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MEFENAMIC ACID: AN EMULGELS FOR TOPICAL DRUG DELIVERY SYSTEM

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ABSTRACT

Topical drug delivery is the delivery of drugs anywhere in the body via skin, vaginal, ophthalmic and rectal routes. Pills may be given for localized or systemic results. Topical formulations with varying physicochemical homes, which includes solid, semisolid, or liquid, may be developed. The topical system is created by means of preparing a drug emulsion and incorporating it into an emulgel. Emulgels is a thermodynamically strong method with low interfacial anxiety that is made through combining a surfactant and a co-surfactant and has numerous properties which include multiplied permeability and accurate thermodynamic stability. Emulgel has a twin control and a sustained release pattern. Emulgel improves bioavailability in addition to affected person compliance. The pH, viscosity, particle size, zeta capacity, drug content material, stability study, pores and skin inflammation test, and other properties of the organized formula are evaluated.

KEYWORDS: Topical drug delivery, Emulgel, surfactant, bioavailability.

INTRODUCTION

Topical drug delivery is the "process of applying a medication-containing formulation to the skin to treat a cutaneous ailment." The application of topical treatments like ointments, creams, and lotions is uncomfortable for the patient since they are typically very sticky. They must be utilized carefully because they have a reduced spreading coefficient. They struggle with stability as well. To solve this issue, transparent gels have grown in popularity in cosmetic and pharmaceutical formulations.[1,2]

The formation of gels results from the considerable entrapment of an aqueous or

hydroalcoholic liquid in a system of colloidal solid particles. Gel compositions offer a quicker therapeutic release than ointments and creams. Gels have one fundamental disadvantage despite all of their benefits: they cannot deliver hydrophobic medications. To get over this restriction, an emulsion-based technique is being created that will efficiently incorporate and deliver a hydrophobic therapeutic component across gels. Emulgels are dosage forms that combine the benefits of gels and emulsions. Emulsions have a refined appearance and can be readily removed from the skin. They also penetrate the skin fairly well. "Emollient, non-staining, water-soluble, easier spreadability, longer shelf life, bio-friendly, translucent, and a pleasing look are just a few of the benefits of emulgels for dermatological treatment

2 Topical Drug Delivery System[1-3]

The skin is the primary mechanical defense against penetration of many pharmacological compounds, and it also serves as an ideal site for local and systemic drug delivery. Over the last few decades, the topical route of medication delivery has been increasingly popular. Despite the limitations of traditional topical medication delivery techniques, such as poor retention and bioavailability. This disadvantage is resolved through intensive research aimed at developing novel topical drug delivery technologies that increase safety, effectiveness, and side effects.

3 Advantages[4,5]

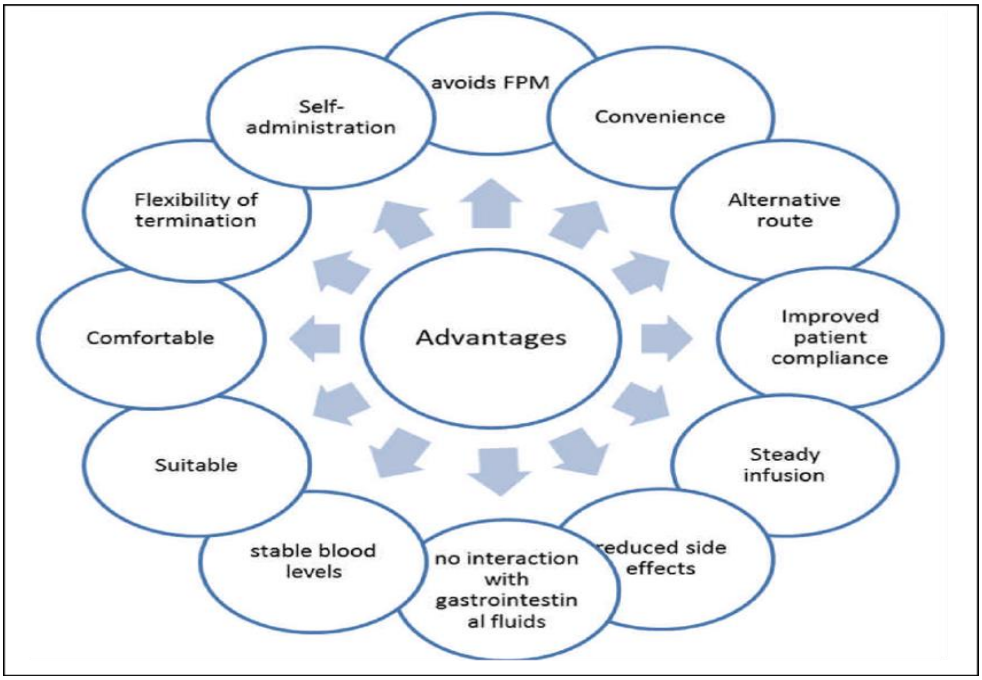


Fig. 01: Advantages of TDDS.

Disadvantages[4,5]

1. Contact dermatitis causes skin inflammation.
2. There's a chance of allergic responses.
3. Some drugs pass through the skin with little or no permeability.
4. It is challenging to absorb large
5. The development of a bubble during the emulgel manufacturing process

The skin is the body's largest organ and serves as an exterior protection system. It covers the outside of the body and serves as a mechanical barrier between the interior part of the body and the outside environment, in addition to the defence mechanism.[6]

A) Factors Affecting Topical Medicine[6]

- ✓ Skin Physiological Factors
- ✓ Skin thickness
- ✓ The skin's lipid composition and component.
- ✓ Sweat gland density.
- ✓ pH of skin.
- ✓ Circulation. Skin hydration.
- ✓ Skin inflammation and disease conditions

B) Drug Physiochemical Factors

- Distribution coefficient.
- Molecular weight
- Effect of Excipients

Gel

- ✓ Gel is a “high to low viscosity semisolid formulation made up of a dispersion of either big organic molecules or small inorganic particles, or of both. it can be enclosed and penetrated by liquid phase. The diluted cross link polymer system prevents the gels from flowing in steady state. The gel is a highly liquid rich system when continuous structure is present, solid.

Structure of Gel

- ✓ A gel is made up of a natural or synthetic polymer that has been dispersed across a hydrophilic liquid or dispersion media to create a three-gel formulation is applied to the

skin, the liquid evaporates, leaving behind a thin film in which the medicine is trapped. Physically, the skin is covered by a thin matrix created by gel composition. The stiffness of gel is provided by a dense network of polymers used in its formation. The nature of the particles and the type of form responsible for links influence the network's structure and the gel's physical characteristics.

Application of Gel[7-10]

- ✓ Gels are administered directly to the "affected area, mucous membrane of the mouth, vagina, anus, or the eye to provide a local effect"
- ✓ For longer-lasting drug release and effect, the gel version of the into the body or injected intramuscularly.
- ✓ The polymers utilized in gel formulations can be used as suppository bases, protective colloids in suspensions, binders in tablet granulation, and thickeners in oral liquids. Many cosmeceutical products, including hyaluronic acid gel for moisturization and anti-aging, use gel compositions.
- ✓ Gels are a better vehicle for drug administration topically because they are nongreasy stable, and they need little energy during formulation. Since lotions and ointments in this area are too greasy for patients to tolerate, gels containing anti-inflammatory steroids are used to treat scalp inflammations.

Emulge

- ✓ Emulgel provides significant advantages over both new and conventional vesicular systems in a variety of ways: Having a long shelf life, being emollient, non-staining, water-soluble, thixotropic, greaseless, easily spreadable, rapidly removable, translucent, and visually appealing. Emulgel is a dosage form for steroids, antibiotics, and analgesics and antifungal medications that was recently expanded. Topical agents like ointment, cream, and lotion have a number of drawbacks. Emulgel must "occasionally be applied, are sticky, and unsettling to patients and they also have a reduced spreading coefficient, they also experience stability issues and all of these aspects within the major group of semisolid preparations have expanded the usage of transparent gel in cosmetics and pharmaceutical preparations". Gels a colloid system has severe disadvantages despite its many benefits, such as the delivery of hydrophobic medicines. An emulsion-based approach is being utilized to address this problem, allowing even hydrophobic medicinal molecules to be effectively incorporated and administered through gel mixtures.[11]

Method of preparation of Emulgel

- ✓ The procedure involved mixing the chemical to either an oil or an aqueous phase, depending on the drug's solubility, making a gel basis, and merging the emulsion and gel base at a 1:1 ratio.[12]

PREPARATION METHOD

- ✓ STEP 1: Constant stirring is used to prepare the gel using the gelling ingredient and water.
- ✓ STEP 2: Emulsion preparation. either w/o or o/w.
- ✓ STEP 3: Integrating the emulsion into the Emulgel

Figure 03: Flow chart of Emugel Preparation.

Key Ingredients in Emulgels Dosage Form

1 Aqueous Material

Water and Alcohol are frequently utilizing materials to create the aqueous phase of an emulsion.

2 Oils

Mineral oils are commonly used as a vehicle for the administration of medications as well as for their occlusive and sensory qualities, either alone or in conjunction with soft or hard

paraffin. The most often used fixed vegetable oils include rachis, cottonseed, and maize oils, as well as castor oil, fish liver and many other.[13]

3 Emulsifiers

Emulsifying substances are employed in the production process to improve emulsification and to regulate stability over a shelf life that can vary from a few days for newly made emulsions to months or years for prepared products. “Sorbitan monooleate (span 80), sodium stearate, polyethylene glycol 40 stearate, stearic acid, and polyoxymethylene sorbitan monooleate (tween 80), sorbitan monooleate (span 80), sorbitan monooleate (span 80), and sorbitan monooleate.

4 Gelling Agents

These substances are used to make any dose form more consistent and can also be employed as thickeners.[14,15,16]

5 Carbopol

Acrylic acid is crosslinked with polyvalency ethers or divinyl glycol to create Carbopol polymers. It goes under the name carbomers. Due to their cross-linking and ability to create a micro gel structure, carbomers polymers are perfect for usage as a medication carrier in dermatology. When controlled drug distribution is preferred, they can be used. These are anionic polymers that need to be naturalized in order to gel. To naturalize these polymers in liquids, organic amines like triethanolamine can be used.[26] Carbopol has a wide concentration range, a pronounced flow pattern, and a high viscosity at low concentrations. It has excellent compatibility with various active substances, as well as good bio adhesive and thermal stability. Carbopol comes in a variety of modified structures, including Carbopol 910, Carbopol 934, Carbopol 940, and so on.[27] Chemical substitution and physicochemical qualities differ amongst them. Figure. The basic chemical structure of Carbopol is depicted.[17,18,19]

6 Permeation Enhancers

These substances interact with the skin's elements to transiently and d irreversibly enhance skin permeability28. One example is propylene glycol. Penetration boosters can function one/more of the following three ways

- Disruption of the “highly organized structure of the stratum corneum lipids”
- Contact with a protein that is present in the intercellular environment

- Better stratum corneal drug, co enhancer or solvent partitioning.[20]

Advantages of Topical Emulgels Formulation are

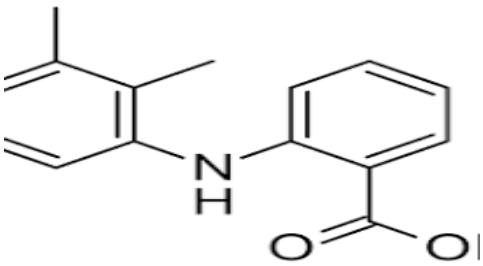
- ✓ Low allergic potential, good physiological compatibility, and high biocompatibility are requirements for the Emulgel formulation.
- ✓ Facilitate hydrophobic drugs
- ✓ Better loading capacity
- ✓ Better stability
- ✓ It improved patient compliance
- ✓ Avoidance of the first pass metabolism

Emulgels Evaluation: following Parameter are used to evaluate prepared Emugel

- Physical examination
- Study of Rheology
- Coefficient of Spreading
- Irritation test for skin (patch test)
- Strength measurement of Bio adhesive

DRUGPROFILE

Class: Mefenamic acid, an anthranilic acid derivative is a prototypical nonsteroidal anti-inflammatory agent (NSAIA).



Molecular Weight: C15H15NO2 =241.3

Solubility: Mefenamic acid occurs as a white to greyish-white powder and is insoluble in water and slightly soluble in alcohol.

Storage and stability: Store at controlled room temperature, 20 to 25 degrees Celsius

pKa: 4.2.

Mechanism of action: Mefenamic acid has pharmacologic actions similar to those of other prototypical NSAIAs. The drug exhibits anti-inflammatory, analgesic, and antipyretic activity. The exact mechanisms have not been clearly established, but many of the actions appear to be associated principally with the inhibition of prostaglandin synthesis. Mefenamic acid inhibits the synthesis of prostaglandins in body tissues by inhibiting cyclooxygenase; at least 2 isoenzymes, cyclooxygenase-1 {COX-1) and -2 (COX-2), respectively), have been identified that catalyze the formation of prostaglandins in the arachidonic acid pathway. Mefenamic acid, like other prototypical NSAIAs, inhibits both COX-1 and COX-2.

Absorption: Mefenamic acid appears to be rapidly absorbed from the Gl tract. Following oral administration of a single 1-g dose of mefenamic acid to healthy adults, peak plasma drug concentrations of approximately 10-20 mcg/mL are reached in 2-4 hours.

Distribution: Mefenamic acid is extensively bound to plasma proteins. It is not known if the drug or its metabolites cross the placenta. The drug is distributed into milk in very small amounts.

Elimination: The plasma half-life of mefenamic acid has been reported to be 2 hours.

Therapeutic Uses: Mefenamic acid is used for the management of mild to moderate pain and primary dysmenorrhea. The potential benefits and risks of mefenamic acid therapy as well as alternative therapies should be considered prior to initiating mefenamic acid therapy. The lowest possible effective dosage and shortest duration of therapy consistent with treatment goals of the patient should be employed.

Administration: The potential benefits and risks of mefenamic acid therapy as well as alternative therapies should be considered prior to initiating mefenamic acid therapy. Mefenamic acid is administered orally.

Dosage: The lowest possible effective dosage and shortest duration of therapy consistent with treatment goals of the patient should be employed. Dosage must be carefully adjusted according to individual requirements and response, using the lowest possible effective dosage.

Adverse effects

- ✓ Cardiovascular Effects

- ✓ Gl Effects
- ✓ Hematologic Effects
- ✓ Nervous System Effects
- ✓ Ocular and Otic Effects
- ✓ Renal Effects
- ✓ Hepatic Effects[21,22]

CONCLUSION

Emulgel is a novel approach that has been proven to be the most convenient, superior, and efficient delivery system. Because of its non-greasy nature and lack of oily bases, it gives gel-like properties and gives excellent drug release when compared to conventional topical delivery systems. Emulgel has a high drug loading capacity and is effective in drug delivery at the target site. Penetration of a drug through the skin is effective due to its small particle size. Emulgel is formed by incorporating emulsion into the gel base and provides a dual control release effect. The emulgel technique helps to solve different problems, such as creaming, phase separation and its stability improves. Hydrophobic drugs can be delivered with the help of emulgel and they can be incorporated into the oil phase of the emulsion and combined with gel. This technique improves patient compliance and increases the bioavailability of the drug in specific areas.

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