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Preparation Methods and Pharmaceutical Significances of Emulgel dosage form: A Review

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ABSTRACT

Emulgels are a novel type of pharmaceutical formulation developed by combining emulsions and gels. The present review was based on the preparation methods and pharmaceutical significances of emulgel dosage form: a review. When designing the product, it is essential to evaluate the topical emulgel for its lack of toxicity, irritation, comedogenicity, and sensitization. Penetration enhancers can work through one or more of 3 mechanisms i.e., destruction of the highly ordered lipid structure of the stratum corneum, interaction with extracellular proteins and better penetration of the drug, activator or solvent into the stratum corneum. The purpose of these substances is to improve the transdermal administration of the medication. The type and concentration of the penetration enhancer can have a big impact on how well a medicine penetrates from an emulgel. The procedure for creating emulgel consists of three simple steps. The initial two stages involve the separate formation of the emulsion and gel base. It illustrates the fundamental stages involved in the preparation of emulgel. The process of gel phase preparation entails dispersing gelling agents, such as carbopol or HPMC, into distilled water. To produce emulgel, the emulsion and gel phases are mixed together in a 1:1 ratio with gentle stirring. In conclusion, Emulgel is a new topical drug delivery method that works better with hydrophobic medications and is clearly superior when used with hydrophilic and lipophilic medications. Similar to Emulgel, it can enhance diffusion, adhesion, viscosity, and extrusion; this novel therapeutic approach has gained widespread popularity.

Keywords: Emulgel, ingredients, merits, demerits, preparation methods.

INTRODUCTION

Emulgels are a novel type of pharmaceutical formulation created by combining emulsions and gels. They are created by trapping a liquid including water or alcohol within a solid matrix made up of small particles. It functions as a dual-controlled delivery mechanism that is more stable than a single emulsion [1]. Emulgels are very much effective in delivery of topical dermatological agents but they are not suitable for hydrophobic or lipophilic drugs. Moreover, the topical drug delivery system has been a very impactful way of pouring the medicine at the desired site without producing serious systemic outcomes [2]. They also facilitate the bioavailability of drugs at target sites by leaving the first pass metabolism or pre-systemic metabolism occurring in Liver. In topical formulations, the release rate of preparations depends upon the physical, chemical properties and nature of carrier molecules. Release rate and stability of emulgels are dependent as per the nature and concentrations of polymers taken as gels [3].

The utilisation of transparent gels has increased in pharmaceutical and cosmetic formulations as a result of the limitations associated with the extensive range of semisolid preparations. The presence of a small amount of

gelling material creates a macromolecular fibre network that immobilises the colloid gel, which is predominantly liquid with a 99% composition. At present, almost 40% of chemicals that are helpful for medicinal purposes have a property of being hydrophobic [4].

However, the ability of gel to manage these substances is greatly limited. An effective method for incorporating and delivering a therapeutic hydrophobic substance with enhanced solubility and skin penetration is the emulsion-based gel. The emulgel's ability to deeply penetrate soft tissues can lead to a notable enhancement in the drug's pharmacological impact and a reduction in dosage [5]. There has been a surge of interest in the use of novel polymers that have complex functions as thickeners and emulsifiers in recent years. The ability of these compounds to form gels allows for the creation of stable emulsions and creams by reducing surface and interfacial tension and increasing the viscosity of the aqueous phase [6].

Ingredients considerations in formulation

When designing the product, it is essential to evaluate the topical emulgel for its lack of toxicity, irritation, comedogenicity, and sensitization. Moreover, it is essential to develop an emulgel that possesses both visual appeal and compatibility with living organisms. The emulgel properties stated above are mostly determined by the formulation excipients used. Formulation difficulties become critical in the emulgel as a result [7]

- ### Synthetic drug moiety/ herbal extract

The medication candidate must possess non-irritating properties towards the skin. The drug's properties significantly influence its absorption into the skin. In order to be made into emulgel for topical or transdermal usage, drugs must possess specific physical, chemical, and biological attributes [8].

- ### Vehicle

The emulgel's carrier is essential in determining the extent to which the medication is absorbed into the skin. The vehicle utilised for the preparation of the emulgel should possess attributes. Furthermore, it must exhibit compatibility with the patient's skin [9].

- ### Water-based materials

This is how the watery phase of the emulsion is formed. The presence of the gelling agent causes the aqueous phase to transform the emulsion form into the emulgel. Water and alcohols are often utilised aqueous substances [10].

- ### Oils

The primary constituent of the emulgel is an emulsion. The primary application of emulgel is predominantly determined by the selection of the specific type and amount of oil used as one of the emulsion phases. When selecting the oil phase, it is important that the oil is pure and does not contain any unwanted and non-saponifiable substances, such as free radicals, peroxides, sterols, and polymers. The oil phase might deteriorate during storage due to a variety of these undesirable elements, which leads to unstable formulation. Two of the most popular oils used in oral preparations are castor oil and non-biodegradable mineral oil, both of which have a local laxative effect. As nutritional supplements, fish liver oils and other fixed oils derived from plants or animals are used [11].

- ### Emulsifiers

A proper number of emulsifying agents can stabilise a thermodynamically unstable system called an emulsion. The main role of emulsifying agents is to decrease the interfacial tension, hence enhancing the stability of the emulsion. The selected emulsifying agent must generate stable emulsions and possess a suitable Hydrophilic-Lipophilic Balance. Additionally, the type and quantity of the emulsifying agent employed to create the emulsion are directly related to the stability of the emulsion. Emulsifying agents are employed to facilitate emulsification throughout the manufacturing process and to maintain stability throughout the product's shelf life. Various chemicals are used as emulsifiers [12].

- ### Gelling substances

The essential elements of the emulgel needed to generate a system thixotropic are gelling (cross-linking) agents. They are typically employed as a thickening agent to enhance the dosage form's quality and texture. The type of gelling agent utilised and its concentration have a significant impact on the stability and drug release of emulgel. For instance, it has been observed that emulgels made with HPMC as a gelling agent

exhibit greater drug release than emulgels made with Carbopol polymers. The stability of emulgel was also reported to be improved by the combination of gelling agents.

Natural and synthetic gelling agents are some of the different types that are utilised in the emulgel production. The main drawback of natural gelling agents, however, is their considerable sensitivity to microbial destruction. As a result, it has been discovered that semi-synthetic and synthetic gelling agents are now often utilised in the creation of emulgel. Carboxy Methyl Cellulose sodium, poloxamer 407, HPMC 2910, Carbopol 934, and Carbopol 940 are the most often used gelling agents in the manufacture of emulgel [13].

- **Enhancers of penetration**

The purpose of these substances is to improve the transdermal administration of the medication. The type and concentration of the penetration enhancer can have a big impact on how well a medicine penetrates from an emulgel. In order to enhance the transdermal dispersion of the medication, it is imperative to adjust the kind and concentration of these substances. The penetration enhancers used in the emulgel should possess qualities such as low irritancy, low toxicity, and enhanced penetrability. These substances facilitate medication absorption by temporarily breaking the skin barrier, making the lipid channels between corneocytes more fluid, and altering the distribution of the drug inside the skin structures [14]. Penetration enhancers can work through one or more of 3 mechanisms [15]:

1. Destruction of the highly ordered lipid structure of the stratum corneum.

2. Interaction with extracellular proteins.

3. Better penetration of the drug, activator or solvent into the stratum corneum

One of three pathways is switched via amplifiers. The secret to altering the polar route is to cause solvent swelling or a change in the structure of proteins. The lipid-protein component of the stratum corneum became more fluid when fatty acid activators were applied. Certain activators alter how they penetrate several layers by acting in both polar and non-polar ways. Activators can make medications more permeable through the skin's proteins. The product plan and formulation are significantly impacted by the type of amplifier employed [16].

Pharmaceutical significances of Emulgel [17]

- Refraining from first-pass or pre-systemic metabolism
- Site-specificity Safety from gastrointestinal in-compatibility
- Effective in short $T_{1/2}$
- Restricted therapeutic range
- Improving patient compliance
- Self-medication appropriateness
- Better stability
- Controlled release

Disadvantages of Emulgel [18]

- It may produce skin irritation or inflammation
- It may exhibit allergic reactions
- High molecular weight drugs or large particle size drugs are not absorbed easily
- Bubbles while formulating Emulgel
- Poor absorption conflict

Method of Emulgel production

Emulsifying specialists are utilized to advance the emulsification at the hour of assembling and to control the soundness during a time span of usability (that can fluctuate from days to months or years) for business plans.

The procedure for creating emulgel consists of three simple steps. The initial two stages involve the separate formation of the emulsion and gel base. It illustrates the fundamental stages involved in the preparation of emulgel. The process of gel phase preparation entails dispersing gelling agents, such as carbopol or HPMC, into

distilled water. To produce emulgel, the emulsion and gel phases are mixed together in a 1:1 ratio with gentle stirring [19].

The procedure involves several steps. The polymer is initially dissolved in deionized water and then consistently agitated at room temperature for the necessary duration and velocity. The subsequent introduction of a sodium hydroxide solution neutralises the dispersion and induces the contraction of the polymer chains, leading to the formation of a stable gel. Afterward, the gel is stored at a temp. of 4 degrees Celsius for a duration of 24 hours, thereby finishing the process of hydrating the polymer gels. The emulgel is formed by adding the oil phase to the polymer gel while stirring it continuously [20].

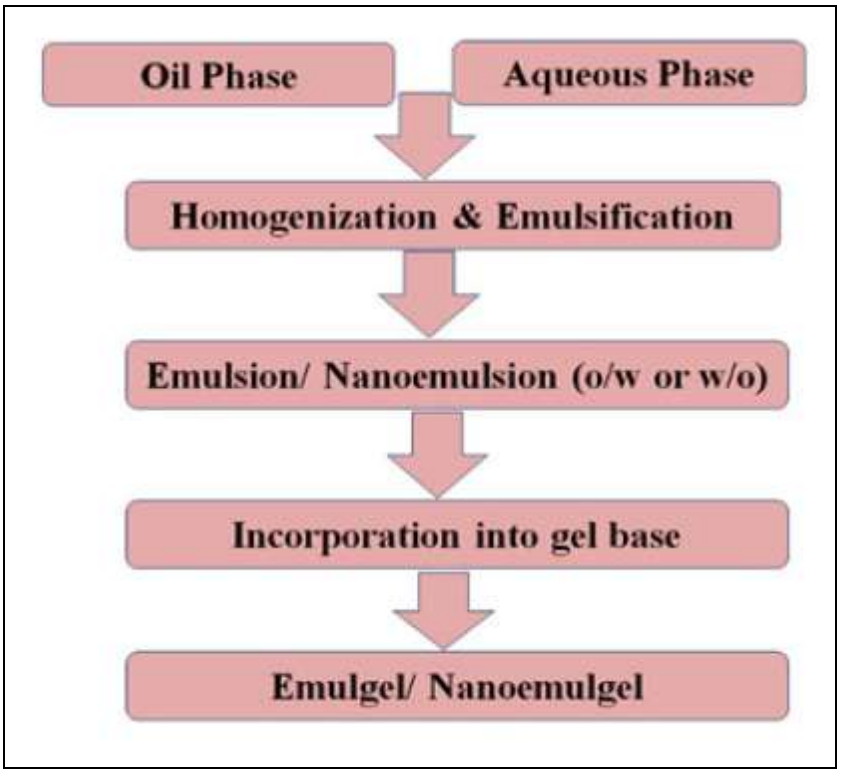

Fig 1. Development of emulgel

The more recent dosage forms, known as emulgels, were created by fusing emulsions with gels. Aqueous or hydro-alcoholic liquid is trapped in a matrix structure of colloidal solid particles to create them. Due to its stability over a basic emulsion, it functions as a dual controlled delivery method. Emulgel's distribute topical dermatological medicines very effectively, although they are not appropriate for medications that are hydrophobic or lipophilic [21]. Additionally, the topical drug delivery system has proven to be a highly effective method of dispensing the medication at the desired location without having negative systemic effects. By leaving the first pass metabolism or pre-systemic metabolism occurring in the liver, they also facilitate the bioavailability of medicines at target locations. The physical, chemical, and molecular characteristics of carrier molecules affect how quickly preparations in topical applications are released into the body. Emulgel's release rate and stability rely on the type and concentration of the polymers used to make them [22].

CONCLUSION

In conclusion, Emulgel is a new topical drug delivery method that works better with hydrophobic medications and is clearly superior when used with hydrophilic and lipophilic medications. Similar to Emulgel, it can enhance diffusion, adhesion, viscosity, and extrusion; this novel therapeutic approach has gained widespread popularity.

CONFLICT OF INTEREST

Authors declare for none conflict of interest.

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