"FORMULATION AND EVALUATION OF TOPICAL AQUEOUS SPRAY OF ENOXAPARIN"

14

Thesis

À

Submitted for partial fulfillment of the requirement for the award of the degree of

MASTER OF PHARMACY

(PHARMACEUTICS)

Submitted by Neha Singh. M PHARM IVth SEMESTER (PHARMACEUTICS) (Enrollment No. GGV/20/06322) (Roll no.20704005)

Supervised by Dr. Ravi Shankar Pandey

(Assistant Professor, Department of Pharmaceutics)



Session 2020-2022

DEPARTMENT OF PHARMACY GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)

Abid Printer 9770398993

"FORMULATION AND EVALUATION OF TOPICAL AQUEOUS SPRAY OF ENOXAPARIN"

Α

Thesis

Submitted for partial fulfillment of the requirement for the award of the degree of

MASTER OF PHARMACY

(PHARMACEUTICS)

Submitted by

Neha Singh.

M PHARM IV SEMESTER

(PHARMACEUTICS)

(Enrollment no. GGV/20/06322)

(Roll no.20704005)

Supervised by

Dr. Ravi Shankar Pandey

(Assistant Professor, Department of Pharmaceutics)



Session 2020-2022

DEPARTMENT OF PHARMACY GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)



DEPARTMENT OF PHARMACY

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.), 495009

(A Central University established by the Central University Act 2009 No. 25 of 2009)

FORWARDING CERTIFICATE

This is to certify that Miss Neha Singh of M. Pharm 4th Semester (Pharmaceutics), bearing Enrollment no. GGV/20/06322 has submitted master of pharmacy dissertation entitled as "FORMULATION AND EVALUATION OF TOPICAL AQUEOUS SPRAY OF ENOXAPARIN", for the partial fulfillment of the requirement for the degree of Master of Pharmacy (Pharmaceutics). She has submitted her Dissertation under the supervision of Dr. Ravi Shankar Pandey (Assistant Professor, Department of Pharmaceutics). Her dissertation is satisfactory, original and is not submitted anywhere else for the award of any degree. I hereby forward her dissertation for M. Pharm degree in Pharmaceutics during the academic session 2020-2022.

Date: 19 10 22

Bilaspur (C.G.)



DEPARTMENT OF PHARMACY

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.), 495009

(A Central University established by the Central University Act 2009 No. 25 of 2009)

CERTIFICATE

This is to be certified that Miss Neha Singh of M. Pharm 4th Semester (Pharmaceutics), bearing Enrollment no. GGV/20/06322 has submitted her Dissertation entitled "FORMULATION AND EVALUATION OF TOPICAL AQUEOUS SPRAY OF ENOXAPARIN" to Guru Ghasidas Vishwavidyalaya, Bilaspur in the partial fulfillment of the requirement for the degree of Master of Pharmacy (Pharmaceutics). I hereby forward her dissertation for the award of M. Pharm. (Pharmaceutics) during the academic session 2020-2021.

Date: 19 10 22

SUPERVISOR RST 10-122 Dr. Ravi Shankar Pandey

Assistant Professor

Department of Pharmaceutics



DEPARTMENT OF PHARMACY

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.), 495009

(A Central University established by the Central University Act 2009 No. 25 of 2009)

DECLARATION

I, NEHA SINGH bearing Enrollment no. GGV/20/06322, hereby declare that my M.Pharm entitled "FORMULATION AND EVALUATION OF TOPICAL AQUEOUS SPRAY OF ENOXAPARIN" submitted to Guru Ghasidas University, Bilaspur and this dissertation composed by me under the direct guidance and suggestion received from my supervisor Dr. Ravi Shankar Pandey (Assistant Professor, Department of Pharmaceutics) for the partial fulfillment of the requirement for the award of degree of Master of Pharmacy in Pharmaceutics. I further declare that to the best of my knowledge the dissertation does not contain any part of work, which has been submitted for the award of any degree either in the University or in any other University/Deemed University without proper citation

Date: 19/10/22

NEHA SINGH

M. Pharm. 4 th Semester

Pharmaceutics

ACKNOWLEDGMENT

A first & most essentially humble solicitation to the supreme power that always Showers his blessing on me. The GOD is giving me a chance to live and an opportunity to do higher studies in this noble field of pharmacy.

A single flower cannot make a garden or a single star cannot make the beautiful shiny sky at the night in the same way any research work can never be an outcome of a single individual's talent or effort. It is just like climbing a high peak, step by step accompanied with bitterness, hardship, frustration, encouragement, trust and with so many people's kind help.

First of all, with reverence and gratitude, I express my benevolent thanks to my guide Dr. Ravi Shankar Pandey Asst. Prof (Pharmaceutics) Department of Pharmacy, Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.) for his supervision, advice, guidance along with the freedom of work that he gave me. To work under the guidance of such an eminent person have been a great and inexplicable experience, which will ever remember in my life.

I am also thankful to Dr. Bharti Ahirwar (HOD) Department of pharmacy, Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.) for providing me the required facilities and also their timely words of advice, despite of their busy schedule.

I am immensely thankful to my teachers Dr. S.K. Lanjhiyana, Dr. Manoj Kumar, Dr. Sunil Jain, Dr. Ravishankar Pandey, Mrs. Shivani ray Paliwal, Dr. Kedar Meena, Dr. K. Kesavan, Dr. Akhilesh Jain, and Dr. S.H. Bodakhe.

My Special thanks goes to respected Mr. Mohan Ms, Nivedita Gautam, Mr.Shanni Kant Bharti, Ms. Keerti Mishra, Ms. Sakshi Tiwari, Mr. Sournava Jana, Mr. Bala ji, Mr. Avadh,

I am also thankful to non-teaching staff especially and Mr. Murlidhar Gupta, Mr. Nityanand Singh, Mrs. Veena Vaishnav, Mr. Virendera Verma & Mr. Dhirendra Sahoo (Lab in charge of pharmaceutics) Mr. Vishnu. Mr. Giri for organizing required resources and for the assistance. For their kind help and providing me all facilities rendered during the study. A friend in need is a friend indeed, a friend gives hope when life is low, a friend is place when you have nowhere to go, a friend is honest, a friend is true. I am grateful to Jyoti and Vagesh for her & his motivation, critical suggestion at all time.

Its pleasure to express my gratitude whole heartly to my batch mates Shikha Pandey, Bharti Reddy, Balram Kaushik, Tripti, Priyanjana, and Reena.

My deepest gratitude goes to my family who stood with me at all the times and whose support enabled me to stand confidently against all difficult times.

NEHA SINGH

CONTENTS

CHAPTER No.		TITLE	PAGI No.
1.		1	
	1.1	Age of Bruise	2
	1.2	Cause of Bruise	2
	1.3	Types of Bruise	3
	1.4	Classification of Contusion	3-4
	1.5	Complications	4
	1.6	Pharmacological Treatment	4-5
	1.6.1	Limitations of Available Pharmacological Treatment of Bruise.	6
	1.7	Epidemiology	6
	1.8	Objectives	7
	1.9	Research Envisaged	7-8
		Plan of Work	9
		References	10-11

2.	LITH	ERATURE REVIEW	12
			12
	2.1	Topical delivery of enoxaparin	12
	2.2	Medium chain triglycerides (penetration	12
		enhancers).	12.14
	2.3	Topical spray formulation	13-14
	2.4	Animal models	14-15
		References	. 16-17
3.	DRU	JG PROFILE	18
	3.1	Enoxaparin Sodium (Category)	18
		Pharmacology	19
	3.2		19
	3.3	Mechanism of Action	19-20
	3.4	Pharmacokinetics	21
	3.5	Permeation Enhancer Profile	
	3.5.1	Medium Chain Triglycerides (MCTs)	21
	3.5.2	Physicochemical Properties	21-22
	3.5.3	Applications Of MCTs	22
			23
	DDFI	FORMULATION STUDIES	24
4.	PREI		24
	4.1	Pysical Appearence	24
	4.2	Solubility	24
	4.3	Identification/Assay Development	
	4.3	Ultraviolet Spectroscopy	25-27

	4.4	Colorimetric Assay of Drug (using azure A)	27-29
		Results and Discussion	30
		References	31
5.	FORM	MULATIONS AND CHARACTERIZATION	32
0.	5.1	Materials and Methods	32
	5.2	Methods of Preparation of Aqueous Spray Of Enoxaparin	33
	5.2.1	Optimized Formulation 1	34-35
	5.2.2	Optimized Formulation 2	35-36
	5.2.3	Formulation 3 Containing Coconut Water (Having Natural C6 And C8) Characterization of Optimized Formulations	36
	5.3.	Characterization of Optimized Formulations	37
	5.2.1	Visual and Organoleptic Inspection	37
	5.3.1	Ph Measurement	37
	5.3.3	Spray Pattern	37
	5.3.4	Spray Angle	37
	5.3.5	Average Weight Per Metered Dose	38
	5.3.6	Pump Seal Efficiency Test	38
	5.3.7	Drying Time	38
	5.3.8	Volume Per Spray	38
	5.3.9	Drug Content Per Spray, Dose Uniformity	38-39
		Skin Irritation Test	39
	5.4	In-Vitro Skin Permeation Study	39-40 41-45
	RESULTS AND DISCUSSION		
	Refer	ences	46-47

6.	IN VI	48	
	6.1	Animals Used and Chemicals and Materials	48
	6.2	Experimental Method- Induction of Contusion	49-50
	6.3	Treatment Method	50-51
	6.4	Results and Discussion	52-54
	6.4.1	Histological Evaluation of The Treatment Group	54-57
		References	58
7.	SUM	59-62	
	7.1	Summary	59-61
	7.2	Conclusion	62

÷

,

.