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TOPICAL GEL: AS A DRUG DELIVERY SYSTEM

Suryawanshi Gajanan*[1], Fugate Ajay[1], Sameer Shafi[1].
[1]Shivlingeshwar College of Pharmacy, Almala Dist. Latur-413520,
Maharashtra (MH), India.

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Abstract:
A topical gel is a circumfluous lozenge form that's applied to the skin for the delivery of medicines. Topical gels offer several advantages as a medicine delivery system, including targeted delivery, controlled release, and reduced systemic side goods. Topical medicine delivery systems include a large variety of pharmaceutical lozenge form like semisolids, liquid medication, sprays and solid maquillages. Topical gels are stylish choice for treat original infections and skin problems because of it directly apply on the skin or in the point. Topical gels give action direct to the point of action. Topical gels count the GI vexation and metabolism of medicine by which the bioavailability of medicine is lesser. The expression and evaluation of topical gels involve careful consideration of component selection, gel medication, physical and natural characteristics, and stability. Topical gels have been delved for the treatment of a wide range of conditions, including arthritis pain, acne, and psoriasis. farther exploration is demanded to optimize the expression and estimate the efficacity of topical gels for colorful suggestions. Overall, topical gels offer a promising medicine delivery system for localized and sustained medicine delivery. The clinical substantiation indicates that topical gel is a safe and utmost effective treatment option for use in the operation of skin related complaint and used for original action to reduce the side goods associated with another conventional lozenge form.

Keywords: *Topical gel, GI irritation, Bioavailability, Arthritis, Psoriasis etc.*

Corresponding author:
Mr. Suryawanshi Gajanan Madhav,
Shivlingeshwar College of Pharmacy, Almala
Dist. Latur-413520, Maharashtra (MH), India.
Email ID: - gajanansuryawanshi4523@gmail.com
Mobile No: - 7378635213

QR code

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INTRODUCTION:

A topical gel is a pharmaceutical capsule form that is applied to the skin for remedial or cosmetic purposes. Topical gels can be used to deliver a variety of drugs, including- seditious agents, anaesthetics, antibiotics, and hormones, among others. The gel expression allows for easy operation and absorption of the drug through the skin, furnishing targeted remedy to the affected area. Topical gels are generally used to treat skin conditions analogous as acne, psoriasis, and eczema, as well as common pain and inflammation. Topical gels can vary in their composition, but generally correspond of an amalgamation of active ingredients, analogous as drugs or herbal extracts, and a gel- forming agent, analogous as a polymer or a surfactant. Other ingredients analogous as preservatives, emulsifiers, and stabilizers may also be included to enhance the effectiveness and shelf- life of the product. Overall, topical gels offer an accessible and effective means of delivering drugs and other remedial agents to the skin, with minimal systemic absorption and lower side goods than other routes of administration.

Topical medicine delivery system:

A topical delivery system defined as the substance that carries a specific drug into contact with and through the skin. The challenge to topical drug delivery is the transport across the skin barricade. Topical delivery includes two introductory types of product-External topical that are spread, scattered, or differently dispersed on to cutaneous napkins to cover the affected area. Internal topical that are applied to the mucous membrane orally, vaginally or on anorectal napkins for original exertion. For the utmost part topical specifics are used for the localized goods at the point of their operation by virtue of drug penetration into the morning layers of skin or mucous membranes. Although some unintended drug absorption may do, it's sub cures quantities and generally of minor concern.

Gels As Pharmaceutical Lozenge Forms:

Gels are a largely dilute crosslinked network that does not flow in its Steady State. They are made up of a two- part glutinous structure with a lot of liquid. One of their relating characteristics is the actuality of a continuous structure with solid- suchlike parcels. Due to the biocompatibility, network structure, and molecular stability of the integrated bioactive agent, gels have come a favoured material for drug delivery phrasings. The maturity of topical gels is made with organic polymers like carbomers, which give the products an aesthetically pleasing, clear, sudsy appearance and are easily washed off the skin with water. Gels are a substantially dilute cross- linked system, which exhibits no flux when in the steady-state. They correspond of a two element semi-solid system rich in liquid. Their one characteristic point is the presence of continuous structure furnishing solid like parcels. Gels have come a premier material used for drug delivery phrasings due to its biocompatibility, network structure, and molecular stability of the incorporated bioactive agent.

Structure of gels:

A gel consists of a natural or synthetic polymer forming a three- dimensional matrix throughout a dispersion medium or hydrophilic liquid. After operation, the liquid evaporates leaving the drug entangled in a thin film of the gel – forming matrix physically covering the skin25. The presence of a network formed by the interlocking of patches of the gelling agent gives rise to the inflexibility of a gel. The nature of the patches and the type of form that is responsible for the liaison determine the structure of the network and the property of the gel.

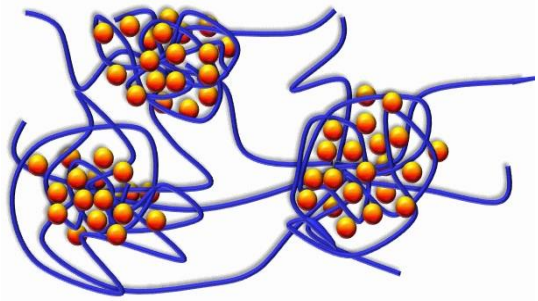


Figure 1: Structure of Gel

Ideal properties of topical gel:

- The gel should be clear and homogenous.
- The gel should be easily broken when shear or force is applied during shaking the vessel.
- The gel should be inert in nature.

- The gel should be not sticky.
- The gel should be no way interacting with other expression element.
- The gel should be stable.
- It should not be irate the skin or any part where the gel is applied.
- The viscosity is optimum.
- It should haven't- microbial exertion.

Ideal characteristics of gels:

- **Swelling Agent: -**

The gelling agent used to prepare gel are suitable for swell the liquid when liquid medium comes to its contact. The swelling property of gel depends on gelling agent and its shows the strength and cleave of flyspeck in the gel.

- **Syneresis: -**

Ultimate of the gels released some water or liquid during standing and after days of storing the phenomenon of releasing fluids from gel is nominated as syneresis. This show that the gel not has sufficient amount of gelling agent or the attention of gelling agent diminishments. It also shows that the expression is thermodynamically unstable. The gel should be syneresis free.

- **Structure: -**

The gel inflexibility is depending on the gelling agent. The selection of gelling agent is most important part of the expression. The gelling agent is responsible for viscosity (resistance to flux) networking and cleave between patches and medium used in expression.

- **pH: -**

The pH of gel is to be isotonic. The change in the pH of gel may beget the skin vexation.

- **Spreadability: -**

The spreading power of gel should be excellent. It indicates the area covered by gel.

- **Ageing: -**

Slow accumulation is generally appeared by colloidal frame. This cycle is known as growing. In gels, growing causes gradually development of a thick association of the gelling specialist.

- **Rheology: -**

results of the gelling specialists and scattering of flocculated strong are available in mock plastic in nature, for illustration permits then on- Newtonian aqueduct conduct, described by decline in viscosity with proliferation in shear rate.

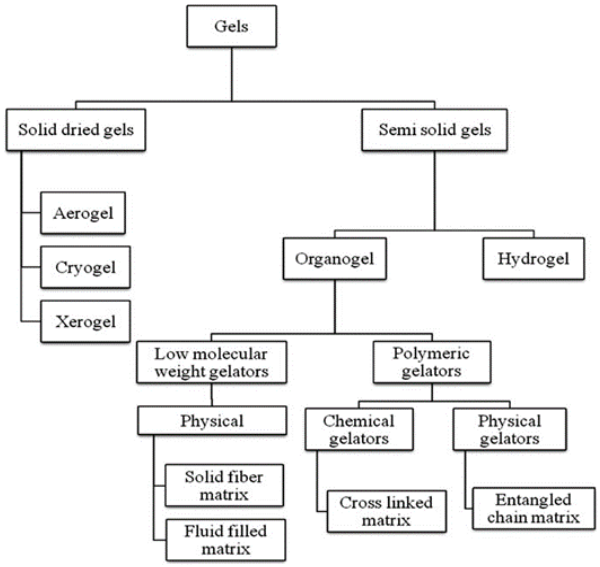
Advantages of topical drug delivery systems:

- Avoidance of the first pass metabolism.
- Accessible and easy to apply.
- Deliver drug more extensively to a specific point.
- Avoidance of the gastro- intestinal incompatibility.
- After the providation of the operation of drugs which are having the short natural half- life, narrow remedial window. bettered patient compliance.
- give felicity for tone- medicine.

Disadvantages of topical drug delivery systems:

- Poor permeability of numerous drugs through skin.
- They can be used only for those drugs who requires the need of truly small tube attention for action.
- Possibility of allergic reactions.
- They can be used only for those drugs who requires the need of very small plasma concentration for action.
- The path of that drugs is not suitable for those drugs that irritate or adapt the Skin.

Classification of gel:



Method for preparation of gel:

There are 3 methods for preparation of gel;

1.1 Fusion System: - In this system the vehicles, gelling agents, complements and drug are blended at high temperature to until a semi solid texture was not formed.

1.2 Cold System: - In this system all the element count drug or active pharmaceutical element is toast 7. and amalgamated simultaneously and also lower the temperature of expression, also add drug and again blending was started until the gel was not formed.

1.3 Dispersion System: - In this system the gelling agent is stirred with water until the gelling agent is swell up and also drug is dissolved in medium and incorporated into it. Add buffer result to adjust the pH of the gel if necessary.

Formulation design:

Topical gel may include the following factors;

1.4 Gel Forming Agent or Polymer

1.5 Drug Substance

1.6 Penetration Enhancers

Gel Forming Agent or Polymer: -

Gelling agents are the polymers that are used to structural network or give texture to the gels;

The following criteria should be satisfied for a polymer to be used in a topical system: -

- Molecular weight, chemical functionality of polymer must allow diffusion and release of the specific drug.
- The polymer should permit the incorporation of a large amount of drug.
- The polymer should not reply, physically or chemically with the drug.
- The polymer should be easily manufactured and fabricated into the asked product and affordable.
- The polymer must be stable and must not decay in the presence of drug and other excipients used in the expression, at high humidity conditions, or at body temperature.
- Polymers and its declination products must be nontoxic.

Gelling Agents are classified as follows;

- **Natural:** - Gelatine, Xanthine, Cassia Tora, collagen, pectin and Guar goo etc.
- **Synthetic:** - Carbopol 934, Carbopol 940, Poloxamers and Polyvinyl Alcohol etc.
- **Semi Synthetic:** - Hydroxypropyl methyl cellulose, Carboxyl methyl Cellulose and Hydroxyethyl Cellulose.

Drug Substance: -

Drug Substance plays a truly important part in the successful development of a topical product. The important drug parcels that prompt its diffusion through gels as well as through skin are as follows.

Physicochemical Properties: -

- drug should have a molecular weight of lower than 500 Daltons.
- drugs largely acidic or alkaline in result are not suitable for topical delivery.
- drug must have respectable lipophilicity.
- A saturated arid result of the drug should have a pH value between 5 and 9.

Biological Properties: -

- The drug should not be directly bothered to the skin.
- drugs, which degrade in gastrointestinal tract or are inactivated by hepatic first pass effect, are suitable for topical delivery.
- Forbearance to the drug must not develop under the near zero order release profile of topical delivery.
- The drug should not stimulate a vulnerable response in the skin.
- drugs which have to be administered for a long time or which beget adverse goods tonon- target kerchief can also be formulated for topical delivery.

Penetration Enhancer-

Penetration Enhancers (also called accelerants or sorption promoters) are defined as substances that are suitable of promoting penetration of drugs into skin, or their achromatism through skin, by reversibly reducing the skin barricade resistance.

An ideal penetration enhancer should have the following Properties;

- It should be pharmacologically and chemically inert, and chemically stable.
- It should be non-inconvenience, noncomedogenic and non- allergenic.
- It should have a rapid-fire- fire onset of action, predictable duration of exertion, as well as a reproducible and reversible effect.
- It should be chemically and physically compatible with the expression ingredients.
- After it's removed from the skin, the stratum corneum should swiftly and fully recover its normal barricade property.
- It should be odourless, tasteless, colourless, and affordable.
- It should be pharmaceutically and cosmetically respectable.
- It should have a solubility parameter similar to that of skin.

Ex. Azone, dimethyl sulfoxide, dimethylacetamide, and dimethylformamide etc.

Complements used in gel formulation:

Preservative: -

Preservatives are used to make the gel long lasting and help them tootles. Methyl Paraben and Propyl Paraben etc.

Drug Solubilizer: -

drug solubilizer is used in the case of drug having poor solubility. Some drugs are deficiently answerable in medium so drug solubilizer helps to dissolve the drug in themedium.E.g., Triethyl- o- amine and PVP(Polyvinylpyrrolidone) etc.

Stabilizers: -

Some gels containing heavy substance and agents which is stabilized by chelating agent, analogous as E.D.T.A. (Ethylene diamine tetra acetic acid).

Applications of gels:

Applications of gels in Pharmaceutical and Cosmetic Industry;

- Gels are applied directly to the skin, mucus membrane or the eye to give original action.
- They act as long acting forms of drug fitted intramuscularly or implanted into the body
- Gelling agents are useful binders in tablet granulation, protective colloids in suspensions, thickeners in oral liquid, and suppository bases.
- Cosmetically gels have been employed in wide variety of products, including detergents, scent products, dentifrices, skin and hair care specifics.
- Gel products containing- seditious steroids are used to treat inflammations of crown because this is an area of the body where creams and ointments are too greasy for patient acceptance.
- Gels have better implicit as a vehicle to administer drug topically in comparison to ointment, because they're non- stick, requires low energy during expression, are stable and have aesthetic value.

Evaluation of gels:

- **pH Dimension: -**

The pH of various gel phrasings is determined by using digital pH meter.1 g of gel is dissolved in 100 ml. recently set distilled water and stored for two hours. The dimension of pH of each expression is done in trinity and average values are calculated.

- **Viscosity Dimension: -**

Brookfield digital viscometer can be used to measure the viscosity of set gel phrasings. The gels are rotated at and1.5 rolls per minute. At each speed, the corresponding dial reading is noted. The viscosity of gel is attained by addition of dial reading with factor given in the Brookfield viscometer canons.

- **Spread Capability: -**

Spread capability refers to the extent of area to which gel readily spreads on operation. It's determined by rustic block and glass slide outfit. The time in sec. taken by two slides to slip off from gel which is placed in between the slides under the direction of certain weight is expressed as Spreadability. lower the time taken for the separation of two slides, better the spread

capability. Spread capability is calculated by using the formula;

S = M.L/ T

Where, S = Spread capability
M = Weight drift to the upper slide
L = Length of a glass slide
T = Time taken to separate the slide completely from each other.

- **Homogeneity: -**

All developed gels are tested for confinity by visual examination after the gels have been set in the vessel. They are tested for their appearance and presence of any aggregates.

- **Grittiness: -**

All the gel phrasings are checked microscopically for the presence of any particulate matter.

- **Extrudability: -**

The gel phrasings are filled in collapsible tubes, after being set in the holders. The extrudability of gel phrasings are determined in terms of weight demanded in grams to extrude0.5 cm. strip of gel in 10 sec.

- **Stability Test: -**

Stability study is carried out by snap- thaw cycling. The product is vanquished to a temperature of 40C for one month, also at 25 0C for one month followed by 40 0C for one month. Syneresis is observed. ultimately, the gel is exposed to medium room temperature and the separating liquid exudates are noted.

- **Drug Content: -**

1 g gel is dissolved in 100 ml. of suitable soap. Absorbance is measured after suitable dilution at λmax nm using UV spectrophotometer.

- **In- Vitro Drug Diffusion Study: -**

In- vitro drug release studies are carried out by using a Franz diffusion cell.0.5 g of gel is taken in cellophane membrane. diffusion studies are conducted at 37 0C ± 1 0C employing 250 ml. phosphate buffer, pH7.4 as the dissolution medium. At time interval of 1 hr, 1 ml pg sample is collected and replaced with new buffer result. Collected samples are analysed by using suitable logical system.

- **Skin Irritation test: -**

Ten healthy joker and womanish impositions were named for skin vexation testing. 100 mg gel was applied on area of 2 cm for 6 hours, on the interior face of upper arm and covered with cotton circumference. After 6 hr the spots were eviscerated with acetone and readings are made according to the scale given by Draize. No vexation 0 Slight vexation 1 vexation.

- **In- vivo Study: -**

Inhibition of carrageenan induced rat paw enema is studied in virile wistar albino rats using mercury paleothermometer. The volume of unilateral hind paw of experimental brutes is measured, ahead and after administration of carrageenan. inhibition is noted.

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