IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Human Journals
Review Article
July 2022 Vol.:24, Issue:4

Emulgel A Novel Perspective for Topical Drug Delivery System: A Review

IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Amruta N Patil*[1], Sulbha G Patil[2], Hitendra S Chaudhari[3], Roshan M Chaudhari[4], Sunil P Pawar[5], Nishant M Patel[6], Darshan D Jain[7], Jayesh A Patil[8]

[1-8]Department of Pharmaceutics, P.S.G.V.P.M'S College of Pharmacy, Shahada Dist. Nandurbar (MH) 425409 India.

Submitted: 21 June 2022
Accepted: 26 June 2022
Published: 30 July 2022

Keywords: Emulgel, Topical drug delivery, Polymer, Bioavailability

ABSTRACT

In novel drug delivery system, emulgel is one of the new technology used topically having characteristics of dual control release i.e. emulsion as well as gel. When gels and emulsions are combined, the dosage form is known as emulgel. The polymer can serve as emulsifiers and thickeners because the gelling capacity of these compounds provides the formulation of stable emulsions and creams by decreasing surface and in Emulgel, Topical drug delivery, Polymer, Bioavailability terfacial tension and at the same time increasing the viscosity of the aqueous phase. The presence of a gelling agent in the water phase converts a classical emulsion into an emulgel. This emulgel are having major benefits on novel vesicular systems as well as on conventional systems in various attributes. This review sets out to discuss benefits, limitations, method of preparation, main components of emulgel, and their parameters for evaluation.

INTRODUCTION:

Topical drug administration is a localized drug delivery system anywhere in the body through ophthalmic, rectal, vaginal and skin as topical routes. The main benefit of topical delivery system is to bypass first pass metabolism. Avoidance of the risks and bothers of intravenous therapy and of the varied conditions of absorption like pH changes, presence of enzymes, gastric emptying time are other advantages of topical preparations. [1, 2]

Gels are a relatively novel class of dosage form created by entrapment of large amounts of aqueous or hydroalcoholic liquid in a network of colloidal solid particles. Gel formulations usually provide quicker drug release compared with conventional ointments and creams. Despite many advantages of gels a major limitation is in the difficulty in delivery of hydrophobic drugs. So to overcome this limitation emulgels are prepared and with their use even a hydrophobic drug can enjoy the special properties of gels. When gels and emulsions are used in combined form the dosage forms are referred as Emulgels. In fact, the presence of a gelling agent in the water phase converts a classical emulsion into an emulgel. Direct (oil-in-water) system is used to entrap lipophilic drugs whereas hydrophilic drugs are encapsulated in the reverse (water-in-oil) system. Emulsions possess a certain degree of elegance and are easily washed off whenever desired. They also have a high ability to permeate through skin. Emulgels for dermatological use have several favorable properties such as being thixotropic, greaseless, easily spreadable, easily removable, emollient, non-staining, water-soluble, longer shelf life, bio-friendly, transparent & pleasing appearance. [3, 4, 5]

Benefits:[6]

- Avoid of first-pass metabolism
- Prevention of gastrointestinal incompatibility
- Site-specific
- Enhanced patient compliance
- Suitable for self-medication
- Greater loading capacity
- Better stability

- Low preparation cost
- Controlled release
- Easy termination of medication if necessary.
- Ease of application
- Incorporation of hydrophobic drugs

Limitations:[7]

- Skin irritation on contact dermatitis
- The possibility of allergenic reactions
- The poor permeability of some drug through the skin
- Drug of large particle size not easy to absorb through the skin
- The occurrence of the bubble during the formation of emulgel

Factors affecting topical absorption of drug:[8, 9]

1] Physiological factors

- Skin thickness
- Lipid content
- The density of hair follicles
- The density of sweat glands
- Skin pH
- Blood flow
- Hydration of skin
- Inflammation of skin

2] Physicochemical factors

- Partition coefficient
- The molecular weight (**< 400 Dalton)**

- The degree of ionisation (only unionized drugs gets absorbed well)
- Effect of vehicles.

Main components of Emulgel:

1] Aqueous Material: This forms the aqueous phase of the emulsion. Typically used agents are water, and alcohols. [10]

2] Oils: For externally applied emulsions, mineral oils, either alone or combined with soft or hard paraffin, are widely used both as the vehicle for the drug and for their occlusive and sensory characteristics. Widely used oils in oral preparations are mineral and castor oils that provide a local laxative effect, and fish liver oils or various fixed oils of vegetable origin (e.g., arachis, cottonseed, and maize oils) as nutritional supplements. [11]

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.E.g: Polyethylene glycol 40 stearates, Sorbitan mono-oleate32 (Span 80).[12, 13, 14]

4] Gelling Agent: These are the agents used to enhance the consistency of any dosage form can also be used as a thickening agent. [15]

5] Permeation Enhancers: These are agents that partition into and interact with skin constituents to induce a temporary and reversible increment in skin permeability. [16]

A general method of preparation of emulgel:

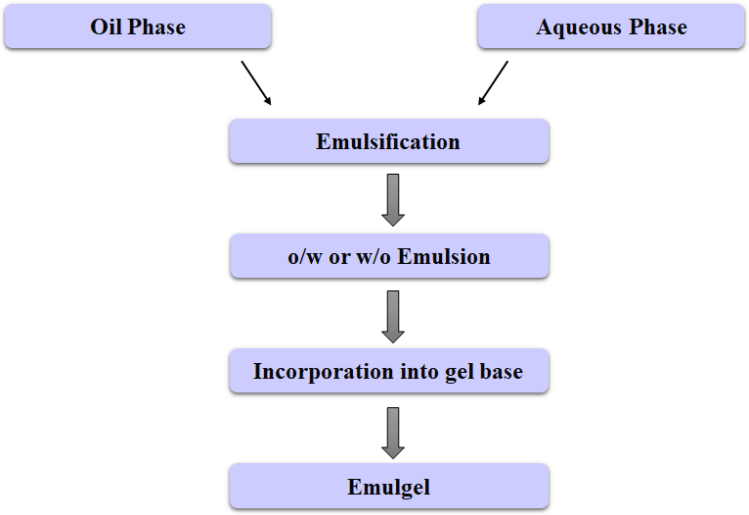

Fig.1: Flowchart of emulgel preparation

Evaluation of emulgel:

Physical appearance:

The prepared Emulsion formulations were inspected visually for their colour, homogeneity, and consistency.[17]

Rheological study:

The viscosity of the formulations was measured using a Brookfield viscometer. The measuring system used was the C-25, which is typically used for highly viscous liquids such as gums, mucus, and polymer dispersions. Viscosities were recorded at various rotations ranging from 10-100 RPM at 37°C. [18]

Drug content determination:

Drug concentration in gellified emulsion was measured by spectrophotometer. Drug content in emulgel was measured by dissolving known quantity of prepared emulgel in the appropriate solvent by Sonication. Absorbance was measured after suitable dilution in UV-VIS spectrophotometer.[19]

Skin irritation test:

The emulgel was applied on the properly shaven skin of rat. Undesirable skin changes, i.e., change in color, change in skin morphology were checked for a period of 24 hrs.[20]

Gel strength:

50 gm of prepared emulgel sample was placed in a 100 ml measuring cylinder. Then, a 35 g weight was positioned on a disc have a wideness of 2.3 cm, a distance of 0.4 cm from the sidewall of the cylinder, and a thickness of 0.5 cm, and this disc was positioned on the gel. Gel strength was measure as the time (in second) needed to move the disc downside (5 cm) through the gel. Gel strength was illustrated as the minimum weight that pressed down the device (5 cm) through the gel. [21]

Bioadhesive strength:

The Bioadhesive potential of each formulation was determined by measuring a force required to detach the formulation from membrane. It was measured by modified balance. The fresh skin is cut into pieces and washed with phosphate buffer pH 7.4. Membrane was mounted on

lower side of glass surface using adhesive tape while another membrane was fixed on upper side of glass slide, kept on the inverted cylinder. Emulgel equivalent to the 50 mg was placed on the membrane surface. Empty beaker was attached to another side of the balance. Membrane surface with gel formulation and upper membrane surface was held in contact with each other for 2 min to ensure intimate contact. Water was added to the beaker until detachment takes place. The mucoadhesive force was expressed as the detachment stress in dynes/cm^2 as shown below: [22]

Mucoadhesive strength (dynes/cm^2) = mg/A

Where *m* is weight required for detachment in gram, g is the acceleration due to gravity (9.80 cm/s^2), and A is area of mucosa exposed.

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 phosphate buffer 7.4. 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: [23]

Swelling Index (SI) % = [(Wt – Wo) / Wo] × 100.

Where, (SI) % = Equilibrium percentage swelling, Wo= Original weight of emulgel at zero time after time t, Wt = Weight of swollen emulgel

Spreadability test:

Spreadability was calculated using apparatus consisting of a wooden plank with scales and pair of glass slides with two pans on either side hanged on pulley. An excess sample was placed between the two slides, and a 100 gm weight was kept on the slide for 5 minutes to press the sample to a uniform size. Added a load (250 g) to the pan. The time (in second) needed for detachment of two slides was considered as a measure of spreadability. [24]

S = m* l / t

Whereas, m -Weight attached to top slide, **l** -Length of slide, **t** -Time in seconds

Extrudability study:

It is a usual empirical test to measure the force required to extrude the material from tube. The method applied for the determination of applied shear in the region of the rheogram corresponds to a shear rate exceeding the yield value and exhibiting consequent plug flow. In the present study, the method adopted for evaluating emulgel formulation for extrudability is based upon the quantity in percentage of emulgel and emulgel extruded from lacquered aluminium collapsible tube on the 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 the average values are presented. The extrudability is than calculated by using the following formula: [25]

Extrudability = Applied weight to extrude emulgel from tube (in gm.) / Area (in cm^2)

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 the dialysis membrane which was placed between donor and receptor compartment of the FD cell. Phosphate buffer pH 7.4 was used as a diffusion media. The temperature of the cell was maintained at 37 °C by a 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 to maintain sink condition. Samples were analyzed spectrophotometrically at specific wavelength and the cumulative % drug release was calculated. [26]

Stability studies:

The prepared emulgels were packed in aluminium collapsible tubes (5 g) and subjected to stability studies at 5 °C, 25 °C/ 60% RH, 30 °C/65% RH, and 40 °C/75% RH for 3 months. Samples were withdrawn at 15-day time intervals and evaluated for physical appearance, pH, rheological properties and drug content. [27]

CONCLUSION:

From this review we can conclude that, Emulgel is the newly developed technique for the topical drug delivery. Since Emulgel helps enhance Spreadability, adhesion, viscosity and extrusion, this novel drug delivery will become a popular formulation in future. As the

emulgel is the recent technique for topical drug delivery it is better suitable for hydrophobic drugs. The topical drug delivery system will be used extensively due to better patient compliance in the future. Moreover, they will become a solution for loading hydrophobic drugs in water-soluble gel bases.

REFERENCES:

1] Surver C and Davis FA, Bioavailability and Bioequivaance, In: K.A Walter (eds.), Dermatological and Transdermal Formulation, Marcal Dekker, New York.2002; 403:323- 327.
2] Sharma S. Topical preparations are used for the localized effects at the site of their application by virtue of drug penetration into the underlying layers of skin or mucous membranes. Pharmaceutical reviews.2008; 6:1.
3] Laithy HM. and El shaboury KMF. The development of Cutina Lipogels and gel microemulsion for topical administration of fluconazole. Ame Pharm Sci. PharmSciTech.2003; 3:10-25.
4] Kuller R, Saini S, Seth N, Rana AC, Emulgel: A surrogate approach for topical used hydrophobic drugs. Int J Pharm Bio Sci.2011;1(3):117-128.
5] Jain A, Gautam SP, Gupta Y, Khambete H, Jain S, Development and characterization of Ketoconazole emulgel for topical drug delivery. Der Pharmacia Sinica. 2010; 1(3):221- 231.
6] Mishra AN. Controlled and novel drug delivery. 4th ed. CBS Publisher and Distributers, Delhi.1997:107-109.
7] Yadav Sunil, Mishra Manoj, Tiwari Anupamaa, Shukla Ashutosh. Emulgel: A New Approach for Enhanced Topical Drug Delivery.2017; 9(1): 15-19.
8] Kalia YN, Guy RH. Modeling transdermal drug release. Adv Drug Delivery Rev.2001; 48:159-72.
9] Ayub AC, Gomes AD, Lima MV, Vianna-Soares CD, Ferreira LA. Topical delivery of fluconazole: in vitro skin penetration and permeation using emulsions as dosage forms. Drug Dev Ind Pharm.2007; 33:273-80.
10] Lachman, L.; Lieberman, H.A. The Theory and Practice of Industrial Pharmacy. 3rd Ed. Varghese Publishing house.1990:534.
11] Vyas, S.P.; Khar, R.K. Controlled Drug Delivery. 1st Ed. Vallabh Prakashan.2002:416-417.
12] Curr AEB. Transdermal Drug Delivery: Penetration Enhancement Techniques Heather. Drug Deliv. 2005; 2:23-33.
13] Rutrer N. Drug absorption through the skin: a mixed blessing .Arch Dis Child.1987; 62:220-221.
14] Zhang XL, Zhao R, Qian W. Preparation of an emulgel for treatment of aphthous ulcer on the basis of carbomers. Chin. Pharm. J. 1995; 30:417-418.
15] Mortazavi SA, Aboofazeli R. An Investigation into the Effect of Various Penetration Enhancers on Absorption of Piroxicam. Iranian Journal of Pharmaceutical Research. 2003; 135-140.
16] Jacob SW, Francone CA. Structure and function of man. WB Saunders Co. Philadelphia.1970:55-60.
17] Kasliwal, N., Derle, D., Negi, J., Gohil, J. Effect of permeation enhancers on the release and permeationkinetics of meloxicam gel formulations through rat skin. Asian J. Pharm. Sci.2008; 3(5):193-199.
18] Sharma N, Kulkarni GT, Sharma A. Development of Abelmoschus esculentus (Okra)-Based Mucoadhesive Gel for Nasal Delivery of Rizatriptan Benzoate. Tropical Journal of Pharmaceutical Research. 2013; 12(2): 149-153.
19] Chaudhari P, Ajab A, Malpure P, Kolsure P, Sanap D, Development and in-vitro evaluation of thermo reversible nasal gel formulations of Rizatriptan benzoate, Indian J Pharm Edu Res. 2009;43:55-62.
20] Murty SN, Hiremath SRR. Physical and chemical enhancers in transdermal delivery of terbutaline sulphate. AAPS Pharm. Sci. Tech.2001; 2:1-5.
21] GalgatteUC,Kumbhar AB, Chaudhari PD. Development of in situ gel for nasal delivery: design, optimization, in vitro and in vivo evaluation. Drug Deliv.2014; 21(1): 62-73.
22] Panwar S, Gandhi S, Sharma A, Upadhyay N, Bairagi M, Gujar S, Darwhekar GN, Jain DK. Emulgel: A Review. Asian Journal of Pharmacy and Life Science.2011;1(3):333-343.
23] Patel RP, Patel G, Baria A. Formulation and evaluation of transdermal patch of aceclofenac, Int J Drug Del. 2009;3: 41-51.

24] SabaleVidya, KunjwaniHarish, SabalePrafulla. Formulation and in vitro evaluation of the topical antiageing preparation of the fruit of Benincasa hispida. Journal of Ayurveda & Integrative Medicine.2011; 2(3):124-128.
25] Bidkar S, Jain BD, Padsalg A, Patel K, Mokale V, Formulation, development and evaluation of Fluconazole gel in various polymer bases. Asi. J. Pharm.2007; 1: 63-68
26] Kakkar AP, Gupta A. Gelatin based transdermal therapeutic system. Ind. Drugs. 1992;29:308-312.
27] ICH Harmonized Tripartite Guidelines, Stability Testing of New Drug Substances and Products. ICH Committee.2003:8