International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

Formulation and development of lornoxicam transdermal patches

Shreya Patel's[1]*, Vaidehi Panchal[1]*,Priya Patel[1]*,Krupa patel[1]*,Jugvi Patel[1]*, Dr.Chainesh Shah[2], Dr.Umesh Upadhyay[3]

1VIIIth Semester B-Pharm, Sigma Institute of Pharmacy, Bakrol, Ajwa, Vadodara – 390019 (Gujarat, India).
2Associate professor, Sigma Institute of Pharmacy, Bakrol, Ajwa, Vadodara - 390019 (Gujarat, India).
*3Principal, Sigma Institute of Pharmacy, Bakrol, Ajwa, Vadodara - 390019 (Gujarat, India). *Corresponding*

Date Of Submission: 01-05-2021 Date Of Acceptance: 12-05-2021

ABSTRACT : Transdermal drug delivery is another route for general drug delivery that minimize surface assimilation and increase bioavailability orally loronoxicam has short elimination of 0.5 life (3-4hr) virtually 90-100%) low oral bioavailability undergoes intensive initial pass metabolism and frequent high dose area unit needed to take care of therapeutic level food scale back absorption of drug. loronoxicam newer NSAIDS of oxicam category is powerful analgesic & anti inflammatory agent clinical investigations established may be a potent analgesic with glorious anti-inflammatory properties painful & inflammatory condition. Loronoxicam act by inhibiting the metabolites of COX branch of arachidonic acid pathway inhibit each isoform constant proportion a dead balanced COX1 & COX2 for transdermic product the goal of indefinite quantity style is to maximise the flux through the skin into the circulation and at the same time minimize the retention and metabolism of drug in skin analysis work is that however the drug penetrate in body and the way its work.

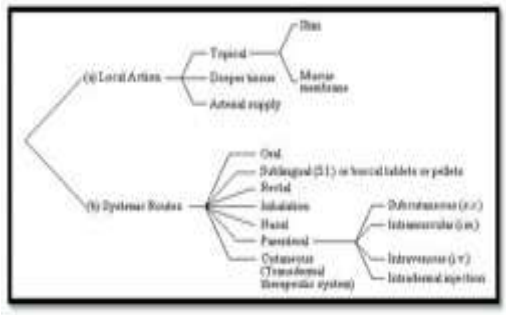
KEYWORDS: HPMC, Lornoxicam, Permeation Enhancers, Stability study, Release Kinetics, Transdermal patches.

I. INTRODUCTION

1.1. Novel drug delivery system

Medication conveyance is the method and extension of controlling API composite to get a restorative outcome which can change discharge for the upside of subduing item proficiency and consistence. [1]

1.1.1. Advantages of Novel Drug Delivery System · Modified Release
· Delayed Release
· Targeted-release drug products
· Recurrence Action
· Persistent Action
Most common routes of administration are:



Various Routes of Drug Administration by Novel Drug Delivery System.

1.2.Transdermal Drug Delivery System [1-4]

Transdermal drug delivery systems are defined as self contained, discrete dosage forms which, when applied to the intact skin, deliver the drug, through the skin, at a controlled rate to the systemic circulation" At present, the most common sort of delivery of medicine is that the oral route. While this has the notable advantage of easy administration, it also has significant drawbacks; namely poor bioavailability thanks to hepatic metabolism (first pass) and the tendency to supply rapid blood level spikes (both high and low), resulting in a need for high and/or frequent dosing, which may be both cost prohibitive also as inconvenient Formulations on skin are often classified into two categories consistent with the target site of action of the containing drugs.

1.2.1.Advantages of Transdermal Drug Delivery System [5,6]

· Transdermal drug delivery are often used as an alternate delivery system for patients who cannot tolerate oral dosage forms or who are nauseated or unconscious.
· Prevents the danger and inconvenience of intravenous therapy.
· Permits continuous zero-order drug administration and therefore the use of medicine with short biological half-lives.

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

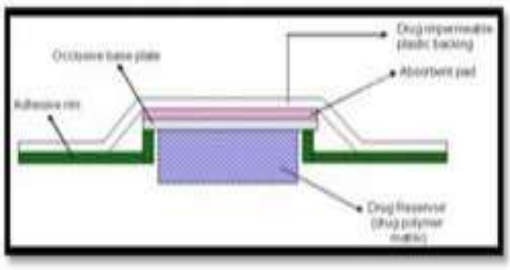
· Increases the bioavailability and efficacy of medicine , since it bypasses hepatic first pass elimination.
· Topical patches are an easy , non-innvasive thanks to deliver drug directly into the body.
· Drug input are often terminated just by removal of patch.
· Topical patches are a painless, non-innvasive way to deliver drug directly into the body.
· Drug input can be terminated simply by removal of patch.

1.2.2.Disadvantage of Transdermal Drug Delivery System [7-9]

· The transdermal route of administration is unsuitable for drugs that irritate or sensitize the skin. · Only potent drugs are suitable candidates for transdermal delivery thanks to the natural limits of drug entry imposed by the skin permeability.
· It cannot develop for the drugs of huge molecular size.

1.3. Matrix diffusion-controlled systems [10,11]

Matrix may be a system during which drugs and polymers are mixed uniformly to supply a homogeneous system. In this approach, the drug reservoir is ready by homogenously dispersing drug particles during a hydrophilic or lipophilic polymer matrix (Figure 1.3). The resultant medicated polymer is then molded into a medicated disc with an outlined area and controlled thickness. The drug reservoir are often formed by dissolving drug and polymer during a common solvent followed by solvent evaporation during a mould at an elevated temperature and/or vacuum. The drug reservoir containing polymer disc is then pasted on to an occlusive base plate during a compartment fabricated from a drug impermeable plastic backing. The adhesive polymer is then spread along the circumference to make a strip of adhesive rim round the medicated disc. The advantage of this technique is that the absence of dose dumping since polymer cannot rupture. One example of this sort in Nitroglycerin-releasing transdermal therapeutic system.

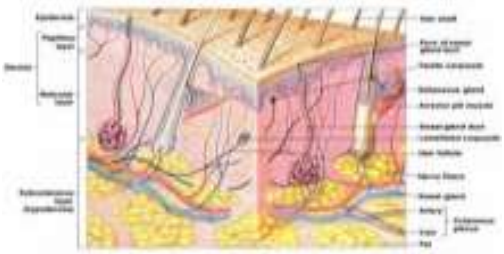


Matrix controlled drug delivery system

1.4. Anatomy of skin [12-18]

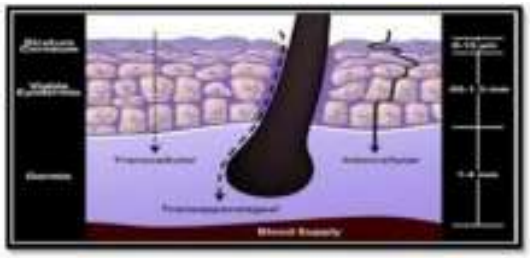
· Skin is that the most extensive and readily accessible organ within the body. Its chief functions are concerned with protection, temperature regulation, control of water output, and sensation. In a mean adult it covers a neighborhood of about 1.73m2 and receives one third of circulating blood through the body at any given times.

Skin layer



Skin can be divided into three layers.
A. Epidermis
B. Dermis
C. Subcutaneous (SC)
A. Epidermis
· Epidermis is outer layer of skin made up of stratified squamous epithelial cells.
· Held together mainly by highly convoluted interlocking bridges responsible for the unique integrity of the skin.
· Epidermis consists of two main parts:
· Stratum corneum
· Stratum germinativum
· Stratum corneum-outermost layer and consist of compacted, flattened, dehydrate keratinized cells in the stratified layers.
· These horny cells are deprived of nuclei and physiologically inactive.
· Subdivided into 3 layers
1. Stratum lucidum (clear layer)
2. Stratum granulosum (granular layer)
3. Stratum spinosum (prickly layer)
· They are formed and continuously replenished by the slow upward migration of cell produced by the basal cell layer of stratum germinativum, which is the regenerative layer of the epidermis.

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781



Drug penetration pathway

1. Transcellular penetration (across the cells)
2. Intercellular penetration (between the cells) 3. Transappendageal penetration (via hair follicles, sweat and sebum glands, and pilosebaceous apparatus) B. Dermis

· Made up of a network of robust collagen fibers with regularly spaced cross-striations.
· It is a gel containing oriented tropocollagen macromolecules.
· The network or gel structure is responsible for the elastic properties of the skin.
· The upper portion of the dermis is formed into ridges projecting into the epidermis, which contains blood vessels, lymphatics, and nerve endings.

C. Subcutaneous (SC)

· Beneath the dermis is the fat containing subcutaneous tissue.

1.5. Method of Preparation and Basic Components of TDDS [19-21]

1.5.1. Method of Preparation

1. Solvent evaporation techniques
2. Solvent casting techniques

1.5.2. Basic Components of TDDS

1. Polymer matrix / Drug reservoir
2. Drug
3. Permeation enhancers
4. Pressure sensitive adhesive (PSA)
5. Backing laminates
6. Release liners

1.5.3. Product Development and Ideal Characteristic

· Because of the uniqueness of this dosage form, the following questions need to be answered to define the final product.

1. Target therapeutic concentration.
2. Dose to be delivered.
3. Maximum patch size acceptable (<40 cm2). 4. Preferred site of application.
5. Preferred application period (daily, biweekly, weekly, etc.).

1.5.4. Ideal Properties of Transdermal Drug Delivery System [22,23]

Ideal Properties of Transdermal Drug Delivery System

SR	Properties	Range
1	Shelf life	Should be up to 2.5 years
2	Patch size	Should be less than 40 cm2
3	Dose frequency	Once a daily - once a week
4	Appearance	Should be clear or white color
5	Packaging properties	Should be easily removable of release liner
6	Skin reaction	Should be non-irritating
7	Release Properties	Should have consistent pharmacokinetic profiles over time and pharmacodynamic

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

8	Packaging properties	Should be easily removable of release liner

1.5.5. Ideal Properties of Drug for Transdermal Drug Delivery System
Ideal Properties of Drug for Transdermal Drug Delivery System

SR	Parameter	Properties
1	Dose	Should be low
2	Half-life in hr	Should be 10 or less
3	Molecular weight	Should be less than 500
4	Partition coefficient	Log P (octanol-water) between –1 and 3
5	Skin permeability coefficient	Should be less than 0.5 x10- 3cm/hr
6	Skin reaction	Should be non-irritating
7	Oral bioavailability	Should be low
8	Therapeutic index	Should be low
9	Concentration	Minute
10	pH of saturated aqueous solubility	5-9

1.5.6. Mechanism Of Action Of Transdermal Patches [24,25]

The function of the skin patch and therefore the flow of the active drug ingredient from the patch to the cardiovascular system via skin transpire through different methods. For a systemically active drug to succeed in a target tissue, it's to require some physicochemical properties which make easy the sorption of the drug through the skin and enter the microcirculation.

1.5.7. Factors affecting transdermal bioavailability [17-20]

· Two major factors affect the bioavailability of the drug via transdermal routes.
A. Physiological factors
B. Formulation factors
A. Physiological factors include
· Stratum corneum layer of the skin
· Anatomic site of application on the body
· Skin condition and disease
· Age of the patient
· Skin metabolism
· Desquamation (peeling or flaking of the surface of the skin)
· Skin irritation and sensitization
B. Formulation factors include
· Physical chemistry of transport
· Vehicles and membrane used
· Penetration enhancers used
· Method of application
· Device used

II. MATERIALS AND METHODOLOGY

2.1. MATERIALS AND EQUIPMENT REQUIRED

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

The following materials, chemicals and instruments had used for Preparation and Characterization of Lornoxicam Transdermal matrix patch as per Table.

2.1.1. List of Materials
List of Materials

MATERIAL	CATEGORY	SOURCE
Lornoxicam	A.P. I	
HPMC K-4, K-15, K-100	Rate controlling Polymer	Colorcon Asia Pvt.Ltd, Goa
Eudragit RS-100	Rate controlling Polymer	Signet chem Ltd. Mumbai
Polyvinylpyrrolidone K 30	Rate controlling Polymer	Sulab (Pioneer sales).(Bardoli)
Polyethylene glycol-400	Plasticizer	Sulab (Pioneer sales).(Bardoli)
Tween 80	Permeation enhancer	Sulab (Pioneer sales).(Bardoli)
Methanol	Solvent	Sulab (Pioneer sales).(Bardoli)

2.1.2. List of Equipment
List of Equipment

EQUIPMENTS	MODEL AND SOURCE
Ultra Violet visible Spectrophotometer	Toshwin analytical Pvt, ltd. Ahmadabad
FT-IR Spectrophotometer	Toshwin analytical Pvt, ltd. Ahmadabad
Sonicator	Remi sales Pvt, ltd. Ahmadabad
Magnetic stirrer	Remi sales Pvt, ltd. Ahmadabad
Franz diffusion cell	Orchid scientific Pvt, ltd. Nasik
Digital pH meter	Electrolab. Mumbai

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

Hot air oven	Metro Pvt, Ltd. New Delhi

2.2 Methodology [26,27]

2.2.1. Preformulation of Drug

The preformulation study is mostly generate data useful to developed stable dosage forms that can be mass-produced for manufacturer.

2.2.1.1. Organoleptic Characteristics of Lornoxicam

Physical examine was done to check Organoleptic Characteristics of Lornoxicam like color and odor.

2.2.1.2. Determination of Melting Point of Lornoxicam

Melting point of Lornoxicam will be evaluated by the capillary method.

2.2.1.3. Identification and Determination of Wavelengthmax (λmax) of Lornoxicam [28,29]

Scanning of Lornoxicam by UV-spectrophotometer in 0.1N Sodium hydroxide (NaOH)Standard stock solution of Lornoxicam prepared by dissolving accurately weighed 100 mg of Lornoxicam in the little quantity of 0.1 N NaOH in 100 ml volumetric flask. The volume was then made up to mark by using 0.1 N NaOH, so asto get the solution of 1000 µg/ml. From the standard stock solution, 2 ml diluted to 100 ml with 0.1 N NaOH. The resulting solution containing 20 µg/ml scanned between 200 to 400 nm and λ of max Lornoxicam in 0.1 N NaOH will observed.

2.2.1.4. Solubility study of Lornoxicam [30]

The solubility of Lornoxicam will determined according to the method adopt an excess amount of drug was taken and dissolved in a measured volume of Phosphate buffer pH 7.4 in a glass vial to get a saturated solution. The solution was sonicated and kept at room temperature for the attainment of equilibrium. The concentration of Lornoxicam in the filtrate was determined spectrophotometrically by measuring absorbance at 376 nm after 24 hrs.

2.2.1.5. Determination of Partition co-efficient [31]

The known quantity of Lornoxicam was added into 5 ml of 1-octanol and it was mixed with 5 ml of Phosphate buffer pH 7.4 in a separating funnel. Then two phases were allowed to equilibrate at 37oC for 24 hrs. with intermittent shaking. The concentration of the drug in the aqueous phase and organic phase was determined by UV spectroscopic method after necessary dilution. The apparent partition coefficient (Kp) was calculated as the ratio of drug concentration in each phase by the following equation. Where, Cor g is concentration of drug in organic phase and Caq is the concentration of drug in aqueous phase.

2.2.1.6. Preparation of Calibration Curve for Lornoxicam

2.2.1.6.1. Preparation of 0.02 N NaOH

Dissolve 0.08gm of NaOH in 100ml of distilled water to make 0.02 N NaOH.

2.2.1.6.2. Preparation of Standard solution (100µg/ml)

Standard stock solution was prepared by dissolving 100mg of Lornoxicam in 100ml of 0.02N NaOH to get concentration of 1000µg/ml solution (stock solution-1). From these required concentrations were prepared by proper dilution from the stock solution.

2.2.1.6.3. Procedure

The prepared stock solution was further diluted with mobile phase to get working standard solution of 5, 10, 15, 20, 25, and 30µg/ml of Lornoxicam to construct beer's law plot for the pure drug, the absorbance was measured at λ max at 377nm, against mobile phase as a blank. The standard graph
was plotted by taking concentration of drug on X-axis and absorbance on Y-axis in the concentration range of 30mcg.

2.2.1.7. Drug–excipient compatibility studies

2.2.1.7.1Fourier Transformer Infrared Spectroscopy

IR spectroscopy will be conducted using a FTIR Spectrophotometer (FTIR-8700, Shimadzu, USA) and the spectrum was recorded in the wavelength region of400– 4000 cm-1. The procedure consisted of dispersing a sample (drug alone and mixture of drug and polymer) in KBr and compressing into discs by applying a pressure of 5 t for 5 min in a hydraulic press. The pellet was placed in the light path and the spectrum was recorded. All spectra were collected as an average of three scans at a resolution of 2 cm-1.

2.2.2. Preliminary solvent selection and Optimization of Plasticizer Concentration

2.2.2.1. Preliminary solvent system:

Film forming solutions were prepared by adding each of the polymer to the various ratios of varied solvent mixtures (S1, S2, S3 and S4) and

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

every solution was stirred for about half hour to make sure complete dissolution of the polymer. the specified amount of plasticizer was added to polymer dispersion. The Solution was kept in undisturbed condition till the entrapped air bubbles were removed. The solution was casted during a glass Petri dish having diameter of 8.5 cm to make 0.3-0.5 mm thick skin patch , and was dried at temperature . The Petri dishes were placed on the leveled surface during drying to avoid variation within the thickness. it had been left for about 24 hours to dry at temperature.

2.2.2.2 SELECTION OF SOLVENT TYPE AND VOLUME
2.2.2.3. SELECTION OF CONCENTRATION OF POLYMER
2.2.2.4. PRELIMINARY SELECTION OF POLYMER TYPE
2.2.2.5. SELECTION OF PLASTICIZER TYPE AND CONCENTRATION
2.2.2.2. Dose of drug and loading drug calculation for Transdermal application [47]
Dose of drug = Oral Dose * Oral Bioavability/Body Surface Area
Where oral dose of drug (Lornoxicam) =4 mg
Oral Bioavability = 90%
Body surface area = 1.73 cm2

2.2.2.3. Drug loading calculation for fabrication of transdermal patch

As on the idea of dose calculation, the fixed required amount of drug must be incorporated during a fixed area of (2*2 cm2). So, the entire amount of drug must be incorporated in total area of petri-plate should be calculated.

2.2.3. Formulation of transdermal matrix patch by using solvent casting method [32-34]

The transdermal matrix patch are going to be prepared by using solvent casting method. The specified amount of plasticizer was added to polymer dispersion. Drug was dissolved to make solution with constant stirring for half hour with adequate clarity and mixed in above dispersion. The solution was kept in undisturbed condition till the entrapped air bubbles were removed. The solution was casted during a glass Petri dish (previously lubricated with glycerin) having diameter range of 7-8 cm and thickness 0.3-0.5 mm. Then it had been dried at temperature. The Petri dishes was placed on the leveled surface during drying to avoid variation within the thickness. it had been approximately 24 hours to dry at temperature , or for 8 hours in Hot air oven at 55 ℃. The dried TDDS was carefully removed from the mould and was dig size required for testing. The formulations were stored in airtight plastic bags till after gluing aluminium foil as backing layer for further use and stored in desiccators.

2.2.4. Physicochemical evaluation
2.2.4.1. Thickness [35]

The thickness of the drug prepared patch is measured by employing a digital micrometer at different point of patch and determines the typical thickness and variance for an equivalent to make sure the thickness of the prepared patch.

2.2.4.2. Content uniformity [36]

10 patches are selected and content is decided for individual patches. If 9 out of 10 patches have content between 85% to 115% of the required value and one has content not but 75% to 125% of the specified
value, then transdermal patches pass the test of content uniformity. But if 3 patches have content within the range of 75% to 125%, then additional 20 patches are tested for drug content. If these 20 patches have range from 85% to 115%, then the transdermal patches pass the test.

2.2.4.3. Drug content determination [37]

An accurately weighed portion of film (above 100 mg) is dissolved in 100 mL of suitable solvent during which drug is soluble then the answer is shaken continuously for twenty four h in shaker incubator. Then the entire solution is sonicated. After sonication and subsequent filtration, drug in solution is estimated spectrophotometrically by appropriate dilution.

2.2.4.4. Moisture content [38]

prepared films are weighed individually and kept during a desiccator containing salt at temperature for twenty-four h. The films are weighed again after a specified interval until they show a continuing weight. The percent moisture content is calculated using following formula.

2.2.4.5. Moisture uptake [39]

Weighed films are kept during a desiccator at temperature for twenty-four h. These are then taken out and exposed to 84% ratio using saturated solution of K-Dur 20 during a desiccator until a continuing weight is achieved. % moisture uptake is calculated as given below.

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

2.2.4.6. Flatness [40,41]

A skin patch should possess a smooth surface and will not constrict with time. This will be demonstrated with flatness study. For flatness determination, one strip is cut from the middle and two from all sides of patches. The length of every strip is measured and variation long is measured by determining percent constriction. Zero percent constriction is like 100 % .

2.2.4.7. Folding endurance [42]

Evaluation of folding endurance involves determining the folding capacity of the films subjected to frequent extreme conditions of folding. Folding endurance is decided by repeatedly folding the film at an equivalent place until it break. the amount of times the films might be folded at an equivalent place without breaking is folding endurance value.

2.2.4.8. Tensile strength [43]

To determine lastingness , polymeric films are sandwiched separately by corked linear iron plates. One end of the films is kept fixed with the assistance of an iron screen and other end is connected to a freely movable thread over a pulley. The weights are added gradually to the pan attached with the hanging end of the thread.

Tensile strength=F/a. b (1+L/l) Where, F = the force required to break;

a=width of film;

b = thickness of film; L = length of film;

l =elongation of film at break point.

2.2.4.9. Water vapor transmission studies (WVT)

Water vapor permeability will be determined with foam dressing method the air forced oven is replaced by a natural air circulation oven. The WVP can be determined by the following formula

WVP=W/A

Where, WVP is expressed in gm/m2 per 24hrs, W is the amount of vapor permeated through the patch expressed in gm/24hrs and A is the surface area of the exposure samples expressed in m2.

2.2.5. Adhesive study evaluation

2.5.1. Shear Adhesion test [44,45]

This test is to be performed for the measurement of the cohesive strength of an adhesive polymer. It are often influenced by the relative molecular mass , the degree of cross linking and therefore the composition of polymer, type and therefore the amount of tackifier added. An adhesive coated tape is applied onto a stainless-steel plate; a specified weight is hung from the tape, to affect it pulling during a direction parallel to the plate. Shear adhesion strength is decided by measuring the time it takes to tug the tape off the plate. The longer the time deem removal, greater is that the shear strength.

2.2.6. Flux and Permeability coefficient [45]

The flux (mg cm-2 hr-1) of Lornoxicam was calculated from the slope of the plot of the cumulative amount of Lornoxicam permeated per cm2 of skin at steady state against the time using rectilinear regression analysis.

The steady state permeability coefficient (Kp) of the drug through rat epidermis was calculated by using the subsequent equation.

Kp = J/C

Where J = the flux

C = the concentration of Lornoxicam within the patch. **2.2.7. In-vitro Permeation study**

An in-vitro permeation study are often administered by using diffusion cell receptor compartment capacity of 12 ml. The excised cellophane paper was mounted between the donor and receptor compartment of the diffusion cell. The formulated patches were placed over the skin and covered with paraffin film. The receptor compartment of the diffusion cell was crammed with phosphate buffer pH 7.4. the entire assembly was fixed on a magnetic stirrer, and therefore the solution within the receptor compartment was constantly and continuously stirred using magnetic beads at 50 rpm; the temperature was maintained at 32 ± 0.5 °C. The samples were withdrawn at different time intervals and analyzed for drug content spectrophotometrically. The receptor phase was replenished with an equal volume of phosphate buffer.

2.2.8. Ex-vivo Permeation study [46]

An ex-vitro permeation study are going to be administered by using diffusion cell receptor compartment capacity of 12 ml. The excised skin of Wister albino rats was mounted between the donor and receptor compartment of the diffusion cell. The formulated patches were placed over the skin and covered with Paraffin film. The receptor compartment of the diffusion cell was crammed with phosphate buffer pH 7.4. The entire assembly was fixed on a magnetic stirrer, and therefore the

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

solution in the receptor compartment was constantly and continuously stirred using magnetic beads at 50 rpm; the temperature was maintained at 32 ± 0.5 ℃. The samples were withdrawn at different time intervals and analyzed for drug content spectro photo metrically. The receptor phase was replenished with an equal volume of phosphate buffer.

Groups	Route of drug administration	No. Of Animals
Skin Permeation Study (Ex-vivo Study)		
Group- I: Wistar Rat skin	**Hypodermal adipose tissue skin asbarrier membrane**	6

2.2.9. Stability study (As per ICH guidelines)

Stability studies will be carried out for optimized patch formulation at 40 ± 0.5°C and 75 ± 5% RH for 1 month. The samples were withdrawn at 0, 10, 20, 30 days and evaluated for physicochemical properties and in-vitro diffusion study.

III. RESULTS

3.1 Preformulation Study for Lornoxicam

Preformulation parameters such as Organoleptic characteristic study, Melting Point Determination, solubility study Wavelength (λ_{max}) Determination, Calibration curve, Identification of Drug by Lornoxicam, DSC study and FT IR study was carried out. This includes the various Preformulation studies for the present research work and the result discusses below every parameter.

3.1.1. Organoleptic Characteristics of Lornoxicam

Organoleptic Characteristics of Lornoxicam

PARAMETER	OBSERVED RESULT
Color	Yellow White powder
Odour	slightly unctuous with faint
Appearance	Yellow crystalline powder

The color of the Lornoxicam was visualized yellow with slightly unctuous or with a faint characteristic odour having yellow crystalline powder appearance as shown in above Table

3.1.2. Determination of Melting Point of Lornoxicam

Melting point results were as presented in belove Table

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

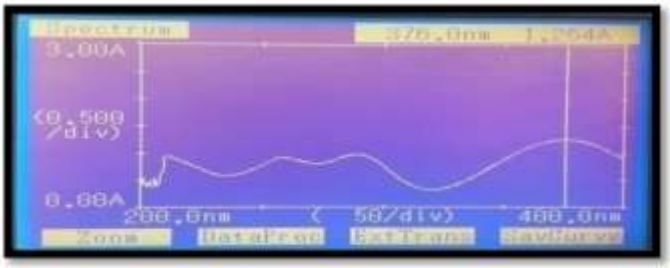
Melting point of Lornoxicam

Drug Name	Standard Value	Observed Value(Mean ± S.D.)(n = 3)
Lornoxicam	225°C-232°C	231 ± 1 °C

Melting point was carried out to determine the purity of sample. The Drug sample has melting point of 231 ± 1 °C which was in the range and indicate the purity of sample as Lornoxicam.

3.1.3. Identification and Determination of Wavelength max (λmax) of Lornoxicam

Scanning of Lornoxicam by UV-spectrophotometer in 0.1N Sodium hydroxide (NaOH)Standard stock solution of Lornoxicam prepared by dissolving accurately weighed 100 mg of Lornoxicam in the little quantity of 0.1 N NaOH in 100 ml volumetric flask. The volume was then made up to mark by using 0.1 N NaOH, so as to get the solution of 1000 µg/ml. From the standard stock solution, 2 ml diluted to 100 ml with 0.1 N NaOH. The resulting solution containing 20 µg/ml scanned between 200 to 400 nm and λmax of Lornoxicam in 0.1 N NaOH was observed.



λmax Spectrum for Lornoxicam

Wavelength (λ_{max}) of Lornoxicam

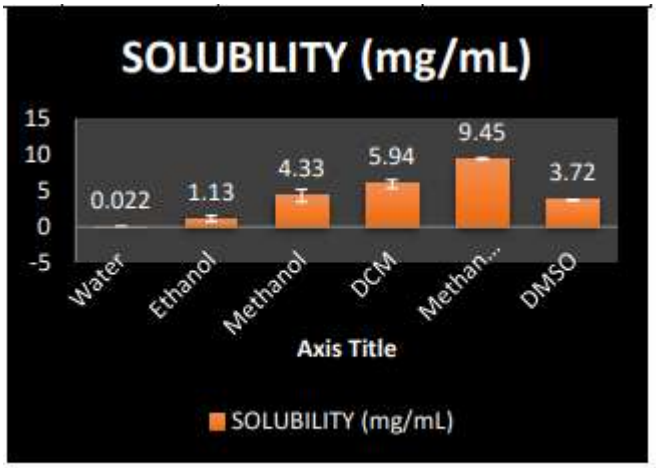
Drug Name	Actual λ_{max}	Observed λ_{max}
Lornoxicam	376nm	376nm

3.1.4. Solubility study of Lornoxicam

Solubility of Lornoxicam

S. R	SOLVENTS	SOLUBILITY (mg/mL) (Mean ± S.D.) (n = 3)	INTERPRETATION
1	**Water**	0.022	Very Slightly soluble
2	**Ethanol**	1.13	Slightly soluble
3	**Methanol**	4.33	Partially soluble
4	**DCM**	5.94	Partially soluble
5	**Methanol: DCM**	9.45	Freely soluble
6	**DMSO**	3.72	Slightly

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781



Solubility profile of Lornoxicam

3.1.5. Determination of partition coefficient of Lornoxicam

Partition coefficient of Lornoxicam

DRUG	ACTUAL VALUE	OBSERVED VALUE
Lornoxicam	Log P=1.8	Log P=1.8

Partition coefficient determination study of Lornoxicam was done with n-octanol and Phosphate buffer pH 7.4. The logarithmic value of partition coefficient (log Pka) of was found to be 1.8. This indicates that Lornoxicam is an ideal candidate for Transdermal drug delivery system.

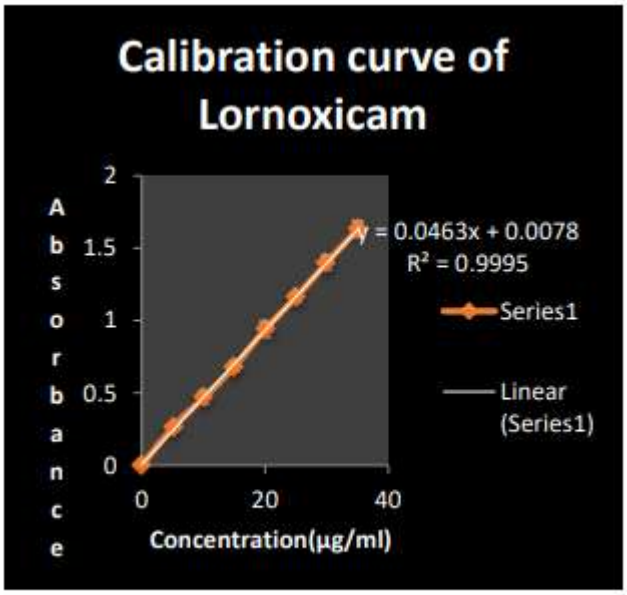
3.1.6. Preparation of Calibration Curve for Lornoxicam

Calibration curve of Lornoxicam

SR	Concentration (mcg/mL)	Absorbance(nm) (Mean ± S.D.) (n = 3)
1	0	0
2	5	0.262
3	10	0.467
4	15	0.683
5	20	0.939

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

6	25	1.159
7	30	1.401
8	35	1.630



Calibration curve of Lornoxicamin phosphate buffer 7.4

SR.	Parameters	Aceclofenac
1	Wavelength (λmax)	376
2	Beer's limit (µg/mL)	5-35
3	Corrélation coefficient (R^2)	0.999
4	Slope	0.0463

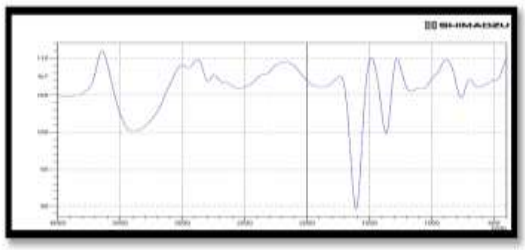
Summary Report of calibration curve for Lornoxicam

The calibration curve for Lornoxicam was obtained by using the 0-35 µg/mL solution of Lornoxicam in Phosphate buffer pH 7.4. The absorbance was measured at 376 nm. The calibration curve for Lornoxicam was shown in figure 10. The absorbance obtained for the given concentrations was shown in Table 12. The calibration curve (Table 13) shows regression equation Y= 0.046x and R^2value 0.999. The result revealed that drug concentration between 0 – 35 µg/mL follows Beer Lambert's law as the regression coefficient was 0.999.

3.1.7. Identification of Drug- Lornoxicam by FT-IR Spectroscopy

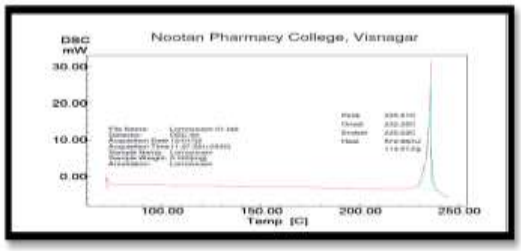
Potassium bromide IR disc was prepared using 1mg of Lornoxicam on Hydraulic Pellet press and scanned in the region of 4000-400 cm^{-1}. The obtained IR Spectrum was compared with reference spectrum of Lornoxicam.

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781



IR spectrum of Lornoxicam

All major peaks of Lornoxicam drug was observed at wave numbers 3417 (2 aromatic N – H stretching vibrations) and 1637 (Aromatic C = O stretching vibrations), 1082 (S = O stretching), 3059 (C- H aromatic), 1539 (C=C aromatic), 1327 (C- N) and 621 (C- Cl) were observed which confirms identity and purity of drug.

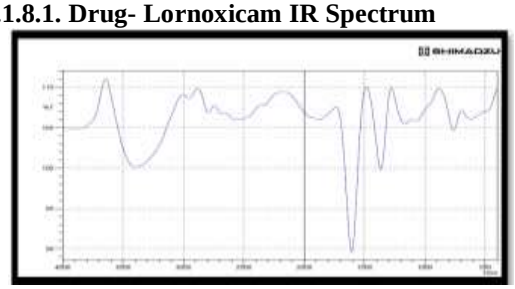


Identification of Lornoxicam by DSC

The DSC curves of commercial simvastatin Figure 11 shows a sharp endotherm at 232.25 ° C might be due to the melting point of Lornoxicam. The obtained FT-IR spectrum and DSC graph compiles with standard data which further confirms identity and purity of Drug.

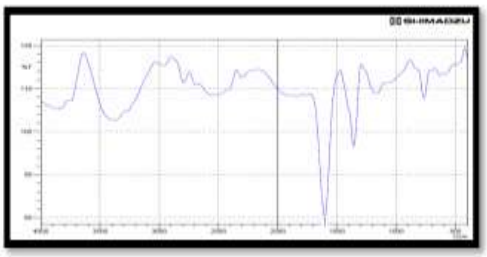
3.1.8. Drug- Excipients Compatibility Studies by FT-IR

3.1.8.1. Drug- Lornoxicam IR Spectrum



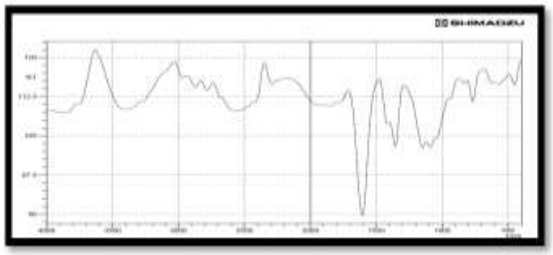
FT-IR Spectrum of sample Drug Lornoxicam

3.1.8.2. Lornoxicam + Eudragit RS 100 IR Spectrum



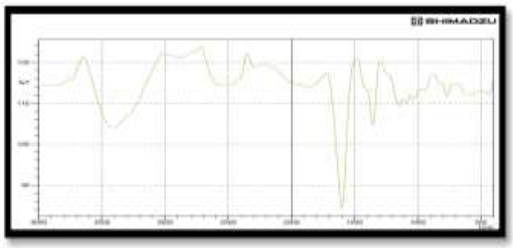
FT-IR Spectrum ofLornoxicam and Eudragit RS 100

3.1.8.3. Lornoxicam + Ethyl Cellulose IR Spectrum



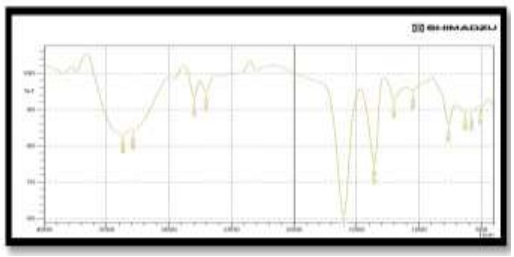
FT-IR Spectrum of Lornoxicam +Ethyl cellulose

3.1.8.4. Lornoxicam + HPMC K4 M



FT-IR Spectrum of Lornoxicam +HPMC K4 M

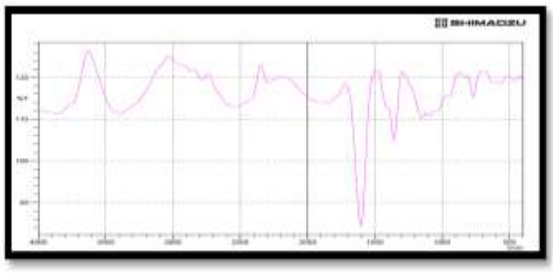
3.1.8.5. FT-IR Spectrum of Lornoxicam + HPMC K 15 M



FT-IR Spectrum Lornoxicam +HPMC K 15 M

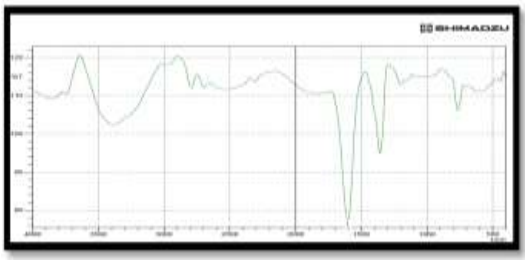
3.1.8.6. FT-IR Spectrum of Lornoxicam + HPMC k 100 M

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781



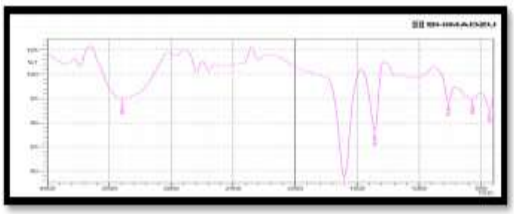
FT-IR Spectrum Lornoxicam +HPMC K 100 M

3.1.8.7. FT-IR Spectrum of Lornoxicam + Chitosan

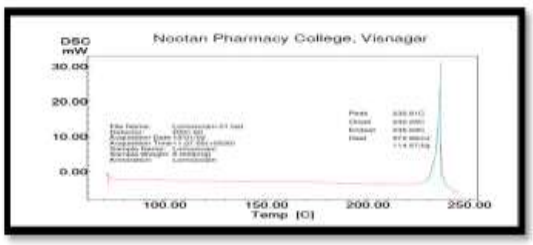


FT-IR Spectrum Lornoxicam + Chitosan

3.1.8.8. Formulation (Lornoxicam + Eudragit RS 100 + Ethyl Cellulose + HPMC K 4 +HPMC K 15+HPMC K 100+ Chitosan) IR Spectrum



FT-IR Spectrum Formulation



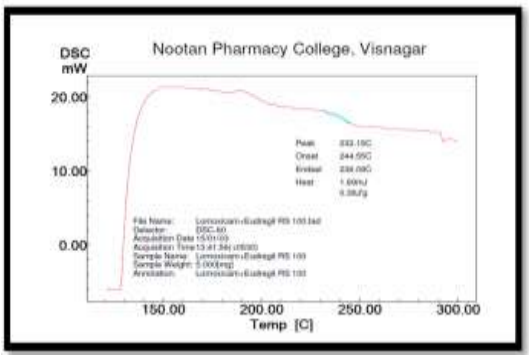
DSC graph of Lornoxicam

3.1.9.2. DSC graph of Lornoxicam and Eudragit RS 100

Above Figure shows IR spectrum of Lornoxicam and drug with all excipients which used in formulation having characteristic absorption band in the following region. The IR spectrum of standard drug Lornoxicam and Ethyl cellulose, HPMC K4M, HPMC K 15, HPMC K100,Eudragit RS 100, Chitosan and formulation shows same peak, functional group at the different frequency. The results revealed no changes seen in the IR peaks of Lornoxicam, when mixed with polymers. These observations indicate the compatibility of polymers with Lornoxicam. FT-IR Spectroscopy was used to study the possible interaction between pure Lornoxicam and with other ingredients in patch formulation. There was no significant difference in the FTIR spectra of pure drug, physical mixture and formulation. All major peaks of Lornoxicam were observed at wave numbers 1637 (aromatic C=O stretching vibrations) and 1082 (S =O stretching vibrations), 1327 (C - N stretching), 623 (C- Cl bending), 2924 (C-H(aromatic) Stretching and 1541 (C = C stretching) were retained in physical mixtures and Patch which clearly indicate that no interaction exists between pure drug and all ingredient. The characteristic peaks of drug appear in the spectra of mixture of drug and excipient same wave number, indicating no modification or interaction between the drug and the excipients. From that it can conclude that the drug has maintained its identity without losing its characteristic properties.

3.1.9. Drug-Excipients Compatibility Studies by DSC

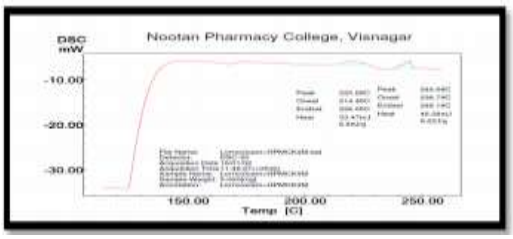
3.1.9.1. DSC graph of Lornoxicam



DSC graph of Lornoxicam and Eudragit RS 100

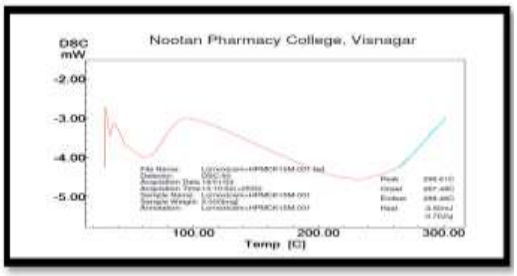
3.1.9.3. DSC graph of Lornoxicam and HPMC K4 M

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781



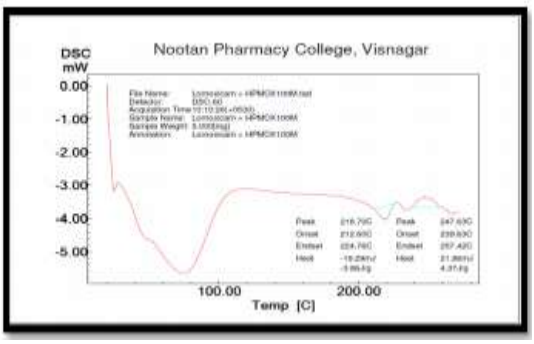
DSC graph of Lornoxicam and HPMC K 4 M

3.1.9. 4. DSC graph of Lornoxicam and HPMC K 15 M



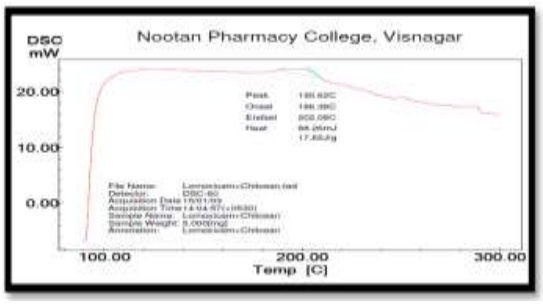
DSC graph of Lornoxicam and HPMC K 15 M

3.1.9.5. DSC graph of Lornoxicam and HPMC K 100 M



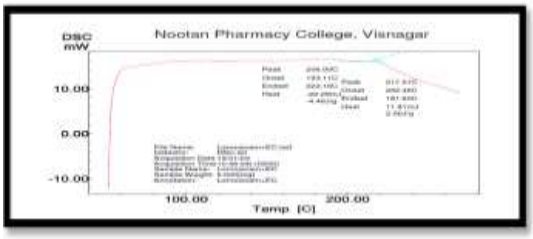
DSC graph of Lornoxicam and HPMC K 100 M

3.1.9.6. DSC graph of Lornoxicam and Chitosan



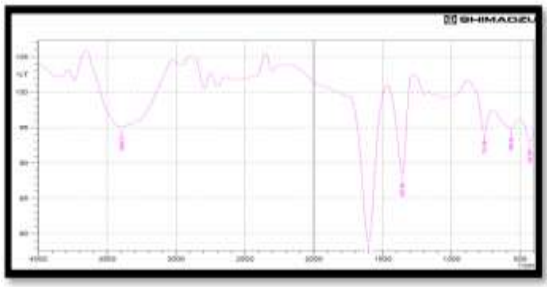
DSC graph of Lornoxicam and Chitosan

3.1.9.7. DSC graph of Lornoxicam and Ethyl Cellulose



DSC graph of Lornoxicam and Ethyl Cellulose

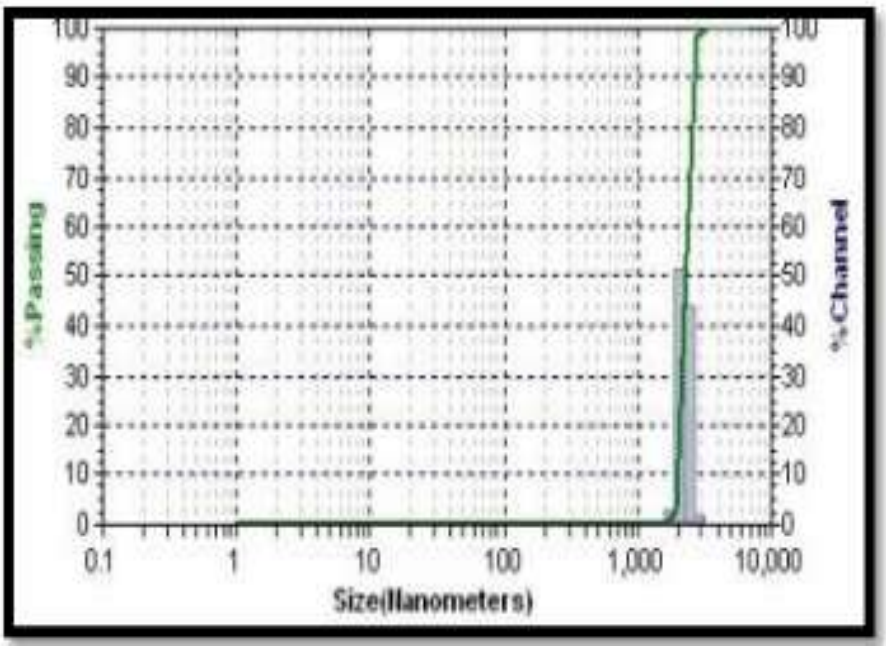
3.1.9.8. DSC graph of Lornoxicam and Formulation



DSC graph of Lornoxicam and Formulation

Above figures depict the DSC of drug Lornoxicam and Ethyl cellulose, HPMC K4M, HPMC K 15, HPMC K100, Eudragit RS 100, Chitosan and formulation. The thermogram of pure Drug exhibits a sharp melting endotherm at 232.25^{o}C which was compared with other DSC thermogram and shows indicate no alteration.

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781



Batch	Polymer Concentra	Polymer Type	Solvent Type	Solvent Volume (mL)	Plasticizer Type	Plasticizcon concentratio mL)
PRELIMINARY SELECTION OF SOLVENT TYPE AND VOLUME						
LMP1	250	HPMC K 4 M	DCM	7	PEG 400	1.4
LMP2	250	HPMC K 4 M	DCM	10	PEG 400	1.4
LMP3	250	HPMC K 4 M	DCM	14	PEG 400	1.4
LMP4	250	HPMC K 4 M	Methanol	14	PEG 400	1.4
LMP5	250	HPMC K 4 M	DCM: Methanol (3:2)	8.4:5.6	PEG 400	1.4
LMP6	250	HPMC K 4 M	DCM: Methanol (2:3)	5.6:8.4	PEG 400	1.4
LMP7	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4
LMP8	250	HPMC K 4 M	DCM: Methanol (1:4)	2.8:11.2	PEG 400	1.4
PRELIMINARY SELECTION OF CONCENTRATION OF POLYMER						
LMP9	200	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4
LMP10	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4
LMP11	300	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4
LMP12	350	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

PRELIMINARY SELECTION OF POLYMER TYPE						
LMP13	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4
LMP14	250	HPMC K 15 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4
LMP15	250	HPMC K 100 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4
LMP16	250	EC	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4
LMP17	250	Chitosan	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4
LMP18	250	ERS 100	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4
PRELIMINARY SELECTION OF PLASTICIZER TYPE AND CONCENTRATION						
LMP19	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1
LMP20	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.2
LMP21	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.4
LMP22	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG 400	1.6
LMP23	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	Tween80	1.6
LMP24	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG Tween 80	1:0.6
LMP25	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG Tween 80	1.2:0.4
LMP26	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG Tween 80	0.8:0.8
LMP27	250	HPMC K 4 M	DCM: Methanol (4:1)	11.2:2.8	PEG Tween 80	0.6:1.0

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

6540	0.00	100.00	18.00	0.00	0.00
5500	0.00	100.00	15.19	0.00	0.00
4620	0.00	100.00	12.77	0.00	0.00
3890	0.00	100.00	10.74	0.00	0.00
3270	1.74	100.00	9.03	0.00	0.00
2750	44.08	98.26	7.60	0.00	0.00
2312	51.24	54.18	6.39	0.00	0.00
1944	2.94	2.94	5.37	0.00	0.00
1635	0.00	0.00	4.52	0.00	0.00
1375	0.00	0.00	3.80	0.00	0.00
1156	0.00	0.00	3.19	0.00	0.00
972.0	0.00	0.00	2.690	0.00	0.00
818.0	0.00	0.00	2.260	0.00	0.00
687.0	0.00	0.00	1.900	0.00	0.00
578.0	0.00	0.00	1.600	0.00	0.00
486.0	0.00	0.00	1.340	0.00	0.00
409.0	0.00	0.00	1.130	0.00	0.00
344.0	0.00	0.00	0.950	0.00	0.00
289.0	0.00	0.00			
243.0	0.00	0.00			
204.4	0.00	0.00			
171.9	0.00	0.00			
144.5	0.00	0.00			
121.5	0.00	0.00			
102.2	0.00	0.00			
85.90	0.00	0.00			
72.30	0.00	0.00			
60.80	0.00	0.00			
51.10	0.00	0.00			
43.00	0.00	0.00			
36.10	0.00	0.00			
30.40	0.00	0.00			
25.55	0.00	0.00			
21.48	0.00	0.00			

Summary

Data	Value
MV(nm):	2,326
MN(nm):	2,260
MA(nm):	2,303
CS:	2.605
SD:	250.6
PDI:	0.02210
Mz:	2,324
σ1:	238.7
Skl:	60.16
Kg:	838.7

Pure Lornoxicam used for the study was characterized and found relatively small particles as reported which can easily permeable through the skin membrane.

3.1.9.10 Selection of Formulation and Process Variables of Preliminary Trial Batches of Lornoxicam Matrix Patch

Formulation Design of Trial batches for Lornoxicam Matrix Patch

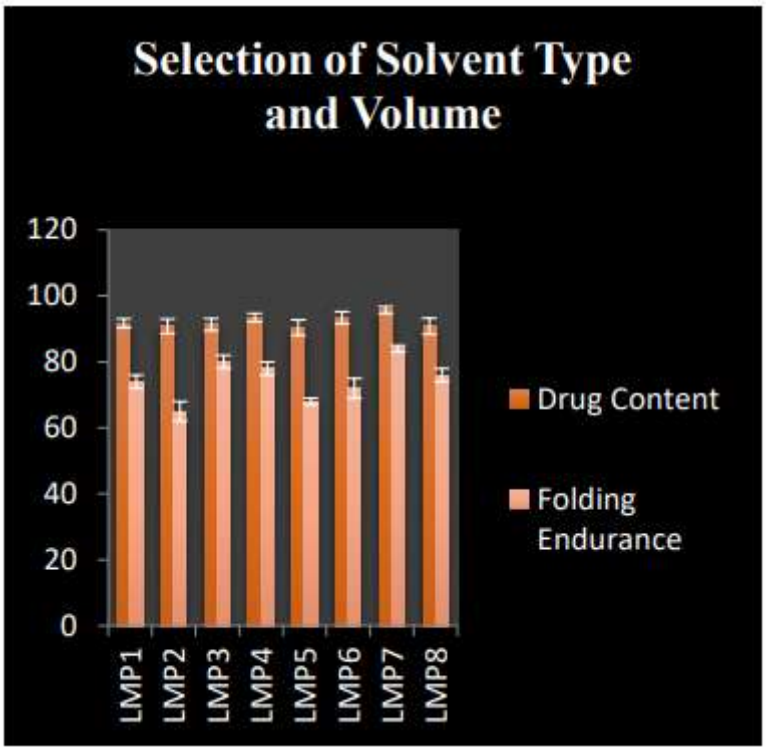
3.2.1. Preliminary selection of solvent type and volume

Preliminary selection of solvent type and volume

	Physical Appearance	Thickness (mm ±S.D.) (n=3)	Weight Uniformity (Gm ±S.D.) (n=3)	Drug Content (% ±S.D.) (n=3)	Folding Endurance (±S.D) (n=3)

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

LMP1	Air bubbles with white spots	0.26	0.225	91.72	74
LMP2	Air bubbles with white spots	0.28	0.289	90.78	65
LMP3	Air bubbles with white spots	0.25	0.270	91.32	80
LMP4	Air bubbles with white spots	0.29	0.224	93.45	78
LMP5	More entrapped air bubbles	0.27	0.250	90.42	68
LMP6	More entrapped air bubbles	0.26	0.280	93.39	72
LMP7	Thin Clear film without air bubbles and good elasticity	0.22	0.251	95.74	84
LMP8	Air bubbles with white spots	0.25	0.225	90.81	76

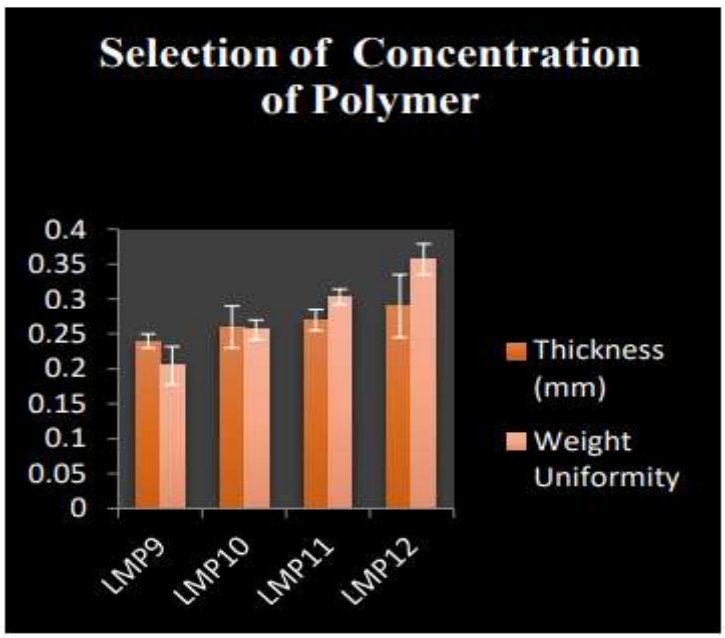


DSC graph of Lornoxicam and Formulation

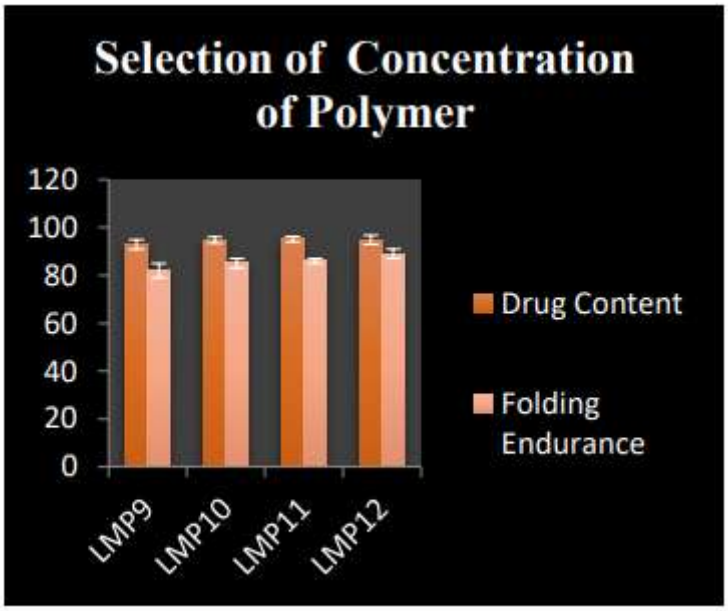
International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

3.2.2. Selection of concentration of polymer

	Physical Appearance	Thickness (mm ±S.D.)(n=3)	Weight Uniformity (Gm ±S.D.) (n	Drug Content (% ±S.D.) (n=3)	Folding Endurance (±S.D) (n=3)
LMP9	Very thin more trans parent, uneven and good elasticity	0.24	0.205	92.87	82
LMP10	Thin transparent uniform flexible and good elasticity	0.26	0.256	94.74	85
LMP11	Thin transparent uniform flexible and good elasticity	0.27	0.303	95.13	86
LMP12	Thin transparent, uniform sticky good elastic	0.29	0.357	94.83	89



International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781



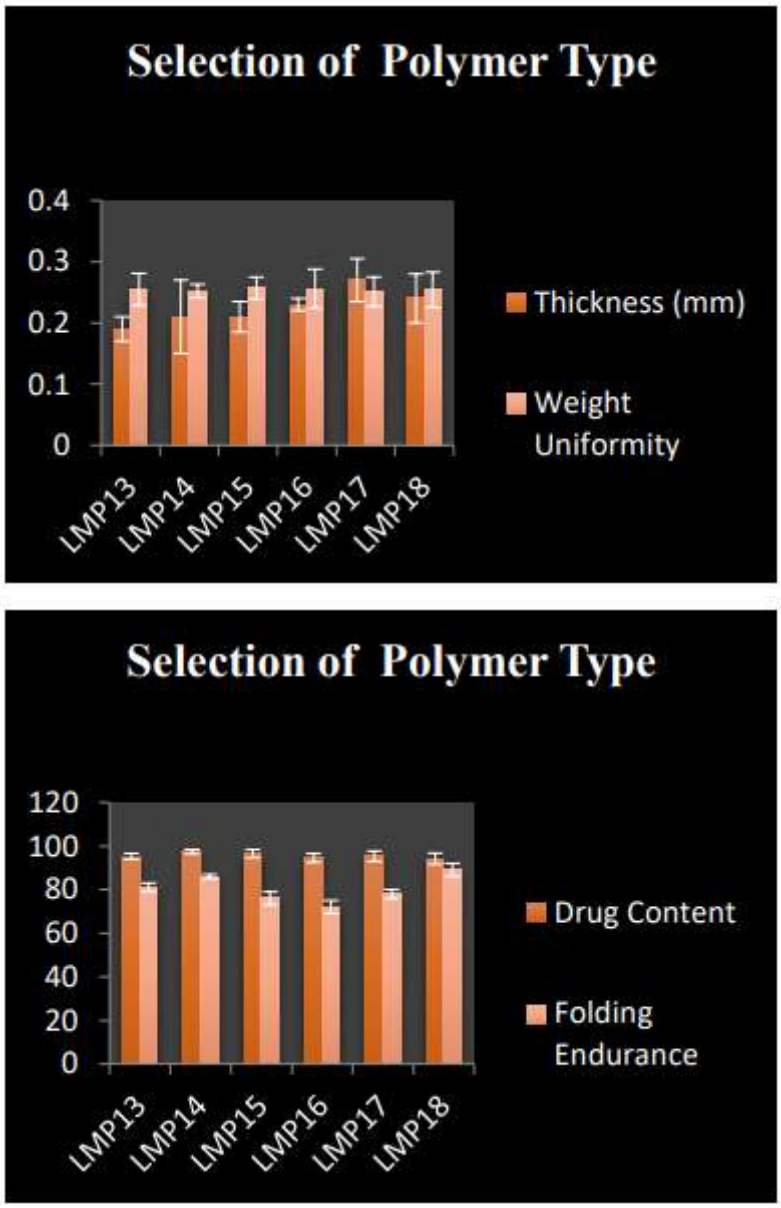
DSC graph of Lornoxicam and Formulation

3.2.3. Selection of polymer type

	Physical Appearance	**Thickness (mm ±S.D.) (n=3)**	**Weight Uniformity (Gm ±S.D.) (n=3)**	**Drug Content (% ±S.D.) (n=3)**	**Folding Endurance (±S.D) (n=3)**
LMP13	Thin more transparent uniform flexible & good elasticity	0.19	0.255	95.22	81
LMP14	Thin more transparent uniform flexible & good elasticity	0.21	0.252	97.41	86
LMP15	Thin more transparent uniform flexible & good elasticity	0.21	0.257	96.45	76
LMP16	Thin less transparent uniform flexible & good elasticity	0.23	0.256	94.52	72

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

LM P17	Thin less transparent uniform flexible & good elasticity	0.27	0.251	95.32	78
LM P18	Thin less transparent uniform flexible & good elasticity	0.24	0.254	94.21	89

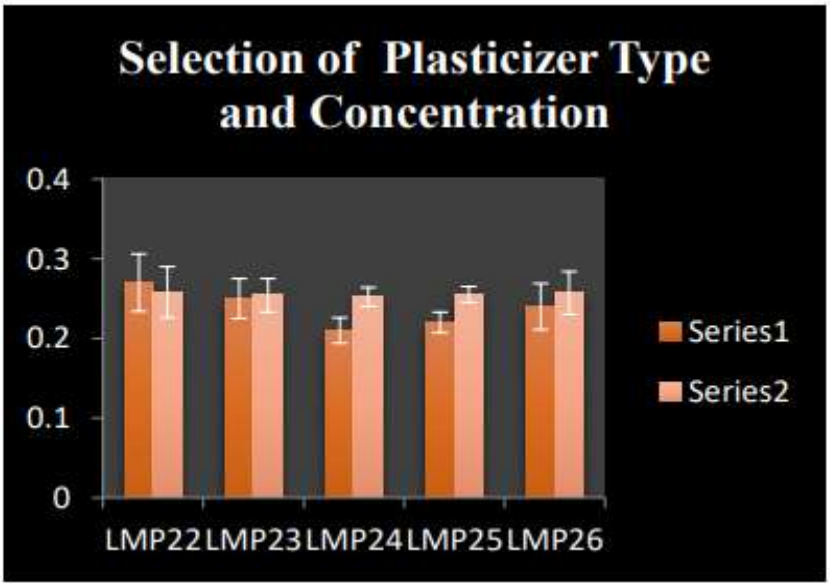


DSC graph of Lornoxicam and Formulation

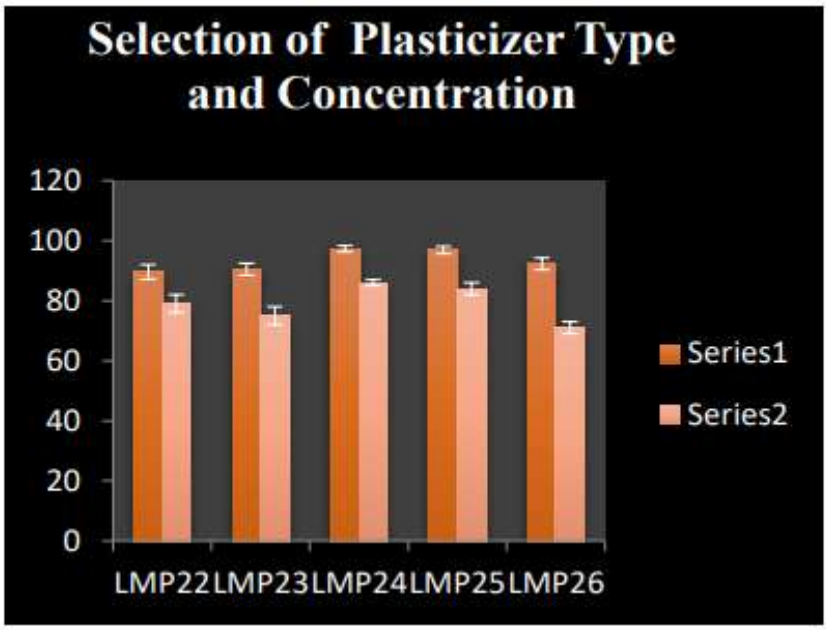
International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

3.2.4. Selection of plasticizer type and concentration

	Physical Appearance	Thickness (mm ±S.D.) (n=3)	Weight Uniformity (Gm ±S.D.) (n=3)	Drug content (% ±S.D.) (n=3)	Folding Endurance (±S.D) (n=3)
LMP19	No film formation	-	-	-	-
LMP20	No film formation	-	-	-	-
LMP21	No film formation	-	-	-	-
LMP22	Thin transparent, uniform sticky good elastic	0.27	0.258	89.58	79
LMP23	Thin transparent, uniform sticky good elastic	0.25	0.254	90.45	75
LMP24	Thin more transparent uniform flexible & good elasticity	0.21	0.252	97.29	86
LMP25	Thin more transparent uniform flexible & good elasticity	0.22	0.255	96.87	84
LMP26	Thin transparent, uniform sticky good elastic	0.24	0.257	92.26	71
LMP27	No film formation	-	-	-	-



International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781



DSC graph of Lornoxicam and Formulation

IV. DISCUSSION

Effect of Solvent type and Volume on Transdermal Matrix Patch

Transdermal patches were prepared with HPMC v a r i o u s grades, EC, Chitosan, and EudragitRS-100 using different casting solventslike1) Dichloromethane 2) Methanol & 3) D C M : Methanol. Obtaining films of were evaluated for different physical property in terms of clarity, frothing, smoothness. Film prepared with first solvent system (1) showed more and more entrapped air bubbles poor appearance because of rapid evaporation of solvent. Film prepared with Second solvent system. (2) showed film with white spot because polymer not fully dissolved in(2)solvent system. Film prepared with third solvent system (3) showed clear film with out any air bubble and also showed good elasticity and strength. So this solvent system was selected for further study.

Effect of Polymer type and Concentration on Transdermal Matrix Patch

The prepared transdermal patches were evaluated for their Physico-Chemical properties like physical appearance, weight uniformity, Drug content, folding endurance and flateness. The physical appearance of the various formulations was uniform, transparent, smooth and flexible in nature. The transparencies of HPMC polymeric patch were more than Eudragit and Chitosan due to less water permeability of eudragit.

1. Thickness: The thickness of patches varies between 0 .19±0.029 t o 0.29±0.027. Low standard deviation values show uniformity of the patches prepared by solvent casting method. As the viscosity of polymer 0 20 40 60 80 100 120 Selection of Polymer Type Drug Content Folding Endurance 0 0.1 0.2 0.3 0.4 LMP22LMP23LMP24LMP25LMP26 Selection of Plasticizer Type and Concentration Series1 Series2 0 20 40 60 80 100 120 LMP22LMP23LMP24LMP25LMP26 Selection of Plasticizer Type and Concentration Series1 Series2 increases, the thickness also increases due to weak hydrogen bonding with water molecule.

2. Drug content: Drug content was found to be92.87% to 95.13%. From there sult it can be concluded that as the amount of low viscosity hydrophilic polymer concentration increases, the drug content also increases due to relatively weak hydrogen bonding between the polymeric moleculeform a less cross-linking matrix structure.

3. Foldingendurance: Folding endurance shows the mechanical strength to with stand with the condition.

Effect of Plasticizer type and Concentration on Transdermal Matrix Patch

From the preliminary formulation it can be find out at which concentration of polymer and plasticizer, the transdermal film forms. Hence the polymeric blend produce controlled release due to cross-linking structure in nature. There was No

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 2 Mar-Apr 2021, pp: 857-883 www.ijprajournal.com ISSN: 2249-7781

film formation at lower concentration of Plasticizer and in appropriate ratio of plasticizer i.e., PEG 400: Tween 80.

V. SUMMARY AND CONCLUSION

Transdermal therapeutic systems are defined as self contained, discrete dosage forms which, when applied to the intact skin, deliver the drug(s), through the skin, at a controlled rate to the circulation . The transdermal drug delivery system has potential advantages of avoiding hepatic first pass metabolism, maintaining constant blood levels for extended period of your time leading to a discount of dosing frequency, improved bioavailability, decreased gastrointestinal irritation that occur thanks to local contact with gastric mucosa and improved patient compliance. a number of the non-steroidal anti-inflammatory drugs have already got been formulated and evaluated as transdermal patches but most of them still been unexplored. Transdermal formulation of non-steroidal anti-inflammatory is promising aspect in near future. a couple of non-steroidal anti inflammatory drugs like Ketorolac, Aceclofenac, Diclofenac, Etoricoxib, Ketoprofen, Piroxicam, etc are incorporated in transdermal dosage form and been evaluated. within the present study transdermal patches of Lornoxicam were prepared using hydrophilic polymer and hydrophobic polymer. The patches were developed for Lornoxicam; dose in given area of 28 cm2 was 8 mg, using various grades of HPMC, EC, Chitosan and Eudragit RS 100 as a parent polymer to sustain the discharge up to 24 hours. By solvent evaporation method the patches were prepared, with incorporation of combination of PEG 400 and Tween 80 as a plasticizer. The preformulation study of Lornoxicam was performed via. freezing point , solubility, partition coefficient and drug polymer compatibility study by FT-IR and DSC and complies with standard data which further conformed drug identity and purity. Physicochemical parameters like weight uniformity, thickness uniformity, folding endurance and Drug content.

REFERENCES

[1]. Kumar R and Philip A, "Modified Transdermal Technologies: Breaking the Barriers of Drug Permeation via the Skin." Tropical Journal of Pharmaceutical Research 2007, 6, 633-644.

[2]. Prausnitz, M.R "Transdermal drug delivery" Nat Biotechnol,2008,26,1261-1268.

[3]. Jain NK. Advances in controlled and novel drug delivery, 1st Ed., CBS Publishers and distributors, New Delhi, 2001 pp.108-110.

[4]. Loyd V. Allen Jr, Nicholas G. Popovich, Howard C. Ansel. Pharmaceutical dosage forms and drug delivery systems, 8th Edition., Wolter Kluwer Publishers,New Delhi, 2005 pp. 298-299.

[5]. Vyas SP. and Khar RK. Controlled drug delivery: Concepts and Advances; 1st Ed., Vallabh Prakashan, pp 411.

[6]. Sharma N, Agarwal G, Rana AC, Bhat Z and Kumar D: A Review: Transdermal drug delivery system: A tool for novel drug delivery system. International Journal of Drug Development and Research 2011,3,70-84.

[7]. Rastogi, V., Yadav,P. Transdermal drug delivery system: An overview, Asian Journal Of Pharmaceutics,2012,6,161- 170.

[8]. Arunachalam,A., ,Karthikeyan, M., Kumar,V. D., Prathap, M., Sethuraman, S., Ashutoshkumar, S., Manidipa, S. "Transdermal Drug Delivery System: A Review" Current Pharma Research,2010,1,70-81.

[9]. Patel RP and Baria AH. " Formulation and evaluation considerations of transdermal drug delivery system" International Journal of Pharmaceutical Research, 2011, 3, 1-9.

[10]. Bhargava T, Ramchandani U, Shrivastava SK and Dubey PK "Current trends in NDDS with special reference to NSAIDs" International Journal of Pharmacy and Bio Sciences 2011, 2, 92-114.

[11]. Vishwakarma S.K., NiranjanS.K., Irchhaiya,R.,Kumar,N "A Novel transdermal drug delivery system, International Journal of research of pharmacy,2012, 3,39-44.

[12]. Shingade G.M.,Gaikwad, D.D. "Review on: recent trend on transdermal drug delivery system" Journal of Drug Delivery & Therapeutics,2012, 2 , 66-75.

[13]. Mathur, V., Satrawala ,Y., Rajput, M. S., "Physical and chemical penetration enhancers in transdermal drug delivery system" Asian Journal of Pharmacy,2010, 4,173- 183.

[14]. Jayaswal, S.B. and Sood, R., The Eastern Pharmacist, 1987, 30, 47-50.

[15]. Patani, G.A. and Chien, Y.W., In; Swerbrick, J. and Boylon, J.C., Eds. "Encyclopedia of Pharmaceutical

Technology", Marcel Dekker Inc., New York, 1999, 18, 317-320, 329.
[16]. Divyeshpatel "Transdermal drug delivery system: A review" International journal of pharmaceutical and toxicology,2011, 1, 62-72.
[17]. Alexander,A.,Dwivedi,S.,Ajazuddin,giri,T.K .,Saraf,S.,Sara f,S.," Approaches for breaking the barriers of drug permeation through transdermal drug delivery" Journal of Controlled Release,2012, 164, 26-40.
[18]. Vishwakarma S.K "A Novel transdermal drug delivery system" International Journal of research of pharmacy,2012, 3, 39-44.
[19]. Hanumanaik m. "design, evaluation and recent trends in transdermal drug delivery system: a review" International Journal of pharmaceutical sciences and research,2012, 3, 2393-2406.
[20]. Sunita, A. "Transdermal Drug Delivery System: A review" THE PHARMA INNOVATION, 2012, 1,66-75.
[21]. Chein Y.W. "Transdermal drug delivery and delivery system. In, Novel drug delivery system" Marcel Dekker, Inc., New york, 1992 pp.301-381.
[22]. Willams A.C and barry B. W., " penetration Enhancers" Adv. Drug Del.Rev.2004,56, 603-618.
[23]. ellet M, Raghavan S.L, Hadgraft J and DavisA.F. "The application of supersaturated systems to percutaneous drug delivery In: Guy R.H and Hadgraft J. Transdermal drug delivery, Marcel Dekker, Inc., New york 2003, pp. 305- 326.
[24]. Brown M.B and Jones S. "A. Hyaluronic acid: a unique topical vehicle for localized drug delivery of drugs to the skin". JEDV 2000,19, 308-318.
[25]. Tsai J.C "Metabolic Approaches to Enhance Transdermal drug delivery". Jour. pharm. Sci, 1998, 85, 643-648.
[26]. Shivakumar HN et al, "Formulation, characterization and evaluation of matrix-type transdermal patches of a model antihypertensive drug". Asian J Pharm ,2009,3,59-64.
[27]. The British Pharmacopoeia., London: Her majestys stationary office; 2001.
[28]. Young-Chang Ah et al, "A novel transdermal patch incorporating meloxicam: In vitro and in vivo characterization." International Journal of Pharmaceutics,2010,385,12-19.
[29]. Hongeli Xi et al, "Transdermal patches for site-specific delivery of an astrozole: In vitro and local tissue disposition evaluation." International Journal of Pharmaceutics,2010,391,73-78.
[30]. Ubaidulla U et al, "Transdermal therapeutic system of carvedilol: effect of hydrophilic and hydrophobic matrix on in vitro and in vivo characteristics." AAPS PharmSciTech,2007,8(1),E13-20.
[31]. Vijayan, V. et al,"Development and physiochemical, in vitro evaluation of Antihypertensive transdermal Patches." J. Pharm.Sci. & Res., 2010, 2, 171-177.
[32]. Ramarao P et al, "Drug release kinetics from polymeric films containing Propranolol hydrochloride for transdermal transdermal use". Pharm dev and tech 2000, 5, 465-472.
[33]. Mamatha T et al, "Transdermal drug delivery for Atomoxetine hydrochloride- in vitro and ex vivo evaluation." Current Trends in Biotechnology and Pharmacy, 2009, 3, 188-196.
[34]. Sanap GS et al, "Preparation of transdermal monolithic systems of indapamide by solvent casting method and the use of vegetable oils as permeation enhancer." Int J Green Pharm,2008,2,129-133.
[35]. Murthy TEGK et al, "Effect of casting solvent on permeability of antihypertensive drugs through ethyl cellulose films." J SciIndRes ,2008,67,147-50.
[36]. Patel HJ et al, "Design and evaluation of amlodipine besilate transdermal patches containing film former." Int J Pharma Res Dev ,2009,7,1-12.
[37]. Richasanan et al, "Transdermal drug delivery system :A review." International Journal of Research and Development in Pharmacy and Life Sciences, 3, 748- 765.
[38]. Murthy TEGK et al, "Effect of casting solvent and polymer on permeability of propranolol hydrochloride through membrane controlled transdermal drug delivery system." Indian J Pharm Sci, 2007,69(5),646-650.
[39]. Subramanian K et al, "An Approach to the formulation and evaluation of transdermal DDS of isoxsuprineHCl." Int J Pharm SciTech,2008,1(1),22-28.Sankar V et al, "Design and evaluation of nifedipine transdermal patches." Indian J Pharm Sci,2003,65(5),510- 525.
[40]. Shinde AJ et al, "Development and

characterization of transdermal therapeutics system of tramadol hydrochloride." Asian J Pharm ,2008,2,265-279.

[41]. Pandit V et al, "Formulation and evaluation of transdermal films for the treatment of overactive bladder." Int J Pharm Tech Res ,2009,1(3),799-804.

[42]. Rao V et al, "Transdermal drug delivery system for atomoxetine hydrochloride-in vitro and ex vivo evaluation." Current Trends in Biotechnology and Pharmacy ,2009,3(2),188-196.

[43]. Satturwar PM et al," Evaluation of polymerized rosin for the formulation and development of transdermal drug delivery system: A Technical Note." AAPS PharmSciTech.,2005,6(4),E649-54.

[44]. http://en.wikipedia.org/wiki/Draiz_test accesson 29-08- 2010.

[45]. http://www.nanosilverinternational.com/pdf/ Research skin Irritation tests.pdfaccess on 29-08-2010.

[46]. Changshun Ren et al, "Design and in vivo evaluation of an in dapamide transdermal patch."International Journal of Pharmaceutics,2009,3701,129-135.