar*, Sai Krushna Padhy. Development and evaluation of transdermal gel of ketorolac tromethamine. *Journal of Pharma Research*. 2016; 5(6): 139-142.
23. Paliwal S, Kaur G, Arya KKR. Formulation and characterization of topical nano emulgel of terbinafine. *Universal Journal of Pharmaceutical Research* 2018; 3(6): 28-34.
24. Jain, A., Deveda, P., Vyas, N., Chauhan, J., et al., 2011. Development of antifungal emulsion based gel for topical fungal infection(s). *IJPRD* 2
25. Obanewa OA, Oyeniran OT. Development and estimation of anti-inflammatory activity of topical Etoricoxib emulgel by carrageenan induced paw oedema method. *Universal Journal of Pharmaceutical Research* 2019; 4(3): 22-26.