IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

TOPICAL GELS AS A DRUG DELIVERY SYSTEM

[1]*Zaid F. Bagwan, [2]Arbaj M. Bagwan, [3]Abdulrauf G Nadaf, [4]Abubkar A. Tamboli, [5]Dr A.M shaikh

[1,2,3 & 4]AAEMF's Delight College of pharmacy, Pimple jagtap road,Koregaon Bhima, Maharashtra 412216

[5] **Hon. Principle,** AAEMF's Delight College of pharmacy, Pimple jagtap road,Koregaon Bhima, Maharashtra 412216

ABSTRACT: Clinical evidence has shown that topical gel is a safer and more effective therapeutic option for managing skin-related conditions and is used for local activity to reduce side effects with other conventional dosage forms. Local drug delivery systems include a variety of dosage forms such as semi-solid, liquid, spray and solid powder formula. Most used semisolids Preparation for topical administration includes gels, creams and ointments. Gel is a network of connected polymers that swell inside the liquid. Its properties largely depend on the interaction between solid-stand and liquid-component polymers. they do not show constant flow. The interaction between the polymer and the liquid dispersed forms a network of three measurably scattered parts connected to each other. The increase of viscosity by complexity and hence internal friction is responsible for the semi-solid state. General gel compositions it provides a suitable method of administering medications, because they are less fat and are easily removed from the skin. Gel offers a composition better applicability and more stable than creams and ointments.

KEYWORDS: Topical gel, Anatomy of skin, Ideal properties of gel, Evaluation parameter of gel.

INTRODUCTION:

General drug delivery can be defined as the application of drugs directly through the skin to treat or cure skin lesions. This topical drug delivery systems most commonly used for local skin infection like a fungal infection or treating other ways there are no suitable administrations. It can penetrate deeper give skin and hence better absorption. It has no advantages over conventional dosage forms. In common, less poisons are thought to be more effective than conventional formulations of bilayered Decomposition and structure. In the form of a theme menu: attempts have been made to ensure. use of drug carriers adequate localization or penetration of a drug within or by the skin to enhance and minimize loci systemic effects or adequate percutaneous care absorption. Topical preparation prevents GI-irritation prevent the metabolism of drugs in the liver to increase bioavailability of drugs. General preparations give its the action is directly related to the place of action. A gel is a double element cross linked three-dimensional network consisting of materials and structures. Materials that form structures The gel network may be composed of one or more inorganic particles organic macromolecules, especially polymers.

I. ANATOMY OF SKIN:

The human skin consists of three but interdependent tissues: The stratified, vascular, cellular called the "epidermis". Beneath the dermis of the joint tissue; Hypodermis.

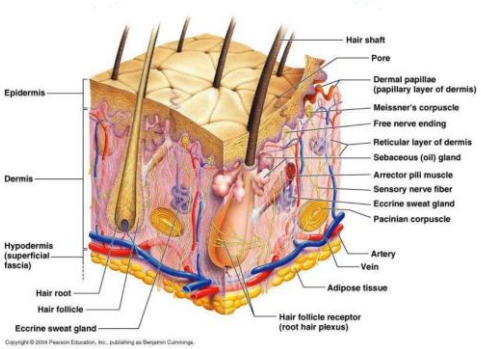

FIG.1 ANATOMY OF TISSUE

1.1 EPIDERMIS:

The epidermis of the skin is formed by a line of epithelium Contains 5 layers.

1. Stratum corneum.
2. Stratumlucidum
3. Stratum granulosum
4. Stratum spinosum and
5. Stratum germinativum

The most important feature of the epidermis is, They have no blood vessels. Nutrients provided by skin capillaries. The epidermis is stratified, squamous, The keratinized epithelium is the topmost layer of the skin. More than 90% are keratinocytes, which are responsible for them characteristics of skin obstruction.

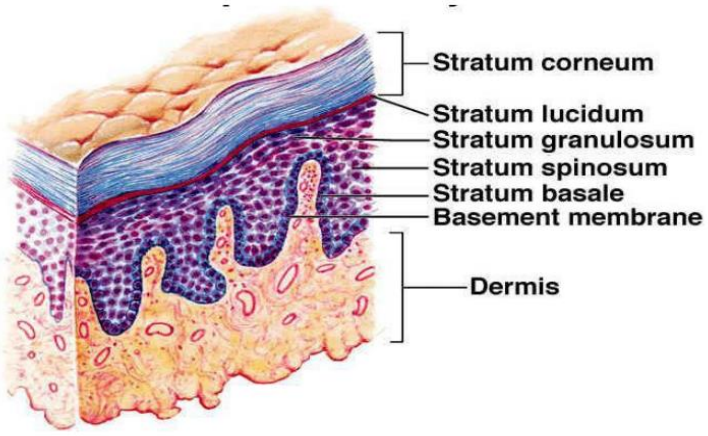

FIG.2:EPIDERMAL LAYER

1.2 DERMIS:

Next to the dermis is a thick fibrous layer of skin and Elastic tissue mainly collagen, elastin and fibrillinum softness and fortitude. dermis contains nerve endings sweat glands, sebaceous glands, hair follicles and blood vessels dermis is a vascularized tissue rich in collagen containing mucopolysaccharides collectively known as "basic substance".

1.3 HYPODERMIS:

The hypodermis is a map of the inner skin. Contact layer is between the skin and the underlying tissues of the body muscles and bones. Sweat glands and hairy glands follicles involve the upper layer but come from the dermis. The sweat glands release a diluted salt solution to the surface. the skin. Evaporation of saline solution washes the skin. this review is also important for regulating the organization of both countries body and skin. Sweet adrenal glands all over the body. The amount of dilution (sweet) effect may depend on at room temperature, the amount of heat produces muscle activity and a variety of emotions factor. Sebo is a fat liquid that is emitted by the hair follicles and is from the skin to the top. Sebum on each hair dry and give your skin a waterproof layer.

II. IDEAL PROPERTIES OF TOPICAL GEL:

a) The gel should be clear and homogeneous.
b) The gel should break easily when broken, or if force is to be applied, while shaking the container.
c) The gel should be naturally inert.
d) The gel should not be sticky.
e) The gel should never interact with other components of the form.
f) the gel should be stable.
g) Neither the skin nor any part on which the gel is applied is irritating.
h) Viscosity is best.
i) must have antimicrobial activity.

III. IDEAL CHARATERISTICS:

a) Swelling:
Gelling agent used to finish off the gel capable of swelling the liquid with a liquid medium its contact. The swelling property of the gel depends on the gelling agent and shows its strength and structure particle gel.

b) Structure:
The stiffness of the gel depends on the gelling agent. The choice of gelling agent is the most important part formula. Gelling agent is responsible for viscosity (resistance to flow) networking and compactness between the particles and the intermediates in the formula.

c) Spreadability:
The gel should have excellent expansion potential. The area is covered with gel.

d) PH:
The pH of the gel is to be isotonic. Fluctuation in pH gel can cause skin irritation.

IV. GELLING AGENT:

Gelling agents are the gel-forming agents when dissolved in a liquid phase as a colloidal mixture forms a weakly cohesive internal structure. They are organic hydrocolloids or hydrophilic inorganic substances. In semisolid dosage form, gelling agents are used at a concentration of 0.5%–10%.

a) Natural gelling agent: Xanthan gum, gellan gum, guar gum, pectin, and gelatin.
b) Cellulose based gelling agent: Hydroxypropyl cellulose (HPC), carboxymethylcellulose, and hydroxyethyl cellulose (HEC).
c) Polymeric gelling agent : Carbomers (carbomer 934P, carbomer 940, carbomer 941)

V. ADDITIVES USED IN GELLING AGENT:

a) Preservative: Preservatives are used to make the gel long lasting and prevent them to spoil .E.g., Methyl Paraben and Propyl Paraben etc.

b) Gelling agent: Gelling agent are hydrocolloids substance which gives thixotrophic consistency to the gel. Gelling agents are organic in nature and are also known as solidifiers or stabilizer and thickening agent.Gelling agents are more soluble in cold water than hot water. Gelling agents like methylcellulose and polaxamers have better solubility in cold water while bentonite, gelatin and sodium carboxymethylcellulose are more water soluble in hot water. Gelling agents require a neutralizer or pH adjusting chemical to create the gel after the gelling huagent has been wetted in the dispersing medium. Gelling agents are used in concentration of 0.5 up to 10% depending on the agent most gelling agents require 24-48 hours to completely hydrate and reach maximum viscosity and clarity. It is easier to add the active drug before the gel is formed if the drug does not interfere with the gel formation.The viscosity of the gelling agents in the gelling layer be within range of about 1000 cps to about 100,000 cps.

c) Stabilizer: Some gels containing heavy metals and agents which is stabilized by chelating agent, such as E.D.T.A. (Ethlylene diamine tetra acetic acid).

VI. EVALUATION PARAMETERS OF GELS:

1) PH Measurements: The pH of various gel formulations was determined by using digital pH meter. One gram of gel was dissolved in 100 ml distilled water and stored for two hours. The measurement of pH of each formulation was done in triplicate and average values are calculated.

2) Concentration of Drug:
1 g of the prepared gel was mixed with 100ml of suitable solvent. Aliquots of different concentration were prepared by suitable dilutions after filtering the stock solution and absorbance was measured. Drug content was calculated using the equation, which was obtained by linear regression analysis of calibration curve.

3) Appearance and homogeneity:
Physical appearance and homogeneity were evaluated by visual inspection.

4) Viscosity measurements:
The viscosity of the gel was measured by the Brookfield Viscometer.

5) Ability of Spreading:

It indicates the extent of area to which gel readily spreads on application to skin or affected part. The therapeutic potency of a formulation also depends upon its spreading value. Spreadability is expressed in terms of time in seconds taken by two slides to slip off from gel which is placed in between the slides under the direction of certain load. Lesser the time taken for the separation of two slides, better the spreadability. It is calculated by using the formula.

S= M.L/T

Whereas,

S stands for = Spreadability.

M stand for = Weight tide to upper slide.

L stands for = Length moved on the glass slide.

T stands for = Time taken to separate the slide completely from each other.

6) Homogeneity ability:

After the gels were placed in a container, all the developed gels were tested for homogeneity by visual inspection. Approved for the appearance and presence of any aggregates.

7) Grittiness:

All formulations were assessed microscopically for the presence of any sensitive particulate matter that was seen under a light microscope. From this it is clear that gel preparation fulfills the requirements of freedom from particular matter and size as desired for any topical preparation.

8) Study of irrigation of the skin:

Guinea pigs (400–500 g) of both sexes were used to test skin irritation. The animals were kept in standard animal feed and had free access to water. Animals must be kept under rule. The hair on the back of the guinea pigs was shaved and a 4 cm2 area was marked on each side, one side was approved for control with the other. Gel was applied (500 mg / guinea pig) twice a day for 7 days and the observed posture was sensitive to any reaction and if any, levels such as 0, 1, 2, 3 no reaction, unbalanced erythema, thin but confluent or moderate but patchy erythema and severe erythema with or without edema respectively.

9) Extrudability parameters:

After the gels have been placed in a container, the formulas are filled in collapsing tubes. The pileus formula is based on a fixed weight of 0.5 cm in grams. fillet gel in 10 seconds.

10) Study of stability:

The stability study of the gel was done as per ICH guidelines the gel was store at 30ºC± 2ºC/ 60% ± 5% RH and 40ºC± 2ºC/ 75% ± 5% RH. The formulation were analysed in the change in physical appearance, pH, spread ability and Viscosity.

11) analysis of kinetic data:

The emission kinetic is estimated by considering four different models in which the zero order, the Higuchi equation and the Korsmeyer-Peppa equation, and the selection based on the comparison of the coefficients, and the comparison of the related coefficients.

12) In vitro diffusion studies for prepared gel:

Diffusion preparations can be carried out in the Franz cell diffusion solution to study the emission of gels through the cellophore membrane. Gel sample (0.5g) was collected on a cellophane membrane and diffusion studies were carried out using 250 ml 37±1° phosphatase buffer (pH 7.4) as dissolution medium. Five milliliters of each sample was periodically withdrawn at 1, 2, 3, 4, 5, 6, 7 and 8 h, and each sample was replaced with an equal volume of fresh medium solution. The samples were then detached for drug content by using phosphate buffer as a blank.

VIII. CLASSIFICATION OF TOPICAL GELS:

A. On The Basis of the Nature of Colloidal Phase:

a) Inorganic hydrogels: are usually biphasic system such as aluminium hydroxide gels and bentonite magma. Bentonite magma has also been used as an ointment base in about 10-25 % concentrations.

b) Organic gels: are usually single-phase systems and may include such gelling agents as carbomer and tragacanth and those that contain an organic liquid such as Plastibase.

B. On the Basis of Solvent System:

a) Hydrogels Preservatives that can be dissolved as colloids or soluble in water include organic, hydrogela, natural and synthetic gums and inorganic hydrogels. Examples are hydrophilic colloids, such as silica, bentonite, spices, pectin, sodium algin, methylcellulose, sodium CMC and alumina, which in high concentrations form semisolids.

b) Organogels include hydrocarbons, animal/vegetable fat, soap base, and hydrophilic organogelos. Included in the hydrocarbon type is Jelene, Plastibase, a combination of mineral and heavy hydrocarbon oils with a molecular weight of about 1300.

C. On the Basis of Gel Microstructure:
Pharmaceutical gels may be categorized on the basis of their network microstructure by the scheme suggested by Flory.

a) Covalently Bonded Structures:
Covalenter networks are connected irreversible systems that are prepared from hydrophilic synthetic polymers. In one of the preparation modes, an infinite number of gel networks arise from the nonlinear co-polymerization of two or more monomeric species with at least one trifunction. Each direction and position through which each polymer chain grows in a random reaction occurs, resulting in a completely disordered final microstructure of this gel.

b) Structure Physically Bonded:
Physically bonded gel network systems are interchangeable. Other factors, such as temperature and ion additions, can induce levels of induction between the sun and the gel. These gels are mainly formed using natural organic polymers (protein and polysaccharides) and semi-synthetic cellular derivatives. Polymer bands are frequently formed in a quasi-random coil, which undergo conformation transitions to the gel. Such a transition can involve large sections arranged in one or more chains that fold into a double or triple helix.

c) Well-Ordered Gel Structure:
Under certain conditions, certain silica, alumina and sols form rigid clay gels or lyogels. When clay forms of smectitis, such as bentonite, hectorite and loponite, come into contact with water, they spontaneously undergo osmotic swelling and through osmotic swelling of the gel. A layer-like clay particle is connected to a coordinated cardhouse cubical structure, which is caused by repulsive forces and interacts with a double layer of electricity.

IX. DRUG SUBSTANCE:
Judicial selection of drugs plays an important role in the successful development of topical work. The important medical properties that cause their diffusion through the skin as well as through the skin are as follows:

A. Biological Properties:

a) Drugs that degrade the gastrointestinal tract or inactivate the hepatic first have a transient effect, and are suitable for topical delivery.

b) Drugs that have to be administered for a long time or that produce non-target adverse effects on the tissue may also be formulated for topical delivery.

c) The patient should not develop a form of topical delivery of a medicine under the zephyr next to the order of discharge.

d) The drug should not stimulate an immune reaction in the skin.

e) The drug should not be directly irritated to the skin.

B. Physicochemical properties:

a) Drugs highly acidic or alkaline in solution are not suitable for topical delivery.

b) A saturated aqueous solution of the drug should have a pH value between 5 and 9.

c) The drug should have a molecular weight of less than 500 DaltonS.

X. FORMULATION AND EVALUATION:
Methods of preparations of topical gels:
1) Fusion method.
2) Cold Method.
3) Dispersion Method.

Preparation can involve a fusion process or require a special procedure, depending on the scenario of the agent involved. The tragacanth system should be prepared for moderate cold weather due to the excessive heat sensitivity of this natural gum. But it is easier to disperse methyl cellulose in hot water than in cold water. Carbopoles are prepared by a unique process. The polymer is dispersed in the acidic medium. When the dispersion is uniform, the gel is induced by destroying the system with an inorganic base (aqueous system) or with an amine such as triethanolamin. This group of acid functions ionize the polymer, drawing the polymer into a colloidal solution, in which state it forms the required matri.
Whether the scale of preparation is large or small, semisolid dosage forms are produced in one of two types. Either they are made to raise the temperature by dispersing the mixture of liquids or liquids and solids (method of fusion) or by dispersing a drug incorporated into a semisolid base (cold incorporation). A cool college is used with heat furrowing drugs, when the drug is added to the already finished semisolid base, or with the vehicle itself is the heat of the lip, as happens in the plastibase.

ACKNOWLEDGEMENT:

The authors would like to express special thanks of gratitude to our fellow classmate **Sohel A. Pathan** as well as our respected **Hon. Principle Dr. A M Shaikh** sir who gave us the golden opportunity to do this wonderful project on the topic' **TOPICAL GELS AS A DRUG DELIVERY SYSTEM** which also helped us in doing a lot of research and we come to know about so many new things. We really thankful to them. they helped us lot in finishing this project within the limited. It helped us to increase our knowledge and skills.

REFERENCES:

1. Penna LE. Gel dosage farms: Theory, formulation and processing: In topical drug delivery formulation. (Ashorn WH and Amann AH). Marcel Dekker Inc. New York. 1990; 381-388.

2. Sanghvi NM, Puri RD and Kamath PR. Study of topical piroxicam formulation. Indian Drugs 1989; 26: 165-168.

3. Satish CS, Satish KP, Shivakumar HG. Hydrogels as controlled drug delivery systems: Synthesis, crosslinking, water and drug transport mechanism. Ind. J. Pharma. Sci. 2006; 68: 133-140.

4. Mishra PR, Namdeo A, Jain S and Jain NK. Hydrogels as drug delivery system. 1996: 33: 181-186.

5.Umamaheswari RB, Jain P and Jain NK. Hydrogel- A novel drug delivery system. Indian Drugs 2002; 39: 243-256.

6. Vintiloiu A. and Leroux JC. Organogels and their use in drug delivery: A Review. J Control Rel. 2007.

7. Mogbhel A and Faghiri A. Influence of dimethyl sulfoxide as a penetration enhancer of piroxicam gel through biological skin. Iranian J Pharm Sci 2006; 2(4): 177-184.

8. Sankar V, Chandrasekaran AK, Durga S, Prasanth KG, Nilani P, Geetha G, Ravichandran V, Vijayakumar A, Raghuraman S. Formulation and stability evaluation of diclofenac sodium ophthalmic gels. Indian J Pharm Sci 2005; 67(4): 473-476.

9. Uma devi, S., Ganesan, M. and Mohanta, G. P., Design and evaluation of tetracycline hydrochloride gels, Indian Drugs, 2002, 39(10), 552-554.

10. Lognathan V, Manimaran S, Jaswanth A, Sulaiman A, Reddy MVS, Kumar BS, Rajaseskaran A. The effects of polymers and permeation enhancers on the releases of flurbiprofen from gel formulations. Indian J Pharm Sci 2001; 63(3): 200-204. Williams AC,Barry BW:Penetration enhancers,Advanced Drug Delivery via Reviews 2004,5:603-618.

11. Barry BW: Novel mechanism and devices to enable successful transdermal drug delivery, European journal of pharmaceutical sciences,2001,14:101-114.

12. Devi R .S, Narayan S, Vani G, and Shymala Devi C.S.: "Gastroprotective effect of Terminalia arjuna bark on diclofenac sodium induced gastric ulcer", Chemical-biological interactions,2007,167(1);71-83.

13. Vyas SP. Khar RK. Targeted and controlled Drug delivery. Novel carrier Systems. J CBS Publications 2002:331-87.

14. Panchagnula R, "Transdermal delivery of drugs", Indian Journal Pharmacology, 1997, 29, 140-156.

15. Cevc G, Schatzlein A, Blume G. Transdermal drug carriers: Basic properties, optimization and transfer efficiency in case of epicutaneously applied peptides. J. Control. Rel.1995; 36:3-16

16. Buhse L, Kolinski R, Westenberger B, Wokovich A, Spencer J, Chen CW, Turujman S, Basak MG, Kang GJ, Kibbe J, Heintzelman B, Wolfgang E. Topical drug classification. Int J Pharm 2005; 295: 101-112.

17. www.drugdeliverypartnerships/synder.html

18. Monti D, Salettone MF, Giannaccini B, Galli-Angeli D. Enhancement of transdermal penetration of dapiprazole through mouse skin. J. Control Rel. 1995; 33: 71-77.

19.https://www.researchgate.net/publication/311588332_AN_OVERALL_REVIEW_ON_TOPICAL_PREPARATIONGEL