IJMPR 2021, 5(5), 70-73

International Journal of Modern Pharmaceutical Research

www.ijmpronline.com

ISSN: 2319-5878
IJMPR
Research Article

SJIF Impact Factor: 5.273

DEVELOPMENT AND EVALUATION OF MATRIX TYPE TRANSDERMAL PATCHES OF PROPRANOLO HCL

***Kapil Kumar, Gurleen Kaur, Bhawan Singh and Deepak Teotia**

Department of Pharmaceutics, Global Institute of Pharmaceutical Education and Research, Kashipur- 244713, Uttarakhand, India.

Received on: 15/08/2021
Revised on: 05/09/2021
Accepted on: 26/09/2021

***Corresponding Author**
Kapil Kumar
Department of Pharmaceutics, Global Institute of Pharmaceutical Education and Research, Kashipur- 244713, Uttarakhand, India.

ABSTRACT

The purpose of this research was to develop a matrix-type transdermal therapeutic system containing drug propranolol hydrochloride with different ratios of (PVP HPMC) polymeric systems by the solvent evaporation technique by using 30 % w/w of di-butyl phthalate to the polymer weight, incorporated as plasticizer. The physicochemical compatibility of the drug and the polymers studied by infrared spectroscopy suggested absence of any incompatibility. Formulated transdermal films were physically evaluated with regard to thickness, weight variation, drug content, flatness, folding endurance moisture. All prepared formulations indicated good physical stability. In-vitro permeation studies of formulations were performed by using Franz diffusion cells.It shown that drug release follows zero order and the mechanism of release is diffusion from the polymer.

KEYWORDS: Transdermal films, Franz diffusion cells, solvent evaporation technique, propranolohcl.

INTRODUCTION

Transdermal drug delivery system (TDDS): During the last decade, transdermal delivery of drugs has received increasing attention in the face of growing awareness that administered by conventional means are frequently excessively toxic and sometimes ineffective. Thus, conventionally administered drugs in the form of pills, capsules, injectables, and ointments are introduced into the body as pulses that usually produce large fluctuation of drug concentration in the bloodstream and tissues and, consequently, unfavorable patterns of efficacy and toxicity.[1-4] Transdermal delivery affords an improved approach to theadministration of drugs by maintaining a therapeutic but constant concentration of drug in the blood for a desired period of time, usually between 1 and 7 days. A transdermal patch or skin patch is a medicated adhesive patch that is placed onthe skin to deliver a time released dose of medication through the skin and into the blood stream.[5]

Formulation Design and Preparation of Transdermal Patches

The backing membrane was prepared by solvent evaporation method. A weighed amount of polyvinyl alcohol (4 % w/w of PV A) was added to a requisite volume of warm distilled water. A homogeneous solution was made by constant stirring and intermittent heating at 60°C on a magnetic stirrer for about five minutes. The moulds were then kept in dryer at 60°C ± 2°C for 6 hours to get uniform, smooth, transparent backing membrane.[6]

Incorporation of drug loaded polymer matrix onto the backing membrane

Matrix type transdermal patches containing propranolol hydrochloride were prepared using different ratios of ethyl cellulose (EC), polyvinyl pyrrolidone (PVP) (Table 6.1) and ethyl cellulose, hydroxypropyl methyl cellulose (HPMC) (Table 6.2) combination by solvent 154 evaporation technique in cylindrical glass moulds opened from both end. The bottom of the mould was wrapped with aluminum foil on which the backing membrane was cast earlier. The two polymers in each combination were weighed in requisite ratio and were then dissolved in ethanol. The ratios of the polymers were varied for all the formulations keeping the total weight fixed at 500 mg. Dibutyl phthalate 30 % w/w of polymer composition was added as plasticizer. Propranolol hydrochloride at a concentration of 20 % w/w of polymer was added and stirred with a mechanical stirrer for 15 minutes to get a homogeneous dispersion. The dispersion (2 ml) was cast on the prepared PV A backing membrane in each mould. The rate of evaporation was controlled by inverting a funnel over the mould and dried at 40°C for 6 hours. After drying, all the patches were removed from the moulds and were kept in desiccator for further study.[7-9]

Tensile strength[9,10]

The tensile strength measurement was done using an instrument assembled in the laboratory.

Water vapour transmission (WVT) rate[11,12]

WVT rate = WL/ S

Where, W = water vapour transmitted in gm,
L =thickness of the transdermal patch in em,
S = exposed surface area in cm^2

Drug content study: This test provides the means for measuring the amount of drug that is actually present in each transdermal patch formulations. Transdermal patches were taken individually, crushed and taken in a 100 ml volumetric flask. The volume was made up to 100 ml with distilled water and kept for 48 hours at room temperature with occasional shaking. After 48 hours, samples are withdrawn, suitably diluted and analyzed using UV -visible spectrophotometer at 290 nm for the actual amount of drug present in the patches.[13]

SKIN PERMEATION PROFILE AND DRUG RELEASE KINETICS FROM THE TRANSDERMALPATCHES

In vitro permeation studies of drug loaded transdermal patches

Drug release studies are required for predicting the reproducibility of rate and duration of drug release. The importance of polymer dissolution on drug release from matrices has been known for ensuring the sustained release performance of the delivery system Skin, the largest organ of the human body, provides a painless and patient-friendly interface for systemic drug administration. In addition to provide a leading edge over injections and oral routes by increasing patient compliance and avoiding first pass metabolism, respectively; the transdermal route provides sustained and controlled delivery of drugs. It also allows continuous input of drugs with short biological half-lives and can eliminate pulsed entry into systemic circulation, which often causes undesirable side effects.[14-16]

In vitro permeation studies using dialysis membrane

In vitro pem1eation studies were carried out using modified Keshary-Chien diffusion cell. The dialysis sac was previously soaked for 24 hours in distilled water. The patches were adhered to the barrier membrane (dialysis membrane) and the sac is tied firmly to the donor compartment of the Keshary-Chien diffusion cell, the receptor compartment of which is filled with 100 ml phosphate buffer of pH 7 .4. The donor compartment is lowered to the receptor compartment in such a way that the dialysis sac just touches the media of the receptor compartment. The total setup was placed on a thermostatically controlled magnetic stirrer set at 37 ± 1 °C. The content of the diffusion cell was stirred using a teflon coated bead at a constant speed (l 00 rpm). Samples were withdrawn (I ml) at predetermined time intervals and replaced with same amount of phosphate buffer of pH 7.4 to maintain the sink condition. After suitable dilution, the samples were analyzed for drug content using UV-visible spectrophotometer at A max 290 nm against a blank. The permeation study was carried out for 48 hours.[17-21]

In vitro skin permeation studies

In vitro skin permeation study was performed taking the skin of albino rat. Young albino rat weighed between (200 gm-250 gm) were taken and sacrificed by excess chloroform inhalation. The abdominal hairs were removed with marketed hair removers. The abdominal skin was carefully separated from the body, with the dermis part remaining intact. Subcutaneous tissues were surgically removed. The skin was then made free from hair and fat by treating with 0.32 M ammonia solution for 35 minutes.

The samples were then analyzed spectrophotometrically at the A max 290 nm against a blank.[15]

RESULTS AND DISCUSSION

Analytical techniques

Table 1: Formulation of propranolol hydrochloride transdermal patches containing ethyl cellulose and polyvinyl pyrrolidone.

Sl.No.	Formulation code	Ratio of polymers	Drug (Mg)	Dibutyl phthalate (% w/w of polymers)	Total weight of polymer (EC and PVP) (mg)	Ethanol (ml)
1.	TTS1	1:2	100	30	500	10
2.	TTS2	1:4	100	30	500	10
3.	TTS3	1:6	100	30	500	10
4.	TTS4	1:8	100	30	500	10
5.	TTS5	1:10	100	30	500	10

Table 2: Physical appearance of the patches.

Formulation code	Thickness (cm)	Weight (gm)	Folding endurance	Percent flatness
TD1	0.00133	0.126	195	100
TD2	0.00159	0.135	155	100
TD3	0.00191	0.128	178	100
TD4	0.00123	0.142	205	100
TD5	0.00210	0.137	141	100

Table 3: Different evaluation parameters of the formulations.

Formulation code	Moisture content (MC) w/w	Moisture uptake (MU) w/w	Tensile Strenght (gm/cm^2) n=3	Drug content (%)
TD1	3.51	2.46	249.14	90.88
TD2	4.19	4.10	220.21	94.82
TD3	3.91	3.81	235.91	93.91
TD4	5.45	2.19	214.24	92.85
TD5	5.15	3.81	264.51	91.89

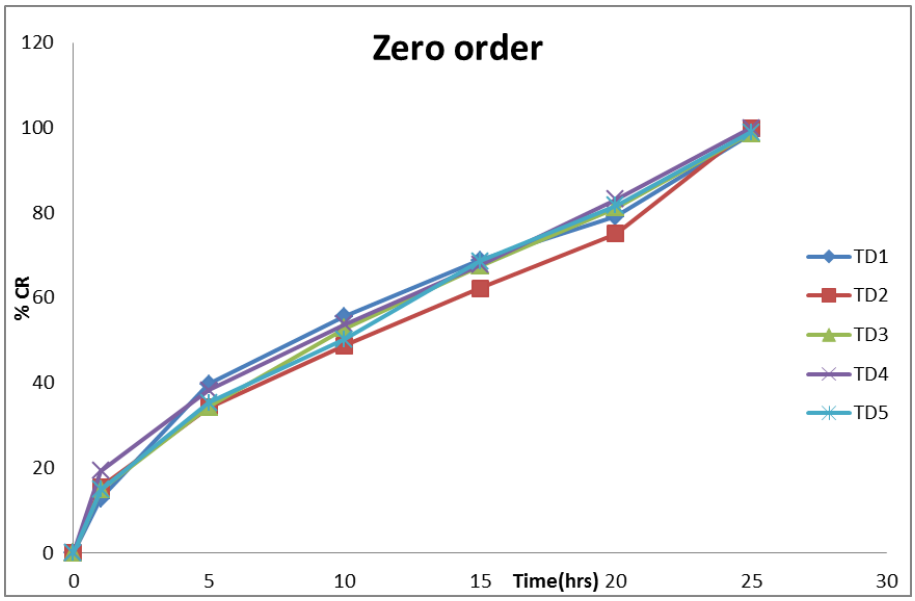

Figure 1: Release profile of different formulations.

The results of compatibility studies by Fourier transform infrared spectroscopy showed no interaction between the drug and polymers. The polymers PVP and HPMC used for the formulation of transdermal patches showed good film forming property. The patches prepared by using HPMC, PVP, Acrycoat 8100, Dibutyl Phthalate, were thin, flexible, smooth and transparent where as the patches prepared by using ethylcellulose were thin, flexible, smooth and opaque.[21]

The weight variation test showed less variation in weight and suggesting uniform distribution of drug and polymer over the mercury surface.

The thickness of the transdermal patches increased with increasing the concentration of polymers HPMC, PVP, Acrycoat 8100, Dibutyl Phthalate, and ethyl cellulose.

Acrycoat 8100 patches showed good flexibility and folding endurance properties when compared to ethylcellulose patches.
All the formulations showed 100% flatness which indicating that all patches could maintain a smooth surface when applied on to the skin.

Theformulations containing high concentrations of polymer showed low percentage of moisture content. The drug content analysis showed minimum variations suggesting uniform distribution of drug.

In vitro release studies suggested that drug release of all the formulations decreased with increase in polymer concentration.[22]

CONCLUSION

Study concludes that propranolol hydrochloride can be delivered in the effective way by the means of transdermal patches.

REFERENCES

1. Das MK, Bhattacharya A. and Ghosal SK. Transdermal delivery of trazodone hydrochloride from acrylic films prepared from aqueous latex. Indian J. Pharm. Sci., 2006; 68(1): 41-46.
2. Barry B. Transdermal Drug Delivery. In: Pharmaceutics The science of Dosage Form Design, Aulton ME, ed. Harcourt Publishers Limited: London; 2"d Edn, 2002; 500-533.
3. Finnin BC. and Morgan TM. Transderrnal penetration enhancers: applications, limitations, and potential. J Pharm. Sci., 1999; 88(10): 955-958.
4. Pharmacopoeia of India, Government oflndia. The Controller of Publication, New Delhi; 3rd Edn., 1996; II: 634.
5. Sankar SR. Text book of pharmaceutical analysis. Rx Publications, Karnataka; 3rdEdn., 2001; 25(1)-25(5).
6. Fatima AA, Chukwuka UK. Development and *in-vitro* evaluation of matrix-type transdermal patches

of losartan potassium. Universal Journal of Pharmaceutical Research, 2017; 2(2): 16-20.
7. Mukherjee B, Mahapatra S, Gupta R, Patra B, Tiwari A. and Arora P. A comparison between povidone-ethylcellulose and povidone-eudragit transdermal dexamethasone matrix patches based on in vitro skin permeation. European J. Pharmaceutics and Biopharmaceutics, 2005; 59: 475-483.
8. Umar S, Onyekachi MK. Development and evaluation of transdermal gel of Lornoxicam. Universal Journal of Pharmaceutical Research, 2017; 2(1): 15-18.
9. Chowdary KPR. and Naidu RAS. Studies on permeability of ethyl cellulose films for transdermal use. The Eastern Pharmacist, September 1, 991; 1 19-122.
10. Sankar V, Johnson DB, Raghuraman S. and Chandrasekaran AK. Design and evaluation of n ifedipine transdermal patches. Indian J. Pharm. Sci., 2003; 65(5): 510-515.
11. Francis DJE. Development and evaluation of matrix type transdermal patches of pioglitazone hydrochloride. Universal Journal of Pharmaceutical Research, 2016; 1(1): 17-20.
12. Panigrahi L. and Ghosal SK. Formulation and evaluation of pseudo latex transdermal drug delivery system ofterbutaline sulphate. Indian J. Pharm. Sci., 2002; 64(1): 79-82.
13. Satturwar PM, Fulzele SV. and Dorle AK. Evaluation of polymerized rosin for the formulation and development of transdermal drug delivery system: a technical note. AAPS Pharm. Sci Tech., 2005; 6(4): E649-E654.
14. Chauhan N, Kumar K, Pant NC. An updated review on transfersomes: a novel vesicular system for transdermal drug delivery. Universal Journal of Pharmaceutical Research, 2017; 2(4): 42-45.
15. Kenji Sugibayashi and Yasunori Morimoto., Polymers for transdermal drug delivery systems. J. Controll. Rel., 1994; 29: 177–185.
16. Ugochukwu AE, Nnedimkpa OJ, Rita NO. Preparation and characterization of Tolterodine tartrate proniosomes, Universal Journal of Pharmaceutical Research, 2017; 2(2): 1-3.
17. Saini Mohit, Sneha, Release Kinetic Study of Matrix Type Transdermal Patch, 2020; I: 1-8.
18. Gurpınar SS, Devrim B, Eryılmaz M. *In-vitro* antibacterial activity of *lactobacilli* metabolites loaded hydrogel formulations against *pseudomonas aeruginosa*. Universal Journal of Pharm Research, 2019; 4(4): 9-11.
19. Anuradha C.M. Matrix type transdermal patches of diclofenac potassium, 2013; I(1): 127-134.
20. Chioma ED. Formulation and evaluation of etodolac niosomes by modified ether injection technique. Universal Journal of Pharmaceutical Research, 2016; 1(1): 1-4.
21. Jia – You Fang., Li – Wen Zhang., Yi – Ping Fang., Enhancement techniques for improving 5 – aminolevulinic acid delivery through the skin. DermatologicaSinica, 2011; 29: 1–7.
22. Elsaied EH, Dawaba HM, Ibrahim EA, Afouna MI. Investigation of proniosomes gel as a promising carrier for transdermal delivery of Glimepiride. Universal Journal of Pharmaceutical Research, 2016; 1(2): 1-10.