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Research Article

EMULGEL: A NEW APPROACH FOR ENHANCED TOPICAL DRUG DELIVERY

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A R T I C L E I N F O

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A B S T R A C T

Objective: Emulgel is a topical preparation prepared by a combination of emulsion and gel. Emulgel is considered one of the most important delivery systems because it has two control systems, namely gel and emulsion. Emulgel generally has no side effects. **Significance:** Emulgel is used to treat pain caused by colds, headaches, body aches, back pain, arthritis and other diseases and injuries. Patient adherence to the above regimen is significant in chronic skin conditions, such as fungal infections, acne, and psoriasis. Emulgel is a recently used drug delivery system (NDDS) technology that has dual release characteristics, namely, emulsion and gel. **Result:** There are various useful properties such as thixotropic, emollient, grease-free, easily spreadable, easily removable, water soluble, long life, non-staining, bio-friendly, transparent and pleasing appearance. Many people who do the insertion can increase the effect of the emulgel. **Conclusion:** Therefore, emulgel is considered as the most conventional systems available in market over other topical drug delivery systems.

INTRODUCTION

Skin drugs are dermatological or pain relievers accessible on remedy or over-the-counter (OTC) that are created as moisturizers, creams, froths, arrangements, suspensions, or gels. In light of their combination of water, oil, the dynamic drug fixing (Programming interface), and different synthetic substances including thickening or gelling specialists, emulsifiers, additives, cancer prevention agents, and solvents, they are sorted as semi-strong medication items. This sort of definition is especially troublesome since it needs exact consistency and dependability, and matching the component of activity and tangible qualities may be troublesome. Skin prescriptions frequently show more vulnerable soundness and have a more limited time span of usability than strong portion structures, similarly as fluid definitions. The strategy for activity connects with the effective's expected utilization and decides if it is planned to treat the skin's surface by infiltrating to a particular layer of the dermis or to enter strong tissues, likewise with pain relievers. An effective ought to have an organization fit to the requests of the item and be easy to apply. An effective ought to have a satisfying surface (otherwise called skin feel), look, and fragrance that don't change over the direction of the item's recorded time span of usability Tan *et al.* [1]

Purpose of Topical Preparations

The ideal goal should be considered while making a successful and proficient effective planning. This straightforwardly connects with the arrangement& planned effect and thespot of activity.

Skin medicines may be utilized for

i) Consequences for the outer layer of the skin: cleaning (expulsion of soil and microbes), tasteful (improvement of look), defensive (counteraction of dampness misfortune, sunscreen), and antimicrobial (decrease of disease).

ii) Consequences for the layer corneum incorporate defensive (sunscreens that enter this layer, for instance), keratolytic (sloughing of the skin, accommodating in treating psoriasis), and defensive properties (saturating).

iii) Viable epidermal and dermal impacts: An assortment of medicine types can arrive at these layers (calming, sedative, antipruritic, allergy medicine). Drugs struggle with getting past the layer corneum, yet assuming they do, they can diffuse into the circulation system once they arrive at the dermis. Testing to make a prescription has just a nearby effect without a resulting blood retention.

iv) Fundamental impacts: A few drugs have been created to make foundational impacts, including scopolamine, dynamite, clonidine, and estradiol.

v) Consequences for the limbs: Some medicine types are intended to follow up on these skin districts (depilatory, exfoliant, antimicrobial, and antiperspirant). After the shock period, contamination keeps on being the main source of dreariness and passing in consume patients. Early extraction, where plausible, and the utilization of skin antimicrobial creams such silver sulphadiazine are protection measures to bring down the gamble of

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wound disease and possible sepsis Buhse et al. [2]The patient with serious consumes is powerless to cutaneous and fundamental diseases Del Rosso et al. [3]

Emulsion

Emulsions are mixtures of two or more liquids that are immiscible. The system is divided into dispersive elements. Many types such as oil in water (O/W), water in oil (W/O), oil in oil (O/O), micro-emulsions, double and multiple emulsions, mixed emulsion etc. for the preparation and stabilization of emulsions, an emulsifier is necessary. Various factors can affect the emulsification process, such as the nature of the oil, emulsifier, concentration of emulsifier used, food, and temperature. [4]

Gels

Gels are made from a large amount of water or hydroalcoholic liquid in a network of colloidal solid particles, which can be inorganic or organic polymers of natural or synthetic origin. The higher aqueous content allows for the expansion of the drug and allows for easier dissolution of the drug compared to creams or lotions. However, this makes gels a poor vehicle for hydrophobic drugs. This limitation of gels can be overcome by making an emulgel. [5]

Emulgel

Emulsion is the name of the plan where an oil-and-water emulsion is held inside a gel stage. An essential emulsion is first made with a proper proportion of oil to water, and this emulsion is then added to the thick gel stage. Watery stage, oils, gelling specialists, infiltration enhancers, and emulsifiers are parts of the emulgel definition, which is utilized to make emulsions. Emulgel has an emulsion that fills in as a mode for medicine disintegration. Most of ordinarily utilized skin plans, including salve, emulsion, suspension, treatment, and cream, have various downsides. When applied to the skin, conventional effective plans make the patient feel sleek and awkward. Conventional effective plans should be applied to the skin with scouring since they have a lower spreading coefficient. The utilization of clear gel details has been extended to drug and restorative definitions because of the disadvantages of all regular semisolid plans. [6] A gel plan is a vigorously saturated, thick, semisolid, solid design that is held set up by the surface strain of a macromolecular organization of strands. In spite of the fact that gel detailing gives a larger number of advantages than the normal effective plan, it has a significant downside in the vehicle of hydrophobic actives. Accordingly, an emulsion captured in gel premise method is being applied to diminish the disadvantage of conveying for hydrophobic restorative atoms. Drugs that are hydrophobic can be remembered for the detailing of an emulgel and directed through the skin all the more successfully. [7]

Advantages of Emulgel [8]

- More noteworthy steadiness - Emulgel is steadier than skin definitions including moisturizer, emulsion, suspension, balm, and cream. Hygroscopicity is the fundamental disadvantage of the powdered dose structure, while stage partition/reversal is available in cream details and treatments display oily, sleek attributes that make them delicate to rancidity.
- While utilizing d/o/w emulsions, hydrophobic meds can be handily blended into gels. The gel base plan's essential disadvantage is the conveyance of hydrophobic or lipophilic drugs. To make an oil/water emulsion, hydrophobic or lipophilic medications are first incorporated into the sleek stage and afterward spread all through the watery stage. The gelis then joined with this emulsion and homogenized or blended to make emulgel. Such a definition, known as an emulgel, gives more prominent prescription strength and delivery.
- Creation plausibility and modest planning costs - the assembling of emulgel requires a progression of direct and speedy stages, which raises the probability that creation will be possible for an enormous scope. Fabricating requires no particular hardware, and, surprisingly, the materials are more affordable and all the more promptly accessible, bringing down the expense of creation.
- More noteworthy stacking limit - The vesicular state of liposomes and niosomes causes spillage and lower catching proficiency, which raises the expense of assembling. In anycase, Emulgel definitions have a superior limit with respect to tranquilize stacking and maintenance due to their immense organization and utilization of polymer chains.
- Emulgel definitions can be utilized for controlled delivery to draw out medicine discharge, which assists with resolving the issue of drugs with more limited half-lives.
- No critical sonication - Vesicular framework development requires significant sonication. The exorbitant sonication makes pollutions and causes the actives debase. One more issue welcomed on by sonication is the spilling of the vesicles.

Disadvantages of Emulgel [9]

- Drugs that are ineffectively solvent and porous can't be directed through the skin.
- Air entanglement can happen during creation, which can make froth work in the detailing.
- Emulgel can't be utilized for the organization of medications with enormous subatomic loads.
- Drug atoms with high molecule sizes are less skin-porous.
- Contact dermatitis might advance to skin crabbiness or a hypersensitive reaction.

Types of Emulgel and Macro-emulgel

This is the most common type of emulgel in which the particle size of the droplets of the emulsion is greater than 400 nm. They are invisible but individual droplets can be seen under a microscope.

Micro-emulgel

Micro emulsions are transparent and thermos table because their droplet sizes range from 100 to 400 nm and they do not clump together. Micro-emulsions include oil, surfactant, co-surfactant and water in particular ratios.

Nano-emulgel

When Nano-emulsions are incorporated into a gel, they are called Nano-emulgel. Nano-emulsions are oil and water well

stabilized by an interfacial film of surfactant and co-surfactant molecules with a globule size of less than 100 nm. Nano-emulsion type formulations possess development with transdermal and dermal delivery properties of in vitro and in vivo development. Nano-emulsions have improved transdermal drug delivery compared to conventional formulations such as emulsions and gels.

Essential ingredients for Emulgel preparations

1. **Aqueous Material:** This forms the aqueous phase of the emulsion. The most common ingredients are water and alcohol.
2. **Oils:** These agents from the oily phase of the emulsion. For emulsions that are applied externally, mineral oil, alone or combined with soft or hard paraffins, is often used both as a vehicle and for the drug and sensory properties. The most common oils used in oral preparations are non-biodegradable minerals and castor oil which provides a local laxative effect, as well as fish liver oil or various specific oils derived from plants (e.g., peanuts, cotton and corn) as food additives.[10, 11]
3. **Emulsifying agents**: Emulsifying agents are used to promote emulsification during production or manufacturing and to maintain stability during a shelf life that can vary from a few days for specially prepared emulsions to months and it is the year for business preparation. For example, polyethylene glycol stearate 4031, sorbitan mono-oleate32 (Span 80), poly-oxyethylene sorbitan monooleate (Tween 80) 33, stearic acid34, sodium stearate.12]
4. **Gelling agents:** These are the agents or ingredients that are used to increase the consistency or stability of any dosage form and can also be used as a thickening agent.[13, 14]
5. **Permeation enhancer:** These are agents that partition into and interact with skin constituents to induce a temporary and reversible increase in skin permeability.[15]

Additives/Excipients used in Emulgel Formulation [16]

- They should not be harmful, for one.
- They should be made available for purchase in the proper grade.
- They should be sensibly estimated.
- They should be genuinely and synthetically stable both all alone and in combinations with
- Different substances.
- They should have matching varieties.

Preparation of Emulgel

Gel and emulsion are consolidated to make emulgel. Both the emulsion and the gel are made independently and consolidated. Watery stage and oil stage are taken independently and joined to make an emulsion. From that point onward, a gelling specialist is utilized to set up the gel. Gel and emulsion are ready, and afterward they are joined with moderateblending. Synthetic substances used as the oil stage incorporate castor oil, clove oil, tween80 and water for the fluid stage, and propylene glycol and paraben for the oil stage. Theprescription is broken up in ethanol, and the two stages are persistently mixed together. Thepolymers are then disintegrated in water with a pH somewhere in the range of 6.0 and 6.5.To make emulgel, emulsion and gel should initially be arranged independently. [17]

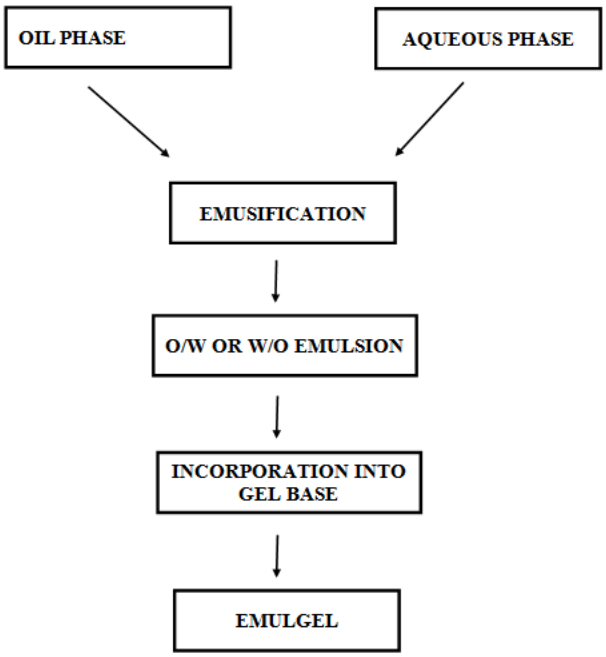

Fig. 1 Flowchart of Method of Preparation of Emulgel

Evaluation parameter of Emulgel

1. **Physical appearance of Emulgel:** Color, homogeneity, consistency, and phase separation of the created emulgel compositions were all visually assessed. The formulation was observed visually. Clarity of the formulation was the first priority of the emulgel, therefore parameters like transparency/translucent and phase separation were included, and the formulations that had superior clarity without phase separation were validated for selection.
2. **pH determination:** The formulation of pH was measured using a digital pH meter. The pH meter electrode was cleaned three times with distilled water before being put into the liquid to measure pH.
3. **Viscosity:** The viscosity of the produced batches was measured with a Brookfield Viscometer with spindle 4. Before the measurement was taken, the formulation whose viscosity was to be evaluated was added to the beaker and allowed to settle for 30 min at the test temperature (25 ^{0}C). Spindle rotated for 10 minutes at a speed of 50 rpm after being put perpendicularly into the middle of the emulgel, being careful not to let it strike the bottom of the jar. The viscosity measurement was noticed.
4. **Spread ability coefficient:** To evaluate the spread ability of an emulgel formed from micro-emulsions, a circle with a 1cm diameter is drawn on a glass plate, and a second plate is placed over it. A 1000 g weight is allowed to sit on the upper glass plate for five

minutes. An increase in diameter and spreading are observed as a result of the emulgel. The formula below was used to calculates readability

$$S = M.L/T$$

Where,
M = weight tied to upper slide
L = length of glass slides
T = time taken to separate the slides

5. **Drug Content:** Using an electric stirrer, 1 g of emulgel was fully dissolved in the ethanol. Samples were centrifuged for 10 minutes at 5000 rpm. 0.1 ml of clear supernatant was taken out and 10ml of ethanol was added to dilute it. Drug content was calculated using a formula.[18]
   Drug content= concentration × dilution factor
   % Drug content = drug content(mg)/lab claim (mg)×100.
6. **In vitro drug Release Study:** For the drug release investigations, a Franz diffusion cell (15.5 ml cell volume, 3.14 cm^2 effective diffusion area) was employed. On the surface of the egg membrane, which was sandwiched between the donor and the receptor chamber of the diffusion cell, emulgel was equally placed. To solubilize the medication, newly prepared PBS solution (pH 7.4) wasinjected into the receptor chamber. A magnetic stirrer was used to agitate the receptor chamber. At appropriate times, samples (1.0 ml aliquots) were collected. After the proper dilutions, samples were examined for drug content using a UV/VIS visual spectrophotometer. As a function of time, the total quantity of medication released through the egg membrane was calculated.
7. **Extrudability:** A container made of collapsible tubes was filled with the formulation. The weight of formulation needed to extrude 0.5 cm of ribbon of formulation in 10 seconds was used to calculate the extrudability.
8. **Homogeneity:** The homogeneity of the formulation is checked visually after a small coating of Emulgel has been applied on a slide.
9. **Stability study:** The Emulgel formulation underwent a four-week physical stability test at several temperatures, including 2°C, 25°C, and 37°C. Within four weeks, it was discovered that theemulgel formulation was physically stable at various temperatures, including 2°C, 25°C,and 37°C.

CONCLUSION

Topical drug delivery is poised to see widespread adoption in the years to come, primarily due to its ability to enhance patient compliance. Emulgel, with their distinct advantages in terms of spreadability, viscosity, and ease of extrusion, are set to emerge as a favored drug delivery system. Furthermore, they will offer an effective solution for incorporating hydrophobic drugs into water-soluble gel formulations.

Conflict of Interest

The authors have no conflict of interest.

References

1. Tan, X., Feldman, S. R., Chang, J., & Balkrishnan, R. (2012). Topical drug delivery systems in dermatology: A review of patient adherence issues. *Expert Opinion on Drug Delivery, 9*(10), 1263-1271.
2. Buhse, L., Kolinski, R., Westenberger, B., et al. (2005). Topical drug classification. *International Journal of Pharmaceutics, 295*(1-2), 101-112.
3. Del Rosso, J., & Friedlander, S. F. (2005). Corticosteroids: Options in the era of steroid-sparing therapy. *Journal of the American Academy of Dermatology, 53*(1) (suppl), 50-58.
4. Pant, S., Badola, A., Baluni, S., & Pant, W. (2015). A review on Emulgel novel approach for topical drug delivery system. *World Journal of Pharmacy and Pharmaceutical Sciences, 4*, 1728-1743.
5. Stanos, S. P. (2007). Topical agents for management of musculoskeletal pain. *Journal of Pain and Symptom Management, 33*.
6. Martin, C. (1994). Antimicrobial prophylaxis in surgery: General concepts and clinical guidelines. French Study Group on Antimicrobial Prophylaxis in Surgery, French Society of Anesthesia and Intensive Care, *Infection Control and Hospital Epidemiology, 15*(7), 463–471.
7. Song, F., & Glenny, A. M. (1998). Antimicrobial prophylaxis in colorectal surgery: A systematic review of randomized controlled trials. *Health Technology Assessment, 2*, 7.
8. Gosselin, R. A., Roberts, I., & Gillespie, W. J. (2005). Antibiotics for preventing infection in open limb fractures. *Cochrane Database of Systematic Reviews, (4)*, CD003764.
9. Coello, R., Glenister, H., Fereres, J., Bartlett, C., Leigh, D., Sedgwick, J., et al. (1993). The cost of infection in surgical patients: A case-control study. *Journal of Hospital Infection, 25*(4), 239–250.
10. Vyas, S. P., & Khar, R. K. (2002). *Controlled Drug Delivery* (1st ed.). Vallabh Prakashan.
11. Bonacucina, G., Cespi, M., & Palmieri, G. F. (2009). Characterization and Stability of Emulsion Gels Based on Acrylamide/Sodium Acryloyldimethyl Taurate Copolymer. *AAPS PharmSciTech, 10*(2).
12. Gibson, M. (2004). *Pharmaceutical Formulation and Pre-formulation*. Interpharm.
13. Mortazavi, S. A., & Aboofazeli, R. (2003). An investigation into the effect of various penetration enhancers on percutaneous absorption of piroxicam. *Iranian Journal of Pharmaceutical Research, 2*, 135-140.
14. Kumar, L., & Verma, R. (2010). *International Journal of Drug Delivery, 2*, 58-63.
15. Jacob, S. W., & Francone, C. A. (Eds.). (n.d.). *Structure and Function of Man* (2nd ed.).

16. Gaynes, R., Culver, D., Horan, T., Edwards, J., Richards, C., Tolson, J., et al. (2001). Surgical site infection (SSI) rates in the United States, 1992–1998: The National Nosocomial Infections Surveillance System basic SSI risk index. *Clinical Infectious Diseases, 33*, S69–S77.
17. Block, J. E., & Stubbs, H. A. (2005). Reducing the risk of deep wound infection in primary joint arthroplasty with antibiotic bone cement. *Orthopedics, 28*(11), 1334–1345.
18. Chaudhari, P., Ajab, A., Malpure, P., Kolsure, P., & Sanap, D. (2009). Development and in-vitro evaluation of thermo reversible nasal gel formulations of Rizatriptan benzoate. *Indian Journal of Pharmaceutical Education and Research, 43*, 55-62.

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