




A REVIEW ON EMULGEL IN THE TREATMENT TOPICAL APPLICATION

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<p style="text-align: center;">Article History</p> <hr/> <p>Received: 06-09-2023 Revised : 22-09-2023 Accepted: 27-10-2023</p> 	<p>Abstract:</p> <p>The simplest and most straightforward method of delivering localised medications through the skin, ophthalmic, rectal, vaginal, and other routes is topical drug administration. Topical drug delivery methods are those in which a formulation containing an active medicinal ingredient is applied directly to the skin to produce the drug's localising action. Local dermatological problems can be effectively treated with focused medication delivery. Drugs applied to the skin for their local action include antiseptics, antifungal agents, skin emollients, and protectants. This route of drug administration has grown in popularity because it avoids first-pass effects, gastrointestinal irritation, and metabolic degradation associated with oral administration. Emulgel is an emulsion of either the water-in-oil or oil-in-water type that has been gelled by combining with a gelling agent. The fundamental benefit of the emulgel is that it is simple to create emulgel formulations for medications that are lipophilic. Most lipophilic medications cannot be directly synthesized as hydrogels due to solubility issues. Because of this, emulgel offers superior lipophilic drug stability and release than a straightforward hydrogel foundation.</p> <p>Keywords: <i>Emulgel, advantages and disadvantages, macro and micro emulsion</i></p>
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1. INTRODUCTION

From time immemorial plants are coexisting with human being. The aesthetic sense in man with a love for the colourful world of plants has drawn the attention of many for the plant kingdom.^{1,2,3} Ever since the advent of man on earth, he became dependant on nature. Plants form an integral part of nature and a primary source of man's food, medicine and other basic needs. The primitive man exposed to various parasitic, infective resulting high rate of morbidity and mortality. This forced man to search for remedies to control the various ailments using different parts of various plant species. We cannot say how exactly ancient people discovered the medicinal properties of herbs. Probably it started with ancient belief, myths and lores got involved with astrology and other occult

practices, developed into folk-medicine and herbalism.^{4,5,6} Man tried to use different parts of various plants.^{7,8,9} All systems of medicine that provide healing touch to ailing humanity contain plant-based medicine. Rig Veda is the oldest holy book of Hindus. Advanced use of plant drug appeared In/Atharva Veda which has an Upaveda called Ayurveda. Ayurveda is the sacred knowledge or science of life. Ayurveda contain information on different type of herbs, the anatomy and physiology of different organ of body and principles of treatment of diseases. The source of plant drug is called Aushadhi, the drug called as Aushadha or Vesaja which means it cures pain & sorrowful experience.^{10,11}

The formulation of drug molecule is applied on skin known as topical route. The drug molecule when

applied on skin and has effective on skin known as transdermal route. For the administration of formulation human skin is suitable for this. Three route are used for drug administration in the skin route.^{12,13}

1.1 Topical Drug Delivery System

On diseases skin the products are applied. This was use for the treatment of general disorder the pharmacological confining the effects of another drug. The mucosal surface are produces local effect and form their application. It shows effect on systemic effect.^{14,15}

1.2 Advantages

- First pass metabolism is been reduced.
- This drug is easy to apply.
- this was reduced the risk and intravenous therapy.
- this route of administration is the substitute.^{16,17}

1.3 Disadvantages

- skin irritation was occurred on skin and this was happened due the drug and excipients.
- The poor skin permeability of Drug molecule.
- application site is developed Allergenic reactions.
- on the skin the large particle is not stayed or it was very difficult to absorbed.^{18,19}

1.4 SKIN

The skin is the largest and readily accessible organs spread extensively all over the body of living beings. Approximately 2m² surface area is covered by an adult human skin which is receiving one third of the blood circulation with a potential to provide medication through skin. The skin separates the vital organs of body from the external environment, provides protection against UV light, physical, chemical, microbial and radiological attack, helps in maintaining body temperature.

Microscopically the skin is a multi-layered organ, composed of many histological layers, but contains three major layers, viz: epidermis (outer layer), dermis (middle layer), and endodermis (inner layer). In the dermis layer, blood vessels network, follicle of hairs, sweat & sebaceous glands are present.^{20,21}

Any alteration in Pathophysiology of skin appendages can cause many inflammatory, immune-mediated,

autoimmune, infectious, neoplastic and traumatic impacts to normal function of the skin appendages. Acne is caused due to Pathologic abnormality of the sebaceous glands.^{22,23}

Figure 1: Physiology of Skin

1.4.1 Skin may consist of three layers: - Epidermis:

The outermost layer of skin epidermis. It is thin. It covers the full body. The thickness of the epidermis layer is around 0.06mm and it also contains numerous types of cells. This help to maintain the temperature and also help to pathogens attacks.

The epidermis includes five main layers:

- Horny Layer
- Stratum Lucidum
- Granular Layer
- Prickly cell Layer
- Stratum Germinativum

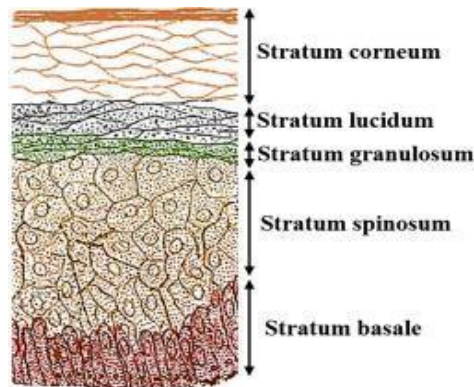


Figure 2: Layers of Epidermis

Stratum Corneum: the stratum corneum is known as the final stage of epidermal cell and it was the superficial layer. It contains of 15 to 30 layers. On skin the physiological and preservative water environment

is serve. It was 40 times thicker and is a horny layer.^{24,25}

Stratum Lucidum: This layer is formed on hand palm, foot sole and thin, translucent layer is present. These are non-nuclear cells.

Stratum Granulosum: The layer contains keratinocytes. These layers manufactured staining particles and granules of keratinophylline.

Stratum spinosum: The Stratum spinosum (spinous layer/prickle cell layer) is a layer of the epidermis located between the *Stratum Basale* and *Stratum Granulosum*. Morphology and histochemical alteration of basal layers are present and move upward. Nuclei of cells were shrinking and flatten. These may form intercellular bridge and has interconnected prickles.

Stratum Basale (Stratum Germinativum): The deepest layer of the skin is known as stratum basale. It lie in the layer of dermis. This is responsible for the detection of colour.^{26,27}

Dermis: The superficial layer of the skin is known as dermis. Depending upon the area of body part its thickness varies being thinnest in the eyelids and thickest in the palms and soles. About 90% of skin thickness is due to the dermis layer. This is also known as the core of the skin. It is the middle portion of the skin. Thickness is around 3 to 5mm.

Hypodermis: This layer just below the dermis and fibrous tissues is present it connects the muscles. Fats are present. It was the main support of the body skin. This was insulating the cold and shock absorbance. This was connected to the bone and muscles. This was on hypodermis and dermis.^{28,29}

1.4.2 SKIN UTILITY

- Skin controls the fluids and tissue which are present in the body.
- Skin protects the body from external harmful stimuli.
- Skin response for the pain, fever and for pressures.
- Skin helps to clean the biochemical wastages.
- Skin rules the temperature of body
- Skin can maintain the blood pressure
- Skin provides the protection against the shock.^{30,31}

1.4.3 Skin Absorption

Skin is the most important route for the absorption of drug substances. Most chemical/ natural substances applied or exposed to surface of skin are either

dissolved or dispersed in liquid or semisolid base (vehicle or carrier system) applied on skin surface. These substances partition or distributed into skin surface.^{32,33}

1.5 Emulsions

Emulsions are composed of two immiscible fluids which is dispersed into one in another. It is a biphasic system. When surfactant or emulsifier increased the stability is also increases. It consists of aqueous phase mixture. It consists of water and aqueous solvents like glycerine, propylene glycol etc. it consists of oil phases and if this oil phase is spread in every part of the aqueous/ water phase that is known as oil-in-water emulsion. If this was distributed in water/aqueous part it is known as water-in-oil (w/o) emulsion.^{34,35,36}

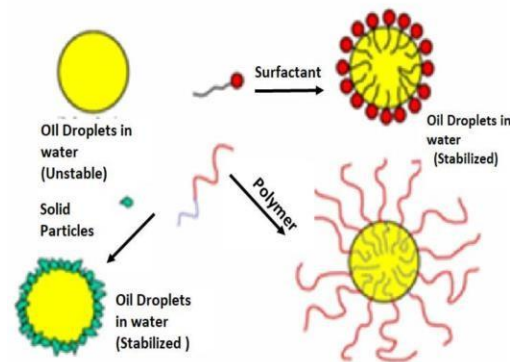


Figure 3. Emulsion Formation

1.5.1 Theories of Emulsification

The emulsified hypothesis shows the emulsifying activity of chemical and surfactant. It was taken by emulsion stability. Surfactant show the main important.^{37,38} there are many hypothesis which show the activity of emulsifier and surfactant formulation for the stability of emulsions.^{39,40,41}

1.5.1.1 Surface Tension Theory

Form all the molecules the liquid molecule is attached to miscible or immiscible phase. There was a inside downward force it may imbalance the force of attraction. This force of attraction is generating a surface tension. This immiscible liquid is coming in connect with and produces tension which produces impact on oppose rapture and has interfacial tension. The middle of the two liquid the surface tension is produces. This will attract the two fluids.^{42,43}

1.5.1.2 Oriented Wedge Theory

In this theory the polar end and emulsifying agent turns into liquid polar and non-polar end will the emulsifiers into oil phases.^{44,45}

1.5.1.3 The Interfacial Film Theory

This theory shows that the interface is formed by surfactants and emulsifier due to the miscible phase of formulations. Because of the film formed the two liquid prevent the coalescence.^{46,47}

1.5.2 Macro emulsions: this is the most used emulsions. It is white to opaque colour. It has size upto 400nm. Digital microscope is use for this study. If the surfactants are increases it also increase the macromolecules.^{48,49}

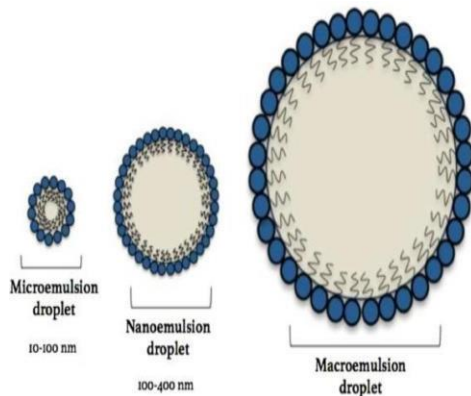


Figure 4: Types of emulsions

1.5.2.1 Types of macro emulsion

1.5.2.1.1 Oil-in-water emulsion (O/W)

It contains mixture aqueous phase and solvents which contains oils and waxes. The O/W emulsions has oil phase in dispersion phase and aqueous phase in continues phase. For oral consumptions the liquid formulation (waxes, oils and fat) is used. It is in active therapeutics and has lipophilic drugs. These drugs are loaded into O/W emulsions. The oil is trapped into nongreasy aqueous phase. This formulation is easily removed from the skin. This formulation is used externally.^{50,51,52}

1.5.2.1.2 Water-in oil-emulsion (W/O)

W/O is a biphasic emulsion. The droplets dropped into continuous phase. It shows occlusive effects on stratum corneum. It also inhibits the eccrine secretion. W/O formulations influences the actives of permeation of emulsion. This type of emulsion has greasy nature and it was not use in the cosmetics. It is also use for cleaning the dirt from skin. It was not washable and has stop the skin dehydration.^{53,54}

1.5.3 Micro emulsions:

It was stable and has clear transparent in nature. This was formed without any aids of external energy. The size of the droplets are 20 nm to 200 nm.^{55,56}

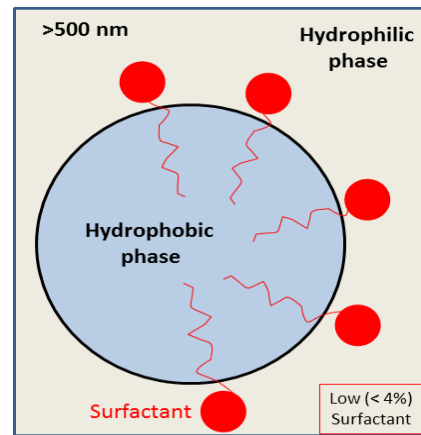


Figure 5: oil-in-water emulsion

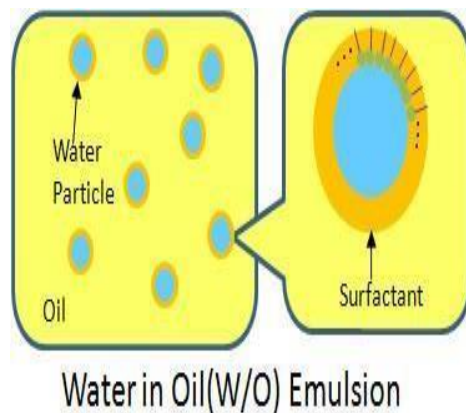


Figure 6: water-in-oil emulsion

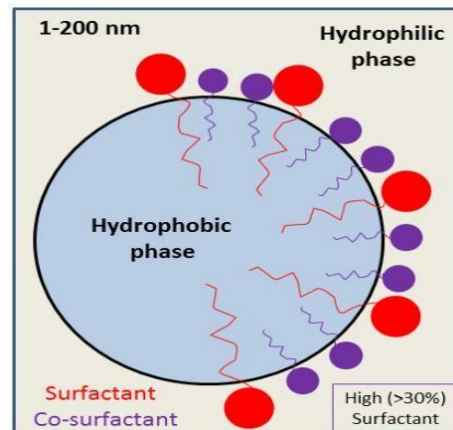


Figure 7: Micro emulsion

1.5.4 Applications:

- This system increases the bioavailability and solubility of drug.
- By using multiple emulsion (W/O/W emulsions) drug molecule for control release and sustained release.
- IV route is use for multiple emulsion

- d) Emulsions are used in many countries for skin infections.
- e) For weeping of skin, O/W emulsion is use.
- f) For the avoidation of first pass metabolism and reduction of side effects topical preparations are use.^{57,58,59}

1.6 Gel

Gel is semisolid formulation. It contains high to low viscous. It contains dispersion formulated which contains organic molecules and inorganic particles which encloses and interpenetrated with liquid phase. When the gels are in steady state there were no flow. It was diluted cross-linked polymer. The gel is rich in liquids.

1.6.1 Structure of Gel

The natural and synthetic polymer contain gels. It has three-dimensional matrix contains dispersion medium and hydrophilic liquid. Gel formulation is applied on skin. Evaporation of gels and has thin film gel formulation. Drug was entrapped into this. The determination of linkages is by particle with structure of network and gelling properties.^{60,61}

1.6.2 Application

- a) Gels are applicable for skin, mouth, vagina and anus for local effect.
- b) The drug which is encapsulated into gels are injected IM. It should be implanted into body. It produces actions.
- c) The gel formulation use polymers and it was binded into granulation tablet. It was protective colloids in suspensions.
- d) Present day in cosmeceutical products gel formulations is use.
- e) It is stable and non-greasy. It required low energy in the formulation. It is use as a vehicle for administration.
- f) Gels are use for the treatment of inflammation and it has scalps.^{62,63}

1.7 Emulgel

Emulgel contains oil and aqueous phase. In this the drug is entrapped into gel. At first the oil and aqueous phase is formed with suitable composition after that the emulsion is incorporated into gel phase. It contains emulsion which help in dissolving drug. Emulgel is most use as ointment, cream and various preparation of dermatitis.^{64,65} Topical formulation has lesser spreading coefficient and it was applied on skin by rubbing. It was use in cosmetic preparations. It was wet and has semisolid liquid rigid. This was

immobilized the surface tension and has macromolecular fibres. The gel formulation has better advantages in topical formulation. Hydrophobic drug is carried into gel and it is been used.^{66,67}

1.7.1 Advantages

➤ Better stability

Emulgel is better than any other topical formulations. Powdered dosage form shows hygroscopicity, formulation of cream and has separation and ointment greasy, oily and has rancidity.

➤ Hydrophobic drugs can be easily incorporated into gels

The drug formulation has lipophilic and hydrophobic. It has oily phase which was distributed by aqueous phase and give o/w emulsion.

➤ Production feasibility and low preparation cost

The emulgel increase the production and manufacturing process. In this formulation the material which is use is cheaper and it was available in low cost.

➤ Better loading capacity

The vesicular structure show the results of leakage and it has less entrapment and has less cost of production. Emulgel has extensive network and it has polymer chain with drug loading and holding capacity.

➤ Controlled release

The emulgel formulation is been mitigate the drug problem and has extended the release of drugs.

➤ No extensive sonication

Sonication is done for the fabrication of vascular system. If the sonication has extensive the vascular has degradation activity and show impurity. In emulgel no sonication is needed and it did not show any problems.^{68,69}

1.7.2 Disadvantages

- a) In skin treatment, poorly soluble and permeable drugs is not used.
- b) During manufacturing Air entrapment is not use because it form foam which disturb the formulation.
- c) The drugs which have higher molecules is not use in Emulgel.

- d) The larger molecule drugs are not use in skin preparations.
- e) In dermatitis, many drugs may produce Skin irritation or allergic reaction.^{70,71}

1.7.3 Important Constituents

i. Vehicle

Vehicle are most important substance for emulgel preparation. It was help to deposit the active moiety and dispersed on to skin. At target site vehicles are use for the delivery of active moiety. For the better pharmacological effects vehicles is use for the better therapeutics effect. For the topical delivery of the drug, stratum corneum show the barrier and has better absorption.

a. Aqueous Materials

the hydrophilic vehicles are used in this formulation. The agents which are use in this are water, polyethylene glycols, propylene glycols, alcohols, glycerine etc.

b. Oils

oils are most important substances. It was use for the preparation of emulsion. With soft and hard paraffin mineral oils are combined and formed externally applied emulsion. For oral preparation, non-biodegradable minerals and castor oil is use for this preparation.

ii. Emulsifier

For the promotion of emulsification time in manufacturing process for the control of stability.^{72,73}

iii. Gelling Agents

Gelling agents are use for the increases of thickening agent and consistency.

iv. Permeation Enhancers

These are the chemical substances. It is use for the increasing in the drug permeation on skin. It interacts with skin components and alter the chemical structure of skin. It was use for increase in skin permeation.

Properties:

- a) These are non-irritating, non-allergenic and non-toxic.
- b) It has rapid activity.
- c) It has longer action duration for predictable and reproducible action.
- d) It is having no pharmacodynamic activity.
- e) It did not have affinity to receptor sites.
- f) It was one way permeation and drug to permeate into the body.
- g) It is also preventing the loss of inside body material to outside.

- h) It was compatible with drug and excipients.
- i) It has appealing the cosmetically and glamorous on skin.^{74,75}

v. Preservatives

This preservative is synthetic and non-synthetic. It is use for the reduction of microbial growth on drugs. Shelf life is increased by using excipients. In a specific range the preservatives have antimicrobial activity. The preservative is selected on the basis of pH ranges. This preservative may help to prevent the formulation from degradation. Topical formulation has 50 to 80% of preservatives.^{76,77}

vi. Antioxidants

Antioxidants are the synthetic or non-synthetic chemical substance. The application should contain:

- a) The inclusion of formulation.
- b) It shows the Safety and Efficacy of the product.
- c) The concentration of finish product is to be control.
- d) On the final product the antioxidant and anti-microbial preservative concentration is labelled well.

vii. Humectants

These are present in the formulation for the retained of water and moisture. These are the group of hydrophilic compounds. These are use in the skin care formulation and also use in the skin dryness symptoms. Humectants produces hydration on the skin and permeate the drug on skin. It was also use in the food additives for the reductions in the moisture.^{78,79}

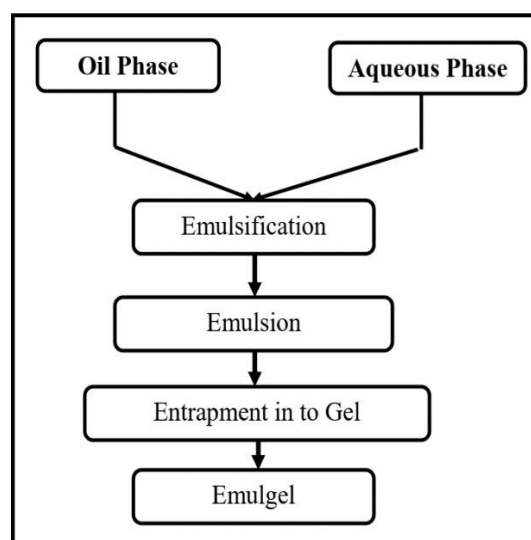


Figure 8: Emulgel preparation

2. CONCLUSION

In the future, drug delivery via emu gel will be used extensively to maintain greater patient compliance. Emulgel provide better spreadability, adhesion and viscosity & this become famous soon. Moreover, they will become a solution gel bases for loading hydrophobic drugs for long term stability.

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