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Formulation and Evaluation of Transdermal Patch

Akanksha d. Taware, Satyashil S. Thorat, Dnyaneshwari M. Waikar, Saurav S. Wayal

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Abstract-
The transdermal drug delivery system is a technique that provides drug absorption via the skin.The system has many advantages over conventional administration routes such as intravenous ororaladministrationforsystemicandlocaldrugdelivery withsimpleadministration.
Themainobjectiveoftransdermaldrugdeliverysystemi stodeliverdrugsintosystemiccirculationthroughskinat predetermined
ratewithminimalinterandintrapatientvariations.
Cefixime is generally a strong antibiotic as it is used actively against a broad category of bacteria.Cefixime is used to treat bacterial infections in many different parts of the body. It belongs to theclass of medicines known as cephalosporin antibiotics. It works by killing bacteria or preventing their growth. However, this medicine will not work for colds, flu, or other viral infections. Toavoid side effects due to oral route transdermal patches of cefixime 200 mg tablet are prepared byusing50mgofdrug.
Keywords:-Transdermal System, Patch.

I. INTRODUCTION

Transdermal drug delivery is a desirable drug delivery system to control and sustain the drugrelease via. Skin Controlled release drug system limits the release of drug and improve theefficiency of drug, which is relatively fast release of drug and improve efficiency of drug, fastrelease system containing the same drugs. It was transdermal patches or transdermal deliverysystem.In this system medicated adhesive patches are prepared which delivertherapeuticaleffective amount of drug across the skin when it placed on skin. They are available in differentsizesandhavingmorethanoneingredient.Atran sdermalpatchcontainighighdoseofdruginside whichis retainedontheskinforprolongedperiodoftime. Drugcanpenetratethroughthe skinvia three pathways–

1) Throughhairfollicles.
2) Throughsebaceousglands.
3) Throughs weat duct.

ANATOMYOFSKIN
Layers of skin–

1. Epidermis–

i) Stratum basale (stratum germinativum) – deepest layer separated from dermis by basement(basallamina)andattachedbyhemi-dismosomes.Cellsarecuboidaltocolumnarandaremyt oticallyactivestemcells.

ii) Stratum spinosum(pricklecelllayer) - irregular,polyhedralcellswithprocessesthatextendout wordandcontactneighbouringcellsbydismosomes.

iii) Stratum granulosum– Diamondshapedcellswhichcontainkeratohyalingranul es.

iv) Stratum lucidum – Itpresent, thin clearlayer consisting of eleidin usually seen in thick skinonly.

v) Stratum corneum-Outermost layer,madeupofkeratinandhornyscaleswhichwereonc elivingcells,dead cells known as squamouslayer

2. Dermis–

Dermis is a layer present below the epidermis but it is much thicker than the epidermal layer (1-5mm thick). Dermis plays a vital role to sustain and support the epidermis. The dermal layer iscomposedoftwomainlayersofconnectivetissue

• Papillarylayer •Reticularlayer

3. Hypodermis–

It is also known as subcutaneous layer/fat or the panniculus layer. It is a layer present below the dermis which connect the skin to the underlying fascia (fibrous tissue) of the bones and muscles.Hypodermis is made up of well vascularized loosed, areolar connective tissue and adipose
tissuethatactasenergyreserveinsulatethebodytopreve ntheatloss,acting asa shock absorber.

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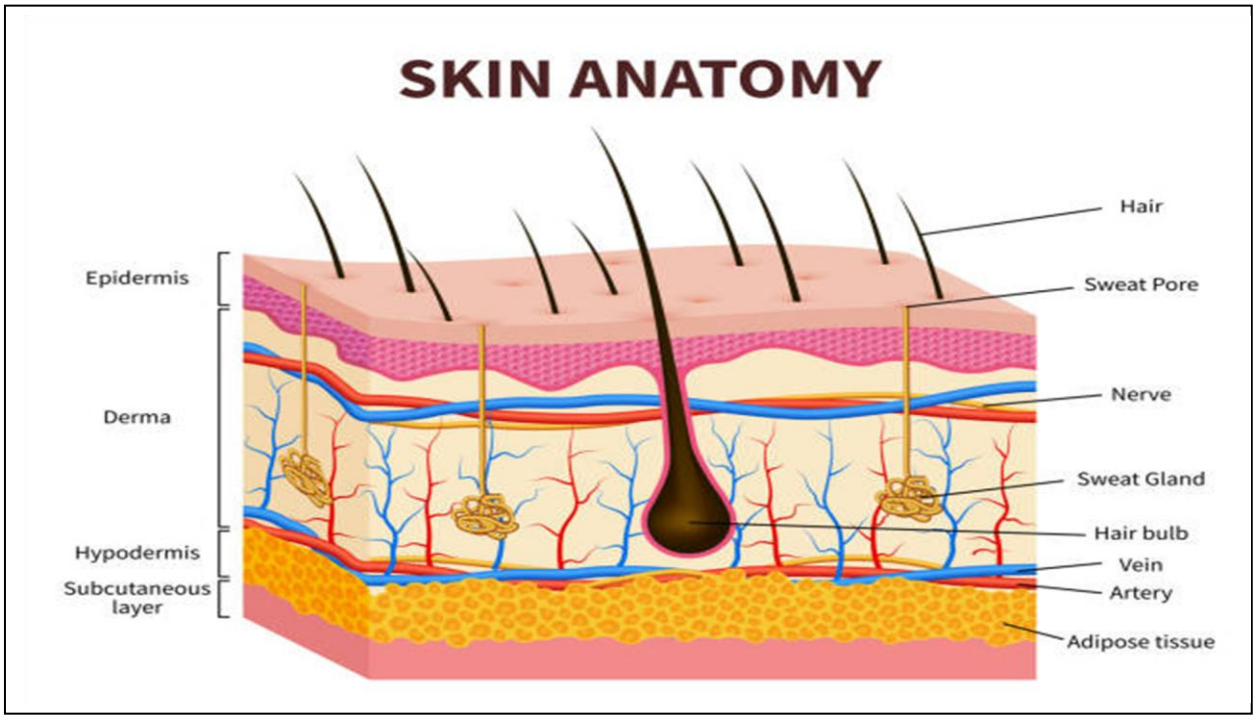

(Fig.1)

Functions of skin-

- Protection
- Sensation
- Mobility
- Endocrine activity
- Exocrine activity
- Immunity
- Regulation of temperature

Types of Transdermal Patches

1) Single layerdrug-in-adhesive
2) Multilayered-in-adhesive
3) Reservoir drug-in-adhesive
4) Matrix drug-in-adhesive

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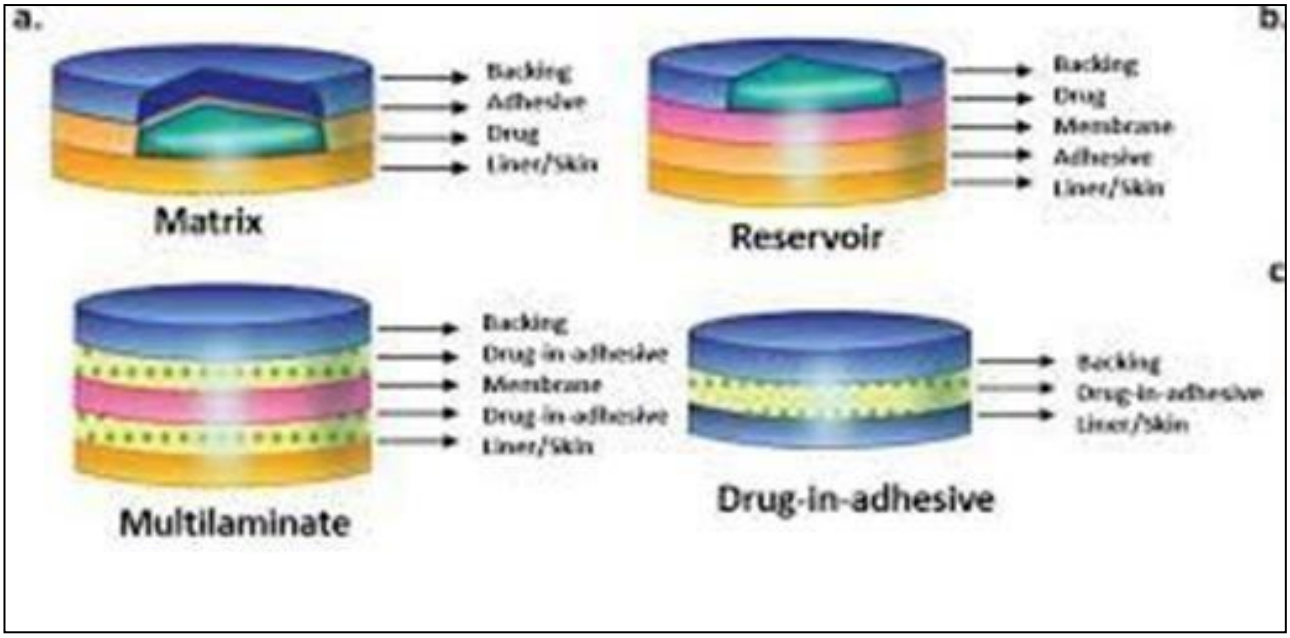

(fig.2)

PreparationMethodforMakingTransdermalPatches-

1) CircularTeflonmouldmethod
2) Mercurysubstratemethod
3) ByusingIPMmembranesmethod
4) ByusingEVACmembranesmethod
5) Byusingproliposomes
6) Byusingfreefilmmethod
7) SolventEvaporationmethod

IngredientsUsedInPreprationofTransdermalPatch

1) Cefixime

Cefixime, sold under the brand name Suprax among others, is an antibiotic medication used totreatanumberofbacterialinfections.Theseinfection sincludeotitismedia,strep throat,pneumonia, urinary tract infections, gonorrhea, and Lymph disease. For gonorrhea typically only one dose is required.

2) Chloroform

A clear,volatileliquidwithastrongsmellsimilartothatof ether.Chloroform was once administered by inhalation to produce anesthesia, given to relieve pain, and used as a remedy for cough.It is quite toxic to the kidneys and the liver.

Until themid-1900s,chloroform wasusedasananestheticto reducepainduringmedicalprocedures.Today,itisnotusedinthiswayduetoitsharmfuleffects.

3) Ethanol

Historically it was used as a general anesthetic, and has modern medical applications as an antiseptic, disinfectant, solvent for some medications, and antidote for methanol poisoning and ethylene glycol poisoning. It is used as a chemical solvent and in the synthesis of organic compounds,and as a fuel source.

Ethanol is used as a solvent to dissolve the active ingredient in some medicines or as an extractionsolventinherbalmedicinalproducts.Ethanolhasalsobeenusedasanantimicrobialpreservative,possessingbacteriocidalandfungicidalactivity.

4) HPMC(HydroxyPropylMethylCellulose)

HPMCChemicalisasynthetichighmolecularpolymer withnaturalcelluloseasrawmaterial.

Preparation-

1) Take25mlofethanolandchloroformrespectively andmixthemtogetherinabeaker.

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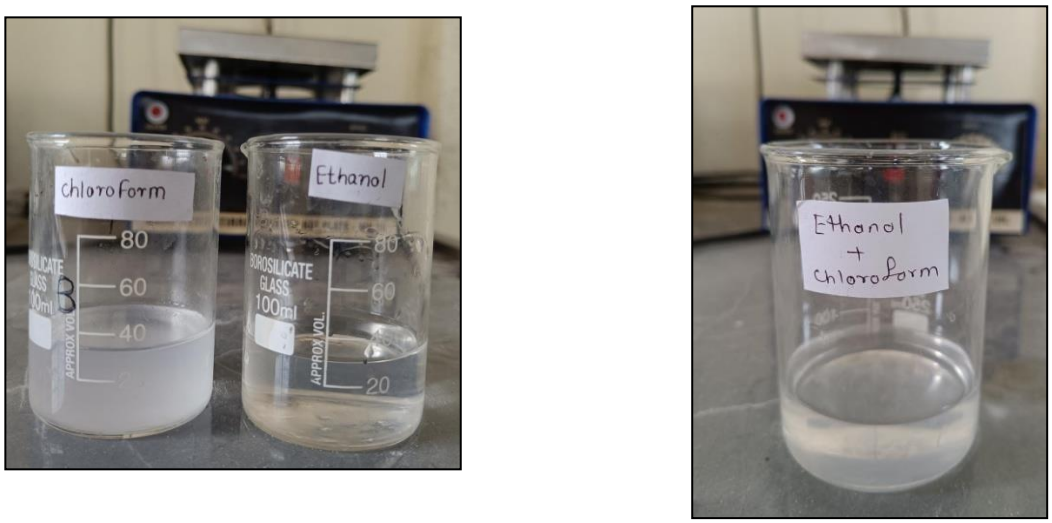

(fig.3.1)

2) Thenkeeptheminmagneticstirrermachinefor 10minsat50rpm.

(fig.3.2)

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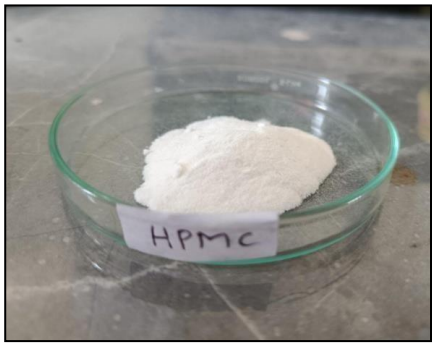
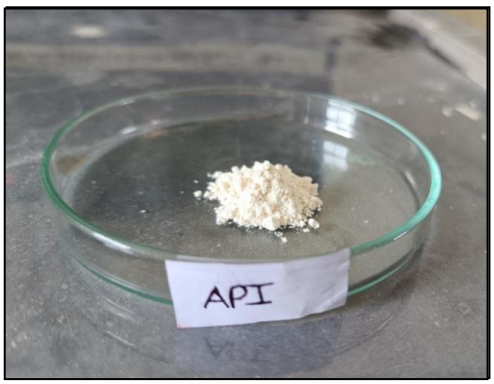
3) Whilestirringslowlyadd2.5gmofHydroxypropylmethylcellulose.



(fig.3.3)

4) It forms a jelly liquid. After the jelly formation add API drug (cefixime tablet for each patch -50mg)



(fig.3.4)

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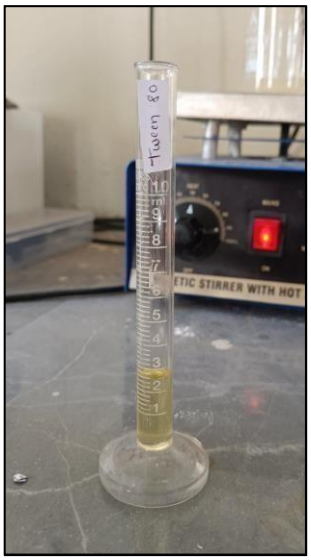
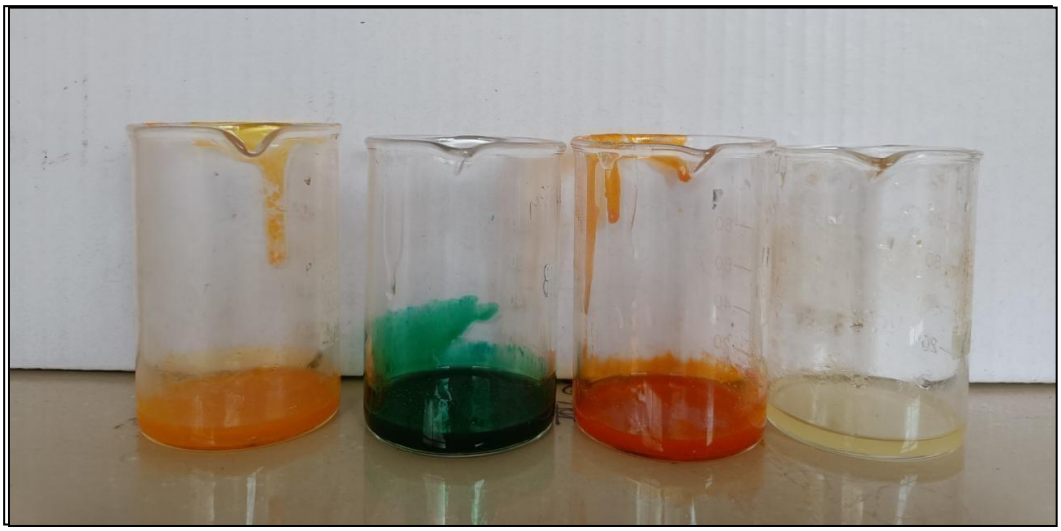
5) AftermixingAPIadd1.5mltween80.



(fig.3,5)

6) Keep it asideafterpropermixing.

7) For making different color patches take the mixture in separate beakers and add coloring agents (In this we use food colours as colouring agent because it cannot produce irritation of skin).



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8) Then keep silver paper on a flat surface and apply glycerin over it. Then spread the mixtureoverituniformly.
9) Keep inverted funnel over the spread mixture for control evaporation.

(fig.3.7)

10) After complete evaporation the mixture will be dry.

11) After that,for the safety of the drug and to stick the drug well on your injury,put an outer cover on it and then the patch is ready to use.

Evaluation paramete
Folding Endurance:
A strip of specific area is to be cut evenly and repeatedly folded at the same place till it broke. The number of times the film could be fold at the same place without breaking gave the value of the folding endurance's 46,51,23resp.
Tensile Strength:
Tensile strength of the film determined with universal strength testing machine. The sensitivity of the machine

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was 1 g. It consisted of two load cell grips. The lower one is fixed and upper one is movable. The test film of size (4 × 1cm^2) is fixed between these cell grips and force is gradually applied till the film broke. The tensile strength of the film is taken directly from the dial re adinging.Tensilestrength is expressed as follows.
Tensilestrength=Tensileloadatbreak/Cross section area

1) Tensile strength of first patch= $\frac{2000}{5} = 400\ g/cm^2$

1)
5

2) Tensile strength of second patch= $\frac{2000}{6.5} = 307.69 g/cm^2$

3) Tensile strength of third patch= $\frac{2000}{2.5} = 800 g/cm^2$

PercentageElongationBreakTest:
The percentage elongation break is to be determined by noting the length just before the break point,thepercentageelongationcanbedeterminedfromthebelowmentionedformula.Elongation percentage = [L1-L2 / L2] × 100 Where, L1 is the final length of each strip and L2 is the initiallengthofeachstrip.

1) Percentage Elongation of firs tpatch= $\frac{8-5}{5} \times 100 = 60\%$

2) Percentage Elongation of second patch= $\frac{8.5-6.5}{6.5} \times 100 = 30.76\%$

3) Percentage Elongation of third patch= $\frac{5.5-2.5}{2.5} \times 100 = 94.50\%$

ThicknessofthePatch:
Thethicknessofthedrugloadedpatchismeasured indifferentpointsbyusingadigitalmicrometerand determines the average thickness. The thickness of first, second & third patch is 0.584 mm resp.

Drug Content:
A specified area of the patch is to be dissolved in a suitable solvent in specific volume. Then the solution is to be filtered through a filter medium and analyse the drug content with the suitable method(UVtechnique).Thedrugcontentinfirst,second&thirdpatchis9%,10%&7%resp.

Sr.no	Folding endurance	Tensilestrength (g/cm^2))	% of elongation	Thickness(mm)	% Drug content
1	46	400	60	0.584	9
2	51	307.69	30.76	0.584	10
3	26	800	94.50	0.584	7

(Table.2)

Factorsaffectingontransdermalpatches
Therearevariousfactorswhichaffectstheactionoftransdermalpatches.Thesearegivenbelow:

a) Physiochemicalproperties

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i) Partition coefficient

ii) Molecular size

iii) Solubility/melting point

iv) Ionization

b) Physiological&pathologicalconditionsofskin

i) Reservioreffectonskin

ii) Lipid film

iii) Skin hydration

iv) Skin temperature

v) Regional variation

vi) Pathological injuries of the skin

vii) Cutaneous self metabolism

viii) Skin barrier propertiesintheneonateandyounginfant

ix) Skinbarrierpropertiesinagedskin

x) Race

xi) Penetration enhancer

Advantagesoftransdermalpatches

a) First pass metabolism of drug get avoided.

b) Gastroi ntestinal incompatibilities get avoided.

c) Self medication is possible.

d) Unwanted side effects gets minimized.

e) Duration of action gets extended and predicted.

f) Drug plasma concentration gets minimized.

Disadvantage so ftransdermal patches

a) Changes of allergic reaction at the site of application like it ching ,rashes, local edema etc.

b) Larger molecular size of drug creat es difficulties in absorption.

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c) Barrier function of skin varies from site tosite on the same or different persons.

d) Drug with hydrophilic character is less suitable as compare to drug with lipophilic characte rbecause of theirl own permeability.

Result

Transdermal patches of cefixime were prepared by solvent evaporating method to achieve a controlled release,improved bioavailability of the therapeutic drug and to reduce the toxicity.This is the effective result for transdermal patches. The physicochemical compatibility of the drug and the polymers was studied by ultra violet spectroscopy. The results obtained showed no physical-chemical incompatibility between the drug and the polymers. The patches were further subjected to various physical evaluations such as folding indurance, drug content,etc.

(fig.4)

Summary

The transdermal drug delivery system is a technique that provides drug absorption via the skin.The system has many advantages over conventional administration routes such as intravenous or oral administration fo rsystemic and loca ldrug delivery with simple administration.

A transdermal patch is a medicated adhesiv epatch that is applied to the skin and used to deliver a particular amount of medication into the blood stream through thes kin.Thisfrequently aids in the healing of a damaged bodily part.

Conclusion

Transdermal drug delivery is painless, convenient and potentially effective way to deliver regulardose of many medication. Transdermal delivery of drug product which is currently

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approved and oral doses form allow for the avoidance first pass metabolism. Wide range of drug can be deliver improved drug uptake, minimum complication and side effect at low cost and easy to use. For-example , 10 years ago nicotine patch had revolutionize smoking session patient were being treated with nitro glycerin for angina clonidine for hypertension scopolamine for motion sickness and estradiol for estrogen deficiency all through patches used by over a million patient per year.Dermal patch are most common form of transdermal delivery of drugs. However, the transdermaltechnology have limitation due to the relatively impermeable thick of outer stratum corneum layer.Researcher are trying to over come this hurdle of poor permeability by physical and chemical means.

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