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FORMULATION AND EVALUATION OF TRANSDERMAL PATCH OF INDOMETHACIN CONTAINING CARDAMOM OIL AS PERMEATION ENHANCER

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ABSTRACT
Transdermal drug delivery system are innovative drug delivery system which is effective for achieving efficient systemic effect by passing hepatic first pass metabolism. Transdermal patches of Indomethacin were prepared by the solvent casting evaporation technique using ethyl cellulose, HPMC, dibutyl phthalate and cardamom oil as permeation enhancer using different ratios. The physicochemical parameters such as flexibility, thickness, weight variation, moisture content, folding endurance and content uniformity were evaluated for the prepared patches. The formulation exhibited flexibility, uniform thickness and weight, smoothness, good drug content (82.1 to 98.8%), and little moisture content. The in vitro diffusion studies were carried out using modified Franz diffusion cell using Cellulose acetate membrane filter(0.45µm/0.47mm) as the diffusion membrane. As polymer increases the drug release decreases. In this research work cardamom oil used as penetration enhancer, and it shows good release as certain time intervals. Among all three formulations F3 formulation showed good drug release i.e 98.8%.
KEYWORDS : *Transdermal patch, Solvent casting method, Cardamom oil, In Vitro study*

INTRODUCTION

Continuous intravenous infusion at a programmed rate has been known as a superior mode of drug delivery not only to bypass the hepatic first-pass elimination but also to keep a constant, prolonged, and therapeutically effective drug level in the body. Recently there has been an increasing awareness that the benefits of intravenous drug infusion can be closely copied, without its potential risks, by continuous transdermal drug administration through intact skin. In response to this new idea several transdermal drug delivery (TDD) systems have recently been developed, aiming to achieve the objective of systemic medication through topical application to the intact skin surface[1].

In this transdermal delivery system medicated adhesive patches are prepared which deliver therapeutically effective amount of drug across the skin when it placed on skin. Medicated adhesive patches or transdermal patches are of different sizes, having more than one ingredient. Once they apply on unbroken skin they deliver active ingredients into systemic circulation passing via skin barriers. A patch containing high dose of drug inside which is retained on the skin for prolonged period of time, which get enters into blood flow via diffusion process. Drug can penetrate through skin via three pathways-through hair follicals, through sebaceous glands, through sweat duct. Transdermal drug delivery system (TDDS) established itself as an integral part of novel drug delivery systems. Hence transdermal drug delivery is defined as self-contained, discrete dosage forms which, when applied to the intact skin, deliver the drug, through the skin at controlled rate to the systemic circulation[2].

MATERIALS AND METHODS

Materials

Indomethacin was procured sample from Horster Biotek Pvt. Ltd, Indore, Hydroxypropyl methyl cellulose and Ethyl cellulose (Vikash Drugs, Mumbai), Dibutyl Phthalate (Vikash Drugs,Mumbai), Methanol(Loba Chemie Pvt.Ltd), Chloroform(Poona Chemical Laboratory) were of analytical reagent grade.

Methods

Hydroxypropyl methyl cellulose and Ethyl cellulose was used for the formulation of Transdermal Patch. Dibutyl phthalate was used as a plasticizer. Cardamom oil is used as permeation enhancer. The polymer was dissolved in chloroform: methanol (1:5) solvent. The drug was dispersed uniformly in the viscous solution with continuous stirring. The resulting mass was poured into in a Petri dish covered with inverted funnel. The Petri dish was left undisturbed at room temperature for one day. The patch was obtained intact by slowly lifting from the Petri dish and transdermal patches were cut into radius of 2×2 cm^3.

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Table no.1 : Formulation Design

Ingredients	F1	F2	F3
Drug (mg)	10	10	10
HPMC (mg)	450	400	400
Ethyl cellulose (mg)	50	100	100
Dibutyl phthalate (ml)	0.5	1	0.5
Methanol (ml)	5	5	5
Chloroform (ml)	1.5	1.5	1.5
Cardamom oil % W/W	0.5	0.5	0.5

EVALUATION AND CHARACTERIZATION

Physical appearance

All the transdermal patches were visually inspected for color, flexibility, homogeneity and smoothness.

Thickness

The thickness of the patches was measured by using a Vernier calliper and the mean values were calculated[4].

Weight uniformity

Patches sizes of 2cm radius (4cm diameter) was cut. The weights of five patches were taken and the weight variation was calculated[5].

Folding endurance

A patch of 2cm radius (4cm diameter) was cut evenly and repeatedly folded at the same place till it brakes. The numbers of times the film was folded at the same place without breaking give the value of the folding endurance[6].

Percentage moisture content

The prepared films were weighed individually and kept in a desiccators containing calcium chloride at room temperature for 24h. After 24h, the films were reweighed and determined the percentage moisture content from the mentioned formula.

$$\% \text{ Moisture content} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

Percent moisture uptake

The weighed films were kept in desiccators at room temperature for 24h containing saturated solution of potassium chloride in order to maintain RH. After 24h, the films were reweighed and determined the percentage moisture uptake from the below mentioned formula[7].

$$\% \text{ Moisture uptake} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Final weight}} \times 100$$

Drug content uniformity

The patches (2×2cm) were taken into a three separate 10 ml volumetric flask and dissolved in methanol (10ml) with the help of mechanical shaker. The solution was centrifuged to separate out any particulate matter. 1ml of sample was withdrawn and transferred in volumetric flask (10 ml of capacity). The sample was dilute upto the mark with distilled water and analysed by UV spectrophotometer at 320 nm using the placebo patch solution as blank and the drug content was calculated.

In Vitro skin permeation study

The in vitro skin permeation study was carried out by using a Franz diffusion cell (receptor compartment capacity: 22ml, area: 2×2 cm (Equivalent to 2.5 mg of drug). The Cellulose acetate membrane filter(0.45μm/0.47mm) was separated and used for in vitro study. The receiver compartment was filled with 22 ml of phosphate buffer, pH 7.4. The Transdermal patch was firmly pressed onto the centre of the Cellulose acetate membrane filter and then the membrane was mounted on the donor compartment. The donor compartment was then placed in position such that the surface of membrane just touches the receptor fluid surface. Heat is provided using a thermostatic hot plate with a magnetic stirrer. The receptor fluid is stirred by Teflon coated magnetic bead which is placed in the diffusion cell. The temperature of receptor compartment was maintained at 30 to 32^0C. The samples were withdrawn at different time intervals and analysed for drug content 320 nm using UV-visible spectrophotometer after suitable dilution. At the same time receptor phase was replaced with an equal volume of buffer solution at each time interval[8].

RESULTS AND DISCUSSION

The spectrum of UV was analysed by UV/Vis spectroscopy and λmax found to be 320 nm with R2 value of 0.9973. It can be concluded that as the concentration of polymer increases the thickness of patch, weight uniformity, folding endurance increases. Drug release decreases with increase in polymer concentration.

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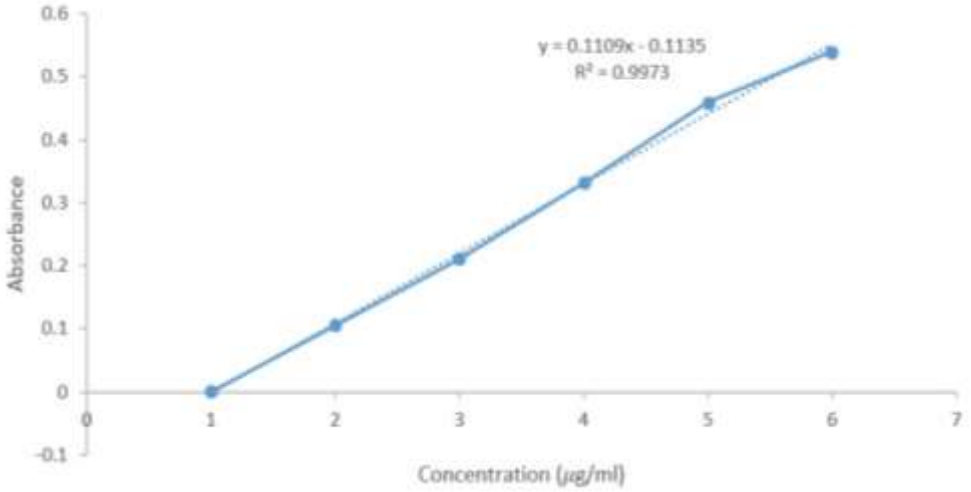
Table no.2: Calibration data of Indomethacin

Sr. no	Concentration (μg/ml)	Absorbance
1	0	0
2	10	0.106
3	20	0.211
4	30	0.332
5	40	0.46
6	50	0.54



Graph 1: Calibration curve of Indomethacin

Table no.3 : Evaluation of Indomethacin Transdermal Patch

Formulation Code	Thickness (mm)	Weight Uniformity (gm)	Folding Endurance
F1	0.8± 0.02	0.13± 0.02	150±2
F2	0.7 ± 0.01	0.82± 0.03	124±5
F3	0.8 ± 0.03	0.96± 0.02	130±3

Table no.4 : Evaluation of Diclofenac sodium Transdermal Patch

Formulation Code	%Moisture Content	%Moisture Uptake	Drug Content (%)
F1	4.11± 0.2	5.12± 0.2	95
F2	5.34± 0.4	7.11± 0.11	91
F3	5.21± 0.2	6.06± 0.4	93

Table no 5: % drug release with and without Cardamom oil

Time (Hrs)	% Drug Release					
	Without oil			With Cardamom oil		
	F1	F2	F3	F1	F2	F3
1	82.1	85	90	86	89.5	96.4
2	90.2	91	91	92.2	97.2	98.2
3	91.5	94	95	94	98.7	98.8

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CONCLUSION

The transdermal patch of Indomethacin was prepared successfully by using different concentrations of ethyl cellulose and HPMC by solvent casting method. All the evaluation parameters showed good results. Cardamom oil used as penetration enhancer in this formulation and it is showing good penetration.

REFERENCES

1. *David Bird and Nuggehalli M. Ravindra, Transdermal drug delivery and patches—An overview, Wileyonlinelibrary.com/journal/meds3,2020,Page no.1-15.*
2. *Ajit Kumar Vishwakarma, An Overview on Transdermal Patches, International Journal of Pharmacy Review and Research, 2017, Vol- 7, Issue 1, Page no.17 -23.*
3. *Priyanka Kriplani et al., Formulation and Evaluation of Transdermal Patch of Diclofenac Sodium, Global Journal of Pharmacy and pharmaceutical Science, Feb 2018, Page no.001-003.*
4. *Gattani SG, Gaud RS and Chaturvedi SC. Formulation and evaluation of transdermal films of chlorpheniramine maleate. Indian Drugs. 2007; 44:27-33.*
5. *Rao RP and Divan PV. Influence of casting solvent on permeability of ethyl cellulose free films for transdermal use. East Pharma. 1997;40: 135-7.*
6. *Kusum DV, Saisivam S, Maria GR and Deepti PU. Design and evaluation of matrix diffusion controlled transdermal patches of verapamil hydrochloride. Drug Devel Indust Pharm. 2003; 29:495- 503.*
7. *Deepak Verma et al, Formulation, Development and Evaluation of Transdermal Patches of Promethazine Hydrochloride, Asian Journal Of Pharmaceutical Education and Research, Volume -8, Issue 2, April- June 2019, Page no. 52-60.*
8. *Constain H. Salamanca et.al, Franz Diffusion Cell Approach for Pre- Formulation Characterization of Ketoprofen Semi- Solid Dosage Forms, Pharmaceutics 2018,10,148, Page no – 1-10.*
9. *Richa Sachan et al, Transdermal Drug Delivery System: A Review, International Journal of Research and Development in Pharmacy and life sciences, Dec-Jan 2013, Volume 3 No.1, Page no- 748-765.*
10. *Asha Das et al, Formulation and Evaluation of Transdermal Patch of Indomethacin containing Patchouli oil as Natural Penetration Enhancer, Asian Journal of Pharmaceutical and clinical Research, Volume 10, Issue 11, August 2017, Page no- 320- 325.*
11. *Lakshmi P K et al , Oils as Penetration Enhancer For Improved Transdermal Drug Delivery: A Review, International Research Journal Of Pharmacy, April 2017,8(4).*
12. *Ataul Hasan et al, A Review on Role of Essential Oil as Penetration Enhancer in Transdermal Drug Delivery System, Sys Rev Pharm 2021; 12(8), Mar-Apr 2021, Vol 12, Issue 8, Page no.439-444.*