

AN EMERGING PARADIGM FOR TOPICAL DRUG DELIVERY: EMULGELS

Abstract

Semisolid mixes are the dermatological substances that get used superficially the most frequently. Topical drug delivery has a number of benefits, including the ability to self-medicate, preventing first-pass metabolism, lowering degradation, and enhancing patient compliance. These delivery methods can be found in a variety of solid, semi-solid, and liquid formulations, including powdered materials, creams, ointments, lotions, emulsions, and powders.

The physiochemical characteristics of the carrier and the medication, which affect the release rates of the medications, determine how effective topical formulations are. A medicine that has been topically applied diffuses from the delivery system, travels to the intended site, and is absorbed by the skin. Increasing the drug's release from the dose form can boost skin absorption.

Keywords: Skin, Lipid, Types, Procedure of Emulgel, Skin pH.

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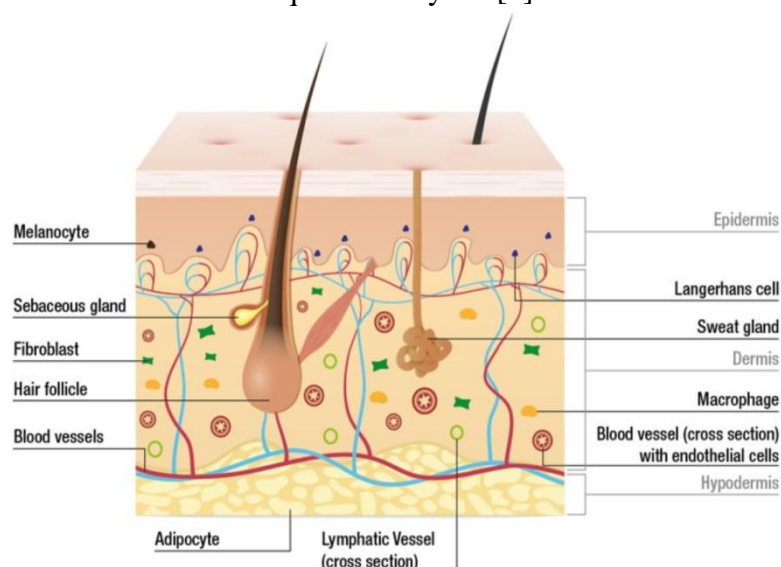
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I. INTRODUCTION

Medications are chemicals that have been delivered to the human body periodically through a number of methods, including as oral, sublingual, rectal, parental, etc., to treat ailments. A topically applied drug delivery technology is often utilised when more conventional methods of medication administration fail or when a local skin condition, like a fungal infection, manifests. A topical drug delivery device administers a formulation or drug containing medication directly to the skin to accomplish a drug's translating action or to treat cutaneous ailments. Despite there are many numerous kinds of dermatological products available for use on the skin, semisolid mixes are the most generally employed ones. [1]. This approach of distributing medications has a number of benefits included avoiding first-pass metabolism, reducing alimentary and frequent quantity degradation, enhancing patient compliance, and facilitating simple self-medication. These systems include powdered materials, creams, ointments, lotions, emulsions, and other solid, semi-solid, and wet formulations [2]. The physiochemical properties of the carrier and the medicinal product used directly affect the release rates of medicines from topical formulations. When a medicine is delivered topically, it diffuses from the delivery mechanism, travels to its target site, and is then absorbed by the skin. Therefore, accelerating up the drug's release from the dosage form might improve percutaneous absorption. Additionally, topical administrations offer a consistent delivery for a longer period of time and an enhanced bioavailability by avoiding your liver's first pass metabolism action [1].

II. STRUCTURE AND PHYSIOLOGY OF SKIN

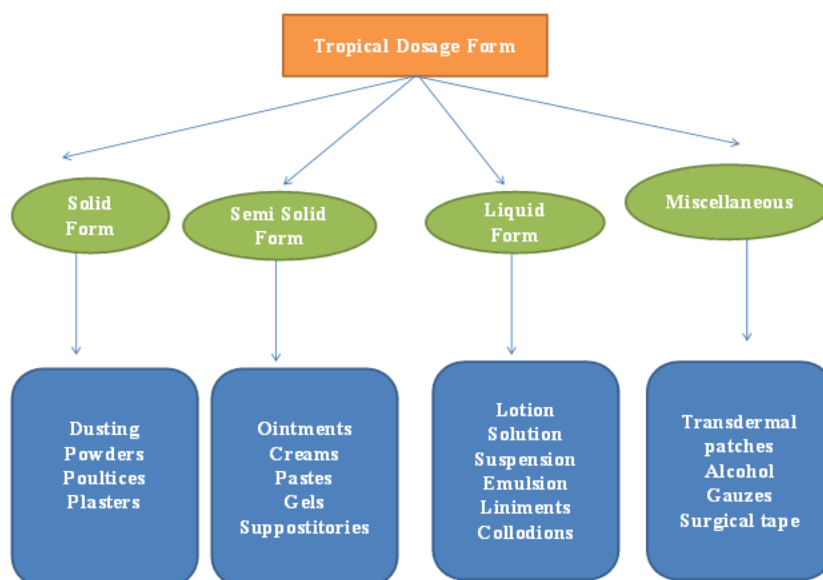
The three separate coverings that make up the skin are the epidermis, dermis, and hypodermis. The epidermis influences how much water the body eliminates and serves as a defence against sickness. Extracellular matrix, which is produced by fibroblasts, makes up the majority of the basement membrane, which binds the dermis and epidermis together. The dermis is made up of two separate layers called the papillary dermis and the reticular dermis. The outermost layer of skin next to the epidermis is called the papillary dermis. In addition, it has mechanoreceptors, thermo receptors, and lymphatic vessels, vessels for blood, nerves, sweat glands, hair follicles, and sebaceous glands. These blood veins transport waste away and provide nutrition to the dermal and squamous layers. [3].



III. PHYSIOLOGICAL FACTORS [4]

1. **Lipid Content:** The stratum corneum of the skin serves as a vital water barrier; when overall lipid content is low, percutaneous penetration is exacerbated.
2. **Skin Thickness:** From the outermost layer of the epidermal layer to the subcutaneous layer, skin thickness varies. The thickness of the epidermal layer fluctuates between 100 to 150 μ m.
3. **Hair Follicle Density:** The infundibulum of the hair follicle has a storage capacity that is around ten times bigger than that of the stratum corneum.
4. **Skin pH:** Increased sweating and fatty acid release at the skin's surface cause a change in skin pH.
5. **Skin Temperature:** Skin flexibility speeds up as the temperature rises.
6. **Skin Hydration:** Promote the drug's ability to pass through the skin.
7. **Skin Inflammation:** Knowing that the stratum corneum is damaged, the permeability rises

IV. CLASSIFICATION OF TROPICAL DOSAGE FORM



V. INTRODUCTION TO EMULGEL

Topical treatments including applications, creams, and cosmetics are widely utilised yet have significant drawbacks. When administered, they are extremely sticky and make the patient uneasy. Additionally, they need to be applied with rubbing because they have a lower spreading coefficient. They also display the stability issue. Every one of these variables within the primary category of semisolid preparations have led to an increase in the use of transparent gels in curative and cosmetic preparations. A colloid, which is approximately 99% liquid by weight, is immobile by the surface tension between the colloid and a macromolecular structure composed of fibres composed of a little quantity of a gelating component. Despite the fact that gels have many advantages hydrophobic medication delivery is a significant drawback. An approach based on oil emulsion is therefore being utilised to get beyond this restriction, allowing even a hydrophobic curative moiety to be successfully integrated and given through gels [5]

Due to their extremely versatile physical characteristics that ensure the minimising of the limitations of conventional drug delivery, hydrogels are contemporary, promising, and intelligent drug delivery systems. They typically include up to 90% water and must contain a polymer that, by cross-linking its chains, creates a three-dimensional network structure, making hydrogels porous enough to hold pharmaceuticals. The fundamental drawback of hydrogels is their inability to transport hydrophobic pharmaceuticals, which is problematic given that the majority of potent medication ingredients are hydrophobic. Emulgels, regularly referred to as creamed gels and gelled emulsions, were created to tackle this negative aspect.

Emulgels are completely novel pharmaceutical delivery systems that combine emulsions in gels, enabling the the advantages of both [2] . They are available in both o/w and w/o types. A reliable and superior approach that incorporates subpar water-soluble pharmaceuticals is emulgel. Given that emulgel has both wet and non-aqueous phases, it can distribute the two types of hydrophilic and lipophilic substances. They have been utilised as a control release formulation recently. These biphasic systems are more durable and have an improved drug loading capacity [4].

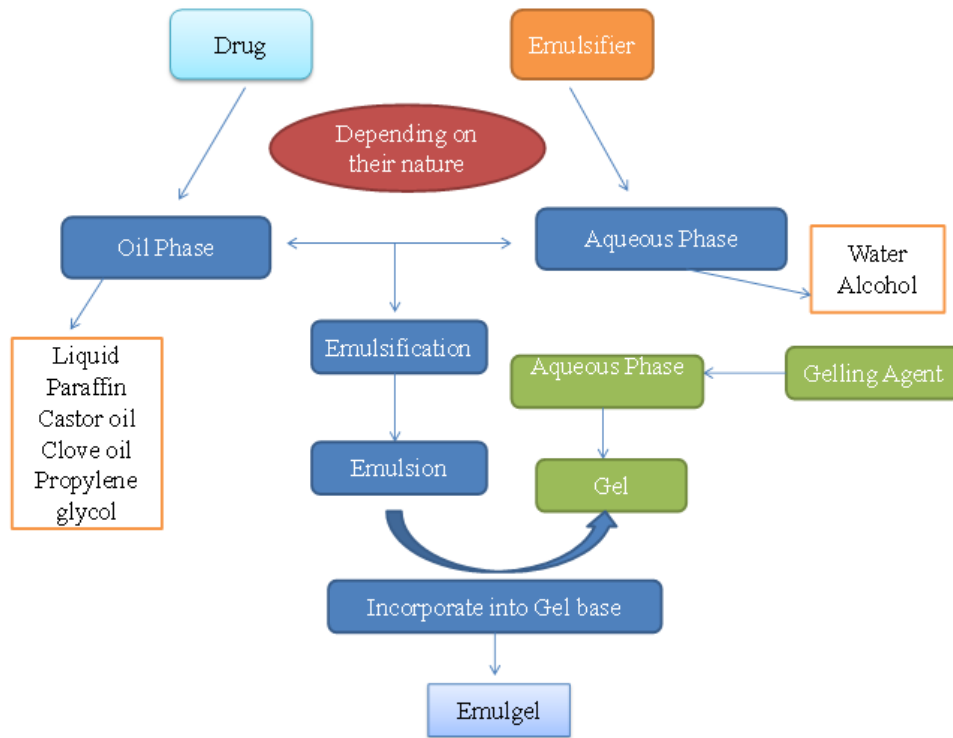
VI. DELIVERY OF DRUG THROUGH EMULGELS

Emulgels are revolutionary methods for drug delivery created by marrying emulsions and gels; as a result, they have the characteristics of both. Either the o/w type or the w/o type can be constructed. The technology Emulgel uses to incorporate subpar water-soluble pharmaceuticals is stable and excellent. Due to the existence of both aqueous and non-aqueous phases, emulgel is capable of carrying both hydrophilic and lipophilic prescription drugs. They have been applied lately as a formulation for controlled dispensing. These biphasic systems are more stable and have the ability of loading additional medicines. Thirdly, topical therapy could be employed for giving medicines under the skin for systemic physical activity. The transepidermal route and the route across pores are the two methods via which drugs can enter the stratum corneum. The transcellular and intercellular routes of the transepidermal conduit can be defined. The transcellular route is the quickest and most direct route, but it encounters significant permeation resistance because it must cross additionally lipophilic and hydrophilic structures, which include those found in the corneum layer and the cytoplasm of dead keratinocytes. Drug sell amongst corneocytes primarily occurs via intercellular transport. Nonetheless, in the case of highly lipophilic and large molecules (and certain electrolytes), these appendages and other diffusion shunts may indeed play a significant role. Theoretical vertical pathways for percutaneous penetration have been proposed, involving the follicular apparatus of hair follicles, sweat glands, and microlesions in the interfollicular horny layer. When a lipophilic drug easily traverses the stratum corneum, it encounters slow diffusion upon reaching the hydrophilic epidermis, leading to a temporary deposition known as the reservoir effect. Substances with a small molecular size and the ability to dissolve in both lipids and water exhibit the most effective permeation. When electrolytes are applied in aqueous solutions, they tend to form a stable hydration field, which hinders absorption by increasing the size of the diffusing component. The drugs' permeability coefficient relies on factors such as the size of the solute, its lipophilicity, and the length of the diffusion path. While Fick's law initially suggests that penetration depends on skin thickness, subsequent research indicates that the lipid composition of the skin plays a more significant role in this process [5].

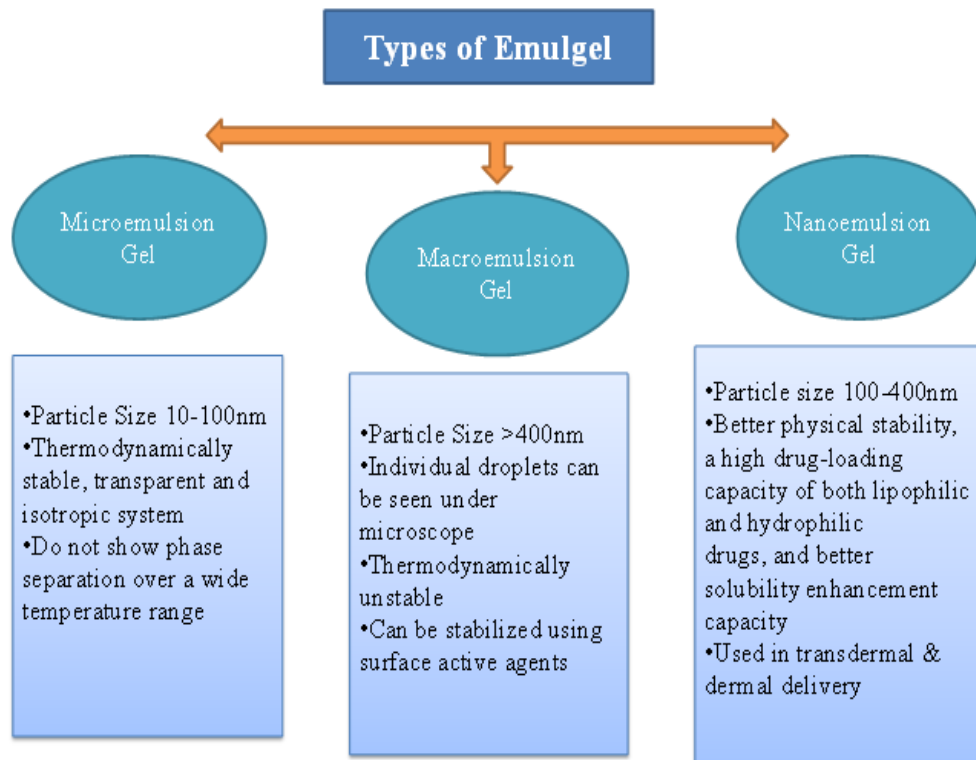
VII. FORMULATION INGREDIENTS OF EMULGELS

Sl. No.	Name of Ingredients	Uses	Examples	References
1	Aqueous Material	Conversion of emulsion into emulgels in the presence of gelling agent	Water, Alcohol	[6]
2	Oil	Act as a vehicle, Part of oily phase in emulsion, Solubility of hydrophobic drugs, medicinal value	Liquid paraffin, Propylene glycol, Isopropyl myristate, Isopropyl palmitate, Isopropyl stearate, Castor oil, Olive oil, Balsam oil, Wool wax, Soyabean oil, Cotton seed oil, Oleic acid, Maize oil, Arachis oil, Fish liver oil	[7]
3	Emulsifiers	Emulsification, Increase stability	Polyethylene glycol stearate, Sorbitan monooleate (Span 80), Polyoxyethylene sorbitan monooleate (Tween 80), Stearic acid and Sodium stearate	
4	Gelling Agents	Act as a thickening agent	Natural materials such as Tragacanth, Carrageen, Pectin, Agar, Xanthan gum, Alginate acid and Starch; Synthetic agents are cellulose derivatives such as Methylcellulose, Hydroxyethylcellulose, Hydroxypropylmethylcellulose, Carboxyvinyl polymers, Carboxymethylcellulose and Magnesium aluminium silicates	[6]
5	Penetration enhancers	Partitioning of the drug into skin structures, or enhance delivery into skin	Menthol, Clove oil, Mentha oil, oleic acid, Eucalyptus oil, Transcutol	[2]
6	pH adjusting agents	Avoiding the risk of skin irritation during application	Triethanolamine, Sodium hydroxide	[2]
7	Preservatives	Protect the formulation from spoiling due to stopping or slowing microbial development	Methyl paraben, Combination of methyl paraben and propyl paraben, Phenoxyethanol, Benzalkonium chloride	[2]

VIII. PREPARATION PROCEDURE OF EMULGELS



IX. TYPES OF EMULGELS



X. MARKETED PREPARATIONS OF EMULGELS

S. No.	Product Name	Drug	Manufacturer	Uses
1	Denacine Emulgel	Clindamycin phosphate	Beit jala pharmaceutical company	Anti-acne
2	Voltaren Emulgel	Diclofenac diethyl ammonium	Novartis Pharma	Relieve pain and inflammation
3	Bengay Ultra Strength Pain Relieving	Methyl salicylate and menthol	Johnson & Johnson	Topical pain relief
4	Flexall 454	7% menthol and 10% camphor	Sanofi	Relief from minor aches and pains associated with arthritis, backaches, and muscle strains.
5	Biofreeze Pain Relief Gel	Menthol	Hygenic Corp.	Relief from muscle and joint pain
6	Iodex Fast Relief Gel	Diclofenac	GlaxoSmithKline Pharmaceuticals	Relive Minor muscular pain and inflammation.
7	Miconaz-H-emulgel	Miconazole nitrate, Hydrocortisone	Medical union Pharmaceuticals	fungal infections of the mouth, throat and gullet
8	Excec gel	Clindamycin, Adapalene	Zee laboratories	Acne treatment
9	Nadicin cream	Nadifloxacin	Psychoremedies	Skin infections such as boils, impetigo, and infected hair follicles
10	Dermafeet Emulgel	Urea 40%	Herbitas	Intense moisturizing and exfoliation activity

XI. FUTURE SCENARIO OF EMULGELS

The future outlook for emulgels is promising and diverse, holding great potential across various fields. In advanced drug delivery systems, emulgels are expected to play a vital role, enabling controlled release and targeted administration of medications, ultimately reducing side effects and improving patient outcomes. The cosmetics and skincare industry will likely see continuous evolution of emulgel-based products, incorporating innovative ingredients to address specific skin concerns.[8]

Moreover, the emergence of nanoemulgels could lead to improved drug solubility and bioavailability, creating new opportunities for therapeutic applications. Emulgels are not limited to human healthcare; they also find utility in veterinary medicine and agriculture. As research and technology progress, emulgels are set to contribute significantly to personalized medicine, where tailored formulations meet the unique needs of individual patients.[9]

With researchers delving into novel possibilities and industries acknowledging their adaptability, emulgels are anticipated to be a major driving factor shaping the future of pharmaceuticals, cosmetics, and diverse sectors.

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